SPECIAL ARTICLE

Child and adolescent psychiatry: challenges, solutions, opportunities, and future directions

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It is estimated that, globally, the mean point prevalence of diagnosable mental disorders in children and adolescents is higher than 11%, and around half of cases of major mental disorders have their onset before the age of 18. Mental disorders with onset in childhood or adolescence have an enormous impact on the developing brain, body and personal identity, as well as on the short- and long-term social, educational and functional capacity of individuals. Child and adolescent psychiatry – as a discipline, profession, academic field, and network of clinical services – is still relatively young, with its formal evolution beginning in the 20th century. Therefore, it is not surprising that there are currently many challenges, but also opportunities and expected future developments, in this area. In this paper, we identify and address the core challenges, possible solutions, opportunities, and future directions of child and adolescent psychiatry. In the first part of the paper, challenges and possible solutions are discussed regarding diagnostic issues, stigma, access to care, shortage of mental health professionals, evidence-based treatments, treatment adherence, parental participation/engagement, integration with schools, digital influences and cyberbullying, and war/forced displacement. In the second part, opportunities and developments are addressed that relate to early identification and intervention, resilience, interdisciplinary collaborations, integration with primary care, community-based approaches, use of digital technologies, precision child and adolescent psychiatry, artificial intelligence and related ethical issues, and cultural diversity and competences. Despite the significance and impact of mental disorders in children and adolescents, clinical delivery and research on these conditions remain underfunded and underprioritized, even in high-income countries, with clinical services and prevention/early intervention research receiving minimal investment. Addressing mental health in children and young people requires multi-level strategies beyond individual treatment, including tackling structural and socioeconomic barriers and creating opportunities for strengthening resilience and well-being. A well-trained workforce, adequate policies, and increased public awareness are crucial. Overall, the current gaps demand urgent action and global funding rebalancing to more adequately meet the critical needs of children and young people challenged by mental illness.

Key words: Children, adolescents, mental health, child and adolescent psychiatry, diagnostic issues, evidence-based treatments, early intervention, digital technologies, resilience, interdisciplinary collaborations

(World Psychiatry 2026;25:190–224)

According to the Global Burden of Disease study[1], in 2019, 293 million out of 2.516 billion individuals aged 5 to 24 years had at least one mental disorder globally, translating into a mean point prevalence of diagnosable mental disorders in children and young

people of 11.63%. When considering specific age ranges, the mean point prevalence of mental disorders was 6.80% among children aged 5-9 years, 12.40% among those aged 10-14 years, and 13.96% in young people aged 15-19 years[1]. Around one-fifth of all disease-related disability was attributable to mental disorders in children and adolescents, with 24.85% of all years lived with disability (YLDs) attributable to mental disorders recorded before age 25 years[1].

Furthermore, meta-analytic evidence summarizing almost two hundred epidemiological studies[2] showed that the peak age at onset across all mental disorders is 14.5 years, with one third (35%) emerging before age 14, around half (48%) before age 18, and the majority (63%) before age 25. Specifically, about 83% of neurodevelopmental disorders have their clinically evident onset during childhood or adolescence[2]. Onset before age 18 is seen in over half (52%) of anxiety and fear-related disorders, nearly half (48%) of feeding and eating disorders, and about 45% of obsessive-compulsive and related disorders[2]. Stress-related disorders are found to begin before age 18 in roughly 28% of cases[2]. Substance use and addictive behaviors show earlier signs in about 15% of individuals, while schizophrenia-spectrum and primary psychotic disorders start before age 18 in around 12% of cases[2]. Mood disorders and personality disorders are less likely to emerge early, but still have their onset before age 18 in about 12% and 10% of individuals, respectively[2].

Based on these figures, the crucial relevance of child and adolescent psychiatry within the mental health arena is self-evident. However, despite its importance, child and adolescent psychiatry – as a clinical discipline, profession, academic field, and network of clinical services – is still relatively young.

Until the 19th century, it was commonly assumed that children's minds were too undeveloped and unstable to exhibit significant signs of psychopathology[3]. Although emotional and behavioral problems have been acknowledged among children and adolescents throughout history, they were not traditionally viewed as medical issