MACHINE LEARNING

Mental Health Challenges Among Youth in the Digital Era: A Review of Online Risks, Protective Factors and Support

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Published November 2026

Abstract

Young people spend a considerable amount of their time on social, academic and emotional interactions online, and the effect of this on their mental health is a public health debate that has sparked considerable engagement. This paper summarises the literature on youth mental health in the digital age through seven selected studies covering the overall evidence, screen time and well-being, social media use and depression and anxiety, cyberbullying, sleep, problematic smartphone use and online peer support. The reviewed works are compared by their focus and by the key issues they leave open for everyday practice, and digital environments are compared by their risks and benefits. A layered conceptual framework linking digital environments, patterns of use, pathways, individual and contextual factors, outcomes and support is then presented, along with a support pathway, sample scenarios and a proposed evaluation framework. Challenges of weak causal evidence, measurement of use, unequal risk, privacy and access to care are outlined, along with ideas for future research. While the evidence suggests small average associations, there are real risks along certain pathways and for certain young people, and there are real opportunities for connection and assistance; the challenge is to translate this into realistic school- and family-based support, particularly in contexts such as India.

Keywords: Youth mental health; digital era; social media; depression and anxiety; cyberbullying; sleep; problematic smartphone use; online peer support; well-being

1 Introduction

Today, children's upbringing occurs in a digital environment. Smartphones and social networks, messengers, video platforms and online games are being used daily for friendship, entertainment and education and are also in the bedroom at night. In parallel, the mental health of adolescents and young adults has been a growing concern, and the two are intertwined in the public discourse [1]. It remains uncertain whether digital life is a cause or a symptom or bystander of the distress of many young people.

The question is urgent due to three developments. First, connection has become continuous thanks to smartphones and social media, so that “online” and “offline” have become one and the same [1]. Second, specific pathways have been identified by research in which digital life could have an impact on mental health, including cyberbullying [2], loss of sleep [3] or problematic and hard-to-control use [4]. Third, more sophisticated research designs are now possible, such as large, preregistered analyses, which enable more careful estimates than the small surveys on which previous alarm was based [1,5]. These trends indicate that it is more important to ask who, how and by what means digital technology is relevant.

The need is not just academic, it's real-world. There are a great variety of young people. Others suffer harassment and/or lose sleep or become compulsive users [2–4] or use platforms to maintain friendships [6]. Parents, teachers and counsellors ask for simple screen-time rules, but the research indicates that the picture is more complicated [1,5]. This is particularly pertinent in India, where access to specialist mental health services is sparse, the population of young people is large, and mobile internet access is widespread. This is the authors' observation; the studies reviewed are not of Indian origin.

This paper deals with a problem that can be simply stated. Public discussion is frequently about screen time as one thing with one effect, while the research refers to a variety of types of screen time, many different effects, and significant interindividual variability. Careful studies are conducted on each strand, but there is not an obvious way of connecting the strands to actual guidance for young people and families and schools.

This paper summarizes the strands, and poses the question: What does a balanced approach to youth mental health in the digital age require? Its contributions are:

- Discussion of seven key studies highlighted in the thematic review which focused on the overall evidence, screen time and well-being, social media, cyberbullying, sleep, problematic smartphone use and online peer support;
- Sectioned comparison of contributions of each study, what it leaves open for everyday practice, analysis of categories of digital environment;
- A conceptual framework with layers that connects digital environments, patterns of use, pathways, individual and contextual factors, outcomes and support, including a support pathway for young people;
- Illustrative scenarios and a proposed framework for evaluating school (or community) support programmes; and a discussion on challenges, mitigations and future research directions.

The paper is organised as follows. The scope of the review is discussed in Section 2 and background on digital environments in Section 3. The reviewed work is discussed by theme in Sections 4–7. The comparison of studies and environments is presented in Section 8, followed by the conceptual framework in Section 9, and implementation and stakeholder perspectives in Sections 10 and 11. Sections 12 and 13 outline scenarios and evaluation; Sections 14 and 15 discuss challenges and ethics; and Sections 16–18 outline findings, future directions and conclusions.

2 Scope and review approach

The review is organized around seven works that address the following areas known to be critical to the understanding of youth mental health in the digital era: state of the evidence [1], social media & depression, anxiety & distress [7], cyberbullying [2], sleep [3], problematic smartphone use [4] and online peer support [6]. All works are studied for the problem addressed, the evidence presented/reviewed, and the potential for the conclusions that they draw to be useful to practice with young people.

The discussion is organised around four guiding questions:

RQ1. How has the research found that digital technology use is associated with overall mental health of young people?

RQ2. What are the specific pathways that lead to poorer mental health that include social media use, cyberbullying, sleep loss, and problematic use?

RQ3. How can digital spaces also be helpful in the mental health of youth?

RQ4. To translate this research into effective, usable interventions for youth, families and schools, what is missing?

It is a selective review and is NOT a systematic review. Conclusions are drawn from the pattern in these works and not the whole field; statements that exceed those made in the cited works are observations by the authors.

3 Background: digital environments of youth

There are several broad categories of digital environment in the lives of young people. Social networking sites allow individuals to create a profile, for friends to find them, for them to post content and for people to like and comment on their posts. They are important for friendship and self-expression and in this context play a significant role in much of the research on depression and anxiety [7].

Private communication, shared play and entertainment is made with messaging applications, online games and video platforms. These are frequently used late in the evening, and may also be locations for harassment and cyberbullying [2]. A third type of online support service consists of peer communities and self-help tools that can be employed to seek information and encouragement [6].

It seems that the use of the device, who uses it, and when is the determining factor for mental health, irrespective of the category [1,7]. Hence, this paper separates the environments (where) from patterns of use (how and when) from pathways (through which mechanism) and the rest of this paper reviews the research accordingly.

4 Overall evidence: digital use and youth well-being

This narrative and meta-review of recent studies (2014–2019) on adolescent mental health in the digital age focuses on depression and anxiety and builds on large-scale preregistered cohort studies and intensive longitudinal studies. They discover that most of the current studies are correlational and yield a varied collection of small positive, negative and non-existent relationships. The most recent and strict research studies indicate only limited correlations between adolescent well-being and the daily use of digital technology, and these studies cannot conclude whether or not the use of digital technology has an impact on adolescent well-being, or whether changes in well-being have an impact on the use of digital technology. The current review is an important one because it is an alert to neither alarm nor complacency.

The same review raises concerns about the need for more research to be done to further refine its conclusions, such as intensive, longitudinal studies of the same youth over time. The message is not that digital technology is harmless, but that the evidence available thus far does not justify straightforward assertions regarding digital technology's overall harm [1]. This means that in a practical programme, guidance should be based on a range of well-documented risks, rather than a blanket concern with screens.

According to the authors' interpretation, the review also suggests that the formulating of a question affects the answer. Research based on measuring the number of hours spent online can overlook

variation in use and averages can conceal the minority that is most impacted. These are design points for researchers but they are also important for parents and teachers to consider, not just how long, but how a particular young person is using technology.

4.1 Screen time and well-being

Orben and Przybylski [5] examined three large data sets, one from the United States, the other two from the UK, that included over 300,000 youth who were surveyed from 2007-2016. They used specification curve analysis, which examines a broad spectrum of reasonable analytic options, rather than a single analytic result, and determined that use of digital technology accounted for at most 0.4% of the variance in adolescent well-being. In the general population, such things as being bullied were significantly associated with well being more than technology use, as were regular sleep and eating breakfast. Technology is therefore just one influence among many.

4.2 Averages and individuals

The authors' interpretation is that the average association of an age group to a specific technology does not mean that no youth are impacted by that technology, as averages can mask subgroups that are more vulnerable or use the technology more negatively. Rather than all digital use being treated as equal, the pathways of social media use, cyberbullying, sleep and problematic use are explored in the sections that follow to better examine how these pathways relate to distress.

5 Social media, depression and anxiety

5.1 Four dimensions of use

In a review of 13 studies, 12 of which were cross-sectional, Keles et al. [7] found studies that examined how social media affects depression, anxiety and psychological distress in adolescents from five databases. They categorized the results into four use domains: time spent, activity, investment and addiction. Results indicated that all four domains were associated with depression, anxiety and psychological distress, but the authors note that there are significant limitations to be considered due to the study designs, study samples and measures used.

5.2 Domains of use and direction of effect

The review reveals that the ways young people use social media are not measured by hours per use, but are segregated into separate areas of use, including activity, emotional investment and addictive use [7]. As almost all of the studies included were cross-sectional, there is no way to determine if heavier use causes low mood, or if low mood causes heavier use, or if a third factor is involved. Keles et al. suggest that there is a need for more longitudinal cohort studies and qualitative studies to examine the mechanisms [7].

5.3 Practical issues

It is possible to find associations both on social media [7] and at population level [5] that are small on average but larger in subpopulation – associations can be there, but not that big. This is the authors' interpretation and may be subject to experimentation. Measurement is another difficulty. Self-reported use is an incomplete measure because the user might over- or under-report their use of a platform [3] and a single question doesn't differentiate between reporting using the platform in a

supportive way and passive scrolling or being the target of hostile conversation. More detailed studies of activity would be beneficial [1,7].

5.4 Individual differences

As stated by Odgers and Jensen [1] the evidence is equivocal with small positive, negative and null associations. To a young person this means that an online platform can make one person feel good, while making another feel bad. Advice and support should, therefore, remind young people and their families that their mood, sleep and relationships are affected by their use and that if they have a sustained pattern of distress, it is time to get help.

6 Cyberbullying, sleep and problematic use

6.1 Cyberbullying

The cyberbullying literature was reviewed by Kowalski et al. [2] as they termed it, "disorganized without a theoretical context", the general aggression model was proposed as a framework and a meta-analysis was conducted of the relationships between youth and cyberbullying with other behavioural and psychological variables from traditional bullying. The most significant associations with perpetration were with normative beliefs about aggression and moral disengagement, whereas the most significant associations with victimisation were with stress and suicidal ideation. These relationships were moderated by methodological and sample characteristics.

6.2 Sleep and screen time

Hale and Guan [3] summarized 67 studies from 1999 to early 2014 concerning the link between screen time and sleep in school-aged children and adolescents. The negative associations with sleep outcomes were found in 90% of the studies, primarily with shorter sleep duration and later sleep timing. The results were different according to type of screen, age, gender and day of the week. The authors caution that they were not able to establish causation; that there were measurement errors for both screen time and sleep; and that they were unable to gather data about the multiple screens used simultaneously or on contents. They recommend reducing screen time, particularly before bed-time.

6.3 Problematic smartphone use

A systematic review, meta-analysis and GRADE assessment of problematic smartphone use among children and youth (use that is difficult to control and affects daily functioning) was conducted by Sohn et al. [4]. They report that about one in four youth in the pooled studies had problem use (about 23%), which correlated with reduced mental health (depression, anxiety, stress and poor sleep). The figures are read as indicative and not exact as measures of problematic use are not consistent across studies and evidence is largely cross-sectional.

6.4 Linking the pathways

The three strands together indicate that sleep, bullying and problematic use could be connected: the latter can be negatively impacted by the lack of sleep [3]; a negative experience online can increase distress [2], and problematic use may lead to difficulty controlling use, which can in turn lead to negative sleep experience [4]. This linking is the authors' interpretation of the individual studies reviewed and none of the cited research studies actually test the entire chain.

6.5 Practical responses

The pathways reviewed provide some pragmatic recommendations. Use of evening products may be limited for sleep, particularly near bedtime [3]. In the case of cyberbullying, it is crucial to teach youth how to block, report, and tell a trusted adult and schools must have clear procedures [2]. In cases of problem use, it is better to know about the difficulty at an early stage and have a conversation with them rather than punish them and in the event of repeated problems, a counsellor or other professional should be engaged. It should be a spiral where a plan is created with the young person, implemented for a few weeks and reviewed, and then kept if it is successful. These suggestions are not the findings of the studies, but rather the authors' interpretation of the evidence.

7 Online peer support and digital support

In their discussion, Naslund and colleagues [6] explore how social media can offer peer-to-peer support for individuals with serious mental illnesses, who are turning to online platforms like Facebook, Twitter and YouTube to share experiences and get advice from others in similar circumstances. They hypothesize a conceptual model of illness journey in which becoming a member of an online peer community is an important point in the illness experience that is associated with lower stigma, increased activation and access to online interventions. Reported benefits: social connectedness, belonging, sharing of personal experiences and coping strategies, empowerment and hope; reported risks: inaccurate information, negative comments and heightened uncertainty around health. On the evidence available at present, the benefits seem to outweigh the risks and the authors observe that it is "not yet known whether skills acquired online are reflected in real-world improvements". There are two caveats here. The work is a commentary and the transfer to young people generally is the present authors' extrapolation relating to mental illness in general. Nevertheless, it implies that the platforms that can cause harm can also decrease isolation and make making a first call for help more accessible, and a programme for young people should seek to harness that while minimising these risks.

8 Comparative analysis

8.1 Comparison of the reviewed studies

The reviewed studies are summarized in Table 1 and, from a practical point of view, what is left open for each of them. The open points are comments of an interpretive nature about how each study relates to real world support of youth, and do not necessarily reflect negative opinions of the study.

Table 1. Summary of reviewed works.

Ref.	Main focus	Open point for everyday support
[1]	Review of adolescent mental health in the digital age	Mostly correlational; cannot separate cause from effect
[2]	Meta-analysis of cyberbullying among youth	Links shown; causality unclear; predates current platforms
[3]	Screen time and sleep in children and adolescents	Sleep is the outcome; mental health not the main focus
[4]	Prevalence and mental health links of problematic smartphone use	Measures vary; no clear route to support

Ref.	Main focus	Open point for everyday support
[5]	Large-scale analysis of technology use and adolescent well-being	Average association is small; says little about specific groups
[6]	Peer-to-peer support through social media	Perspective article; not specific to young people
[7]	Social media use and depression, anxiety and distress	Mostly cross-sectional; direction of effect unclear

There's a clear pattern there. The overall evidence [1] and social media use [7] are supported by each study, as are cyberbullying [2] and sleep [3] or problematic use [4] or peer support [6]. None of them describes the risks; the protective factors; and the practical response in a single voice; and most are based on correlational evidence.

8.2 Comparison of digital environments

A comparison of the three categories of digital environment described in Section 3 is shown in Table 2. It is generalised and individual platforms vary but indicates the relative position of the risks and benefits mentioned in the reviewed work.

Table 2. Generalised comparison of digital environments.

Aspect	Social networking	Gaming and messaging	Online peer support
Main use by youth	Friendship, self-expression	Shared play, private chat	Information, encouragement, advice
Main references	[7]	[2,3]	[6]
Main concerns	Heavy or addictive use [7]	Late-night use, cyberbullying [2,3]	Misleading information, hostile comments [6]
Possible benefits	Belonging and connection	Shared activity with friends	Less stigma; easier first step to help [6]
Sensible safeguards	Privacy settings, reporting tools	Bedtime limits, blocking tools	Moderated, trusted communities
Evidence in reviewed set	Mostly cross-sectional	Association with sleep; causation unconfirmed	Perspective article; limited

The evidence on social networking and on gaming and messaging is primarily correlational and mostly focused on possible harms, while the evidence on online peer support is focused on possible benefits and is the thinnest for young people. If a balanced programme is to be created, it is necessary to deal with imbalanced evidence.

8.3 Research gaps

Combining the two comparisons, the following gaps can be identified:

- **Causal evidence:** The majority of the reviewed findings were correlative and the direction of effect between digital use and distress is not always clear [1,7].
- **Individual differences:** There could be larger associations between individual differences and the average association may be relatively small, but few of reviewed works test this directly [1,5].
- **Kind of use:** Hours of use is more frequently measured than what young people do online, with whom and at what time [3,7].

- **Local settings:** None of the seven reviewed works is local to India, or to similar low-resource settings to which the material might be applicable, as to access to care and patterns of use of the devices may vary.
- **Youth support:** Digital peer support and other digital support to young people is less well understood and the literature that was reviewed on this is a view and not a trial [6].

9 Conceptual framework

9.1 Layers of the framework

From the work that has been reviewed, it can be said that the digital era mental health of a young person is a collection of synergizing layers, as shown in Figure 1. The layers are meant to be "under the hood" conceptual summary and not a tested model and items listed within the layers are examples and not an exhaustive list.

The first layer refers to the digital spaces where youth are present: social networking, games and videos, and messaging. The second layer refers to the pattern of use, which is considered separate from the pattern of use time and includes time spent, type of use, and use at night, and which the reviewed work considers separate [3,7]. The third layer contains pathways found in literature, which are cyberbullying [2], sleep disruption [3] and problematic use [4]. The fourth layer concerns individual and contextual factors, which can vary whether difficulty arises or not – the reviewed studies report on differences by age, gender, and sample characteristics [2,3], as well as the other individual and contextual factors mentioned here, which are the authors' additions.

The fifth layer synthesizes the outcomes (depressive symptoms, anxiety, distress and well-being) and the supports (help-seeking, peer support [6] and professional care). Supports are also provided on the other layers, such as in teaching safe use, sleep routines and how to deal with bullying. The framework is kept simple to make it easy to use as a checklist by parents, teachers and counsellors, but also easy to use as a framework for placing a study by researchers.

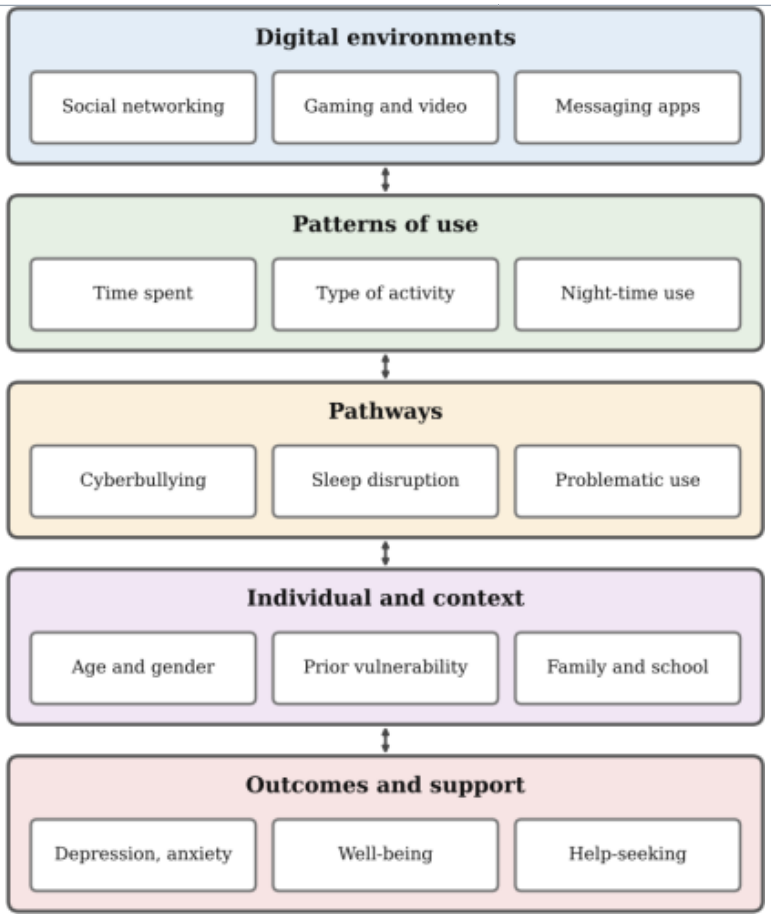


Figure 1. Layered conceptual framework of digital-era youth mental health.

9.2 Support pathway

The overall picture of support to a young person is shown in Figure 2. It can be broken down into the following stages:

1. Starts with common everyday use of digital technologies, which is for most young people common, and often helpful.
2. Contains early signs (sleep, mood and/or social withdrawal).
3. Provides a supportive parent/teacher/friend check-in with a discussion about online and offline.
4. Provides short-term screening by a trained school or college counsellor with validated instruments as needed.
5. Agrees a support plan, including sleep routines, use habits and how to respond to bullying.
6. Refers the young person to professional care if difficulties are serious or persistent.
7. Checks and reviews progress, and plans accordingly.

The check-in and referral process is intentional. They ensure that a caring adult and, if necessary, a qualified professional are in charge of decisions regarding the young person, and that the use of screens is not viewed as an illness or diagnosis, in keeping with the precautions in [1] and the scope of evidence as discussed in Section 8.

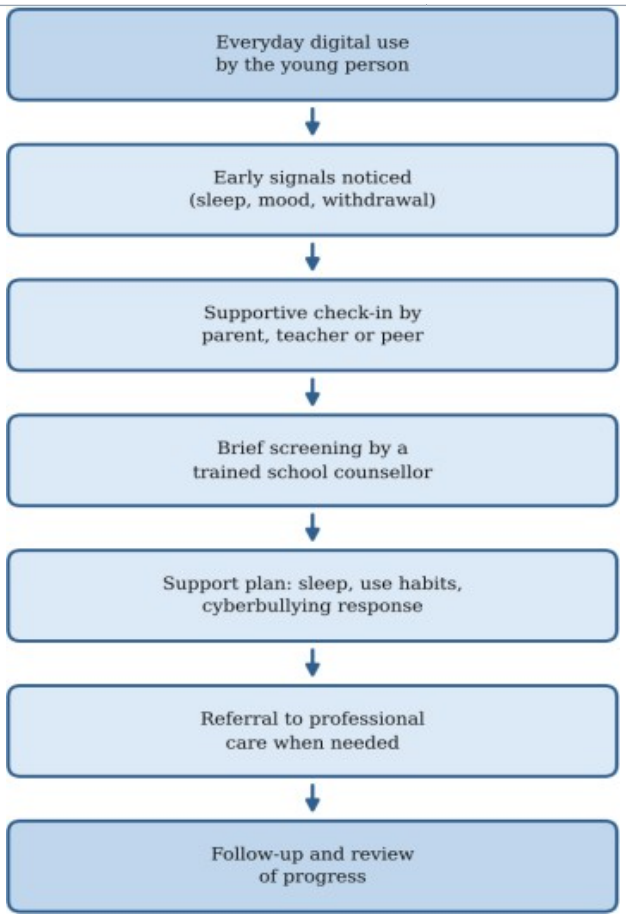


Figure 2. General support pathway for a young person in the digital era.

9.3 Design considerations

The following design principles are based on the review. The first is proportion: concern should be matched by evidence – guidance should be based on specific well supported concerns and not a blanket fear of screens [1,5]. The second is the focus on the individual, rather than standard screen time—how a specific young person is doing is more important than the average screen time. The third is access and confidentiality – young people should be able to access support without fear of exposure or punishment. The fourth is transparency – young people should be aware of what is being observed, recorded and shared about them and why.

9.4 Information handled by a programme

There are various types of information that programmes can support young people with and access and retention requirements for each of these. Participants are identified by basic details, such as age group and class. Screening responses: mood, anxiety, sleep and use habits, and are the most sensitive. Conversations and support plans are noted and what is agreed. When checking the effectiveness of the programme, aggregate counts and trends, without names, are used. It is helpful to separate these items, for example in order to delete screening responses after a period of time but retain anonymous summaries, and to provide support plans to those directly involved.

9.5 Mapping to components of the framework

Table 3 correlates all the components of the framework with the studies that provide evidence for all the components and the major requirement that each component is expected to meet. These are

considered reasonable because each component receives some research support (see the mapping), and mostly studied individually.

Table 3. Mapping of reviewed work to framework components.

Component	Refs.	Main requirement
Overall use and well-being	[1,5]	Claims in proportion to the evidence
Social media patterns	[7]	Look at activity and investment, not hours alone
Cyberbullying response	[2]	Clear reporting and school procedures
Sleep protection	[3]	Evening limits; steady routines
Problematic-use support	[4]	Early recognition; supportive response
Peer support and help-seeking	[6]	Moderated, trusted and safe spaces

10 Implementation considerations

10.1 Reach and scale

The programme can be accessed by a large number of young people in schools and colleges and can be implemented in the existing school and college structures like counselling cells, mentoring and orientation. Practical savings are gained by having short universal activities for all, short screening where required and a referral to the smaller number who require intensive help with costs increasing as the number of trained staff required increases. Avoid repeating the message across multiple programmes by using the same sessions for sleep and bullying and problematic use.

10.2 Safety and confidentiality

Responses to screening should only be taken by trained staff and responses should not be included in the student's academic records. Records should be securely stored, accessed on a need to know basis and should be deleted after a specific period of time. Young people should be aware of the difference between what a counsellor can see, what a teacher can see and what a parent is told. When there is a need to be concerned, a route to urgent professional help should always be available.

10.3 Low-resource and mobile use

A mobile phone is often the primary device for many young people and they may have restricted access to data/privacy at home. Materials should be short, in local languages and offline-friendly. If counsellors are scarce, trained teachers and peer mentors can deliver first-level assistance with guidelines for referrals. If connectivity is not good, then printed or in-person sessions should be provided instead of online sessions.

10.4 Monitoring and feedback loop

Basic measures, such as the number of young people reached, the number referred, the time to first contact and the feedback of young people, should be recorded by any programme. These records will indicate any areas of the programme that are not as effective as desired and will give content to future sessions and guidance as the programme progresses.

11 Stakeholder perspectives

11.1 Young people

Young people will be better equipped to understand the effect of their behaviour on their mood and sleep and have a clearer understanding of what to do when they are being bullied and how to seek help. The research also indicates that digital spaces can provide belonging and peer support [6] which means that reducing use of digital spaces may not be feasible and/or desired. Young people should be included in the development of guidance, if this is something they have a better understanding of than adults. These benefits are reasonable, but they still have to be substantiated by controlled study, as discussed below.

11.2 Parents and teachers

Parents or teachers typically are the first to notice a change in a young person. They require simple accurate information about what the evidence demonstrates and does not demonstrate, and practical skills, such as how to initiate a calm conversation, how to establish sleep routines and how to respond when a young person reports bullying [2,3]. It is important to teach them about their boundaries and when to seek the help of a counsellor/carer or doctor.

11.3 Institutions and platforms

The decision is up to institutions to think about how this guidance can be incorporated into their policies. They should ensure that there are systems in place for reporting cases of bullying, guidelines for data and confidentiality, and trained counsellors available, and provide assistance to staff. They also must measure the impact of their programmes on young people as opposed to taking it for granted that they are effective. For technology platforms, on the other hand, they influence the context within which these experiences take place, in terms of reports, moderation and privacy settings [2,6].

12 Illustrative scenarios

The scenarios below are examples of how young people might be helped using the framework; they are not exhaustive. They do not constitute a trial report.

Scenario 1: Late-night use. A college student uses a cell phone in bed regularly and gets less sleep on weekdays. A friend observes that student is tired and irritable. Following a supportive conversation, the student will agree to an evening routine with a limit on the amount of time spent late using screens in line with the recommendation to place limits on screen time prior to sleep [3]. Where persistent tiredness and low mood are experienced, a counsellor is consulted.

Scenario 2: Cyberbullying. Hostile messages are sent in a class group chat toward a school student. The student blocks and reports the messages, and notifies a trusted teacher who adheres to the school's procedure. The counsellor also inquires after the student's well-being after the messages as victimisation is associated with stress and other distress [2].

Scenario 3: Difficulty controlling use. Student struggles to put down a cell phone when studying and is anxious without it. Instead of punishing the student, a teacher may offer a suggestion to have a short conversation with the counsellor as problematic use is linked with anxiety, stress and poor sleep [4] and a study periods plan is agreed.

Scenario 4: Asking for peer support. A young person who feels alone joins a moderated online community for students under stress. Peer support, as discussed in [6] provides a sense of belonging and shared coping strategies, and a trusted adult remains alert to the youth and ready to arrange professional help if things deteriorate.

13 Proposed evaluation framework

Any comment relating to an impact of a support programme should be supported by evidence. The following framework is suggested, based on measures used in youth mental health research.

13.1 Mental health and sleep measures

Depression symptoms can be measured using the Patient Health Questionnaire (PHQ-9) or the adolescent version PHQ-A and anxiety can be measured using the Generalized Anxiety Disorder scale (GAD-7). The Warwick-Edinburgh Mental Well-being Scale (WEMWBS) can be used to assess General well-being. In [3] it is possible to measure sleep using the Pittsburgh Sleep Quality Index (PSQI) or a sleep diary that tracks the time spent asleep and bedtime. Based on [2,4] problematic use can be measured by using a validated scale like the Smartphone Addiction Scale, Short Version (SAS-SV) and exposure to cyberbullying by using a validated cyber-victimisation questionnaire. These are screening and monitoring tools and not diagnoses and require trained follow-up.

13.2 Behavioural and programme measures

Scores on questionnaires do not indicate any programme was 'helpful'. A controlled study might involve splitting class/school into two groups - one group implementing the programme, one group continuing on as usual - and having each group complete the same assessment, prior to, immediately following and several months after the programme. Measuring 'help-seeking' can include the number of young people who reach out to a counsellor and the length of time that it took. The satisfaction of both teachers and counsellors can be assessed with a brief feedback form and the workload of teachers and counsellors can be monitored with time logs. A list of the measures proposed, and a suggestion on how to obtain each, is given in Table 4.

Table 4. Proposed evaluation measures.

Measure	What it shows	How it is obtained
PHQ-9 / PHQ-A	Depressive symptoms	Self-report questionnaire
GAD-7	Anxiety symptoms	Self-report questionnaire
WEMWBS	General mental well-being	Self-report questionnaire
PSQI / sleep diary	Sleep quality and duration	Questionnaire or diary
SAS-SV or similar	Problematic smartphone use	Self-report scale
Cyber-victimisation	Exposure to online bullying	Validated questionnaire
Help-seeking	Contact with support	Anonymised counselling records

13.3 Study design

A cluster-randomised intervention or matched comparison, assigning schools or classes to programme or usual practice, could be implemented to achieve a practical design. Both groups will

conduct the same measures at baseline, at programme end, and at follow-up and results will be reported by age group, gender and background as averages may mask any differences in groups [1,5]. As the participants are young, the study requires ethical approval, informed consent from the young person and if required, a parent/guardian, a clear plan for how to respond to any serious concern that may arise, and the right to quit at any time.

14 Challenges and mitigation

The main challenges identified from the review, including potential mitigations, are presented in Table 5.

Table 5. Main challenges and possible mitigations.

Challenge	Possible mitigation
Weak causal evidence	Use longitudinal and intensive-measurement designs; preregister analyses; treat findings as provisional [1,7].
Measuring use	Combine self-report with logged use where consented; separate different activities.
Unequal risk	Report results by subgroup; give extra support to those already struggling.
Stigma and low help-seeking	Confidential, normalised entry points; trained peer mentors [6].
Harmful or misleading content	Moderation; trusted sources; digital literacy teaching [6].
Privacy of young people's data	Consent, role-based access, encryption, limited retention and clear deletion rules.

Particular attention needs to be paid to causal uncertainty and measurement. Many of the literature reviewed is correlational [1,7] and a recommendation based on the correlation can be incorrect regarding the cause of the recommendation. Programmes should be kept to a minimum of claims and evaluated as they are implemented.

Another pair of issues are access and cost. The number of trained counsellors is limited and institutions with limited budgets can provide individual support to only a limited number of people. Some simple measures, such as establishing sleep habits, bullying protocols and teacher training, can be effective with many young people at low cost, and referral options will remain for those who require it.

Acceptance by young people is the next challenge. Advice which the young person feels is being monitored or punished may not be taken up or may dampen their enthusiasm for talking. The process of involving youth in design and testing from the start is, therefore, just as relevant as the content of the design itself, and must remain respectful and non-judgemental.

Oversimplified messages are the second great concern. It is not supported by the small average associations reported in [1,5] and it oversimplifies the average associations found in [2–4] with sleep, problematic use and cyberbullying respectively. Messages should be even-handed, and should clearly state what is known and what is not.

15 Ethical and privacy considerations

The information shared by a young person is personal and their participants, especially the younger ones, are minors. Consent, safe storage, restrictions on sharing and compliance with data protection guidelines are critical. Young people and, as appropriate, parents should be informed about materials collected, their retention period, and those who have access to them.

Fairness and stigma is another concern. Screenings should not be used to label a young person, nor should results be utilized for disciplinary or admissions purposes. Support should be provided in a form and a language that is accessible to young people from various backgrounds, including limited access to devices, and results should be reported for each group, to ensure gaps are evident.

There may be risks of overreach and over-reliance. Being overly involved in a young person's phone use can be detrimental to trust and digital self-help or online communities can be a support but not an alternative to professional help when problems are severe [6]. So a programme should clearly outline where and when to go for professional advice and support and promote open dialogue between young people and adults who care for them.

16 Key findings and limitations of the review

The review results in four key findings. First, the available evidence suggests that, on average, digital technology use is only marginally associated with adolescent wellbeing [1] and that correlational studies have been associated with several dimensions of social media use and depression, anxiety and distress [7]. Second, there are specific pathways that provide more specific targets for action: cyberbullying [2], loss of sleep [3] and problematic smartphone use [4].

Third, digital spaces may also serve youth by fostering connections with peers and increased access to assistance [6] but these studies on young people are not specific for young people, and are not subject to trials.

Fourth, the nature of most of the evidence is correlational and none of the reviewed studies is specific to India and statements about cause should be interpreted with a degree of caution until further evidence is gathered, and statements about local applicability should be treated tentatively.

Limitations of the review. It is a narrative description of seven works and does not claim to describe the whole field. The conceptual framework is presented and is a synthesis of the work reviewed, but it is not reported here with the experimental results. Finally, platforms and patterns of use evolve rapidly, and results of previous years, like [2,3] may not necessarily be sufficient to describe the platforms in use this year.

17 Future directions

The directions are several that are coming from the review. Longitudinal studies that followed the same young people over time would help to distinguish cause from effect, as would intensive methods that could provide day-to-day information on use and mood [1,7]. Large pre-registered analyses which examine particular patterns of use and also subgroups, rather than hours of use, would reveal who is most impacted and why [5]. Studies specific to Indian and similar environments, even local languages, are required, as the reviewed studies were not specific. Trials of simple bedtime routines could be extended to gather evidence on sleep [3] and school-based anti-bullying pro-

grammes could be assessed for both their influence on mental health and on bullying [2]. There is also a need for research on young people's spaces for moderated peer-support [6].

In addition, there are new trends and directions that the seven studies do not examine, including the provision of app-based support, early-warning systems based on usage patterns of apps, and digital literacy teaching. These should be evaluated carefully for safety, privacy and effectiveness before using them widely. Studies would also be easier to compare and contribute to real progress if they were routinely reported in terms of measures and young people were engaged as co-designers.

18 Conclusion

This paper is a summary of research that was conducted on digital technology and youth mental health generally, social media, cyberbullying, sleep, problematic smartphone use and online peer support, as well as an analysis of the implications of the research for supporting youth mental health in the digital era. The evidence suggests that associations, on average, are small but that, for some young people, along some pathways, there exist real risks/dangers and real opportunities for connection and assistance. A layered framework and a support pathway involving a caring adult and a professional referral all at their centre are suggested, as is the suggested evaluation framework that demonstrates how their value might be measured. Progress will be made by addressing causality, measurement, privacy and fairness, and evidence from India and other environments not included in the reviewed studies.

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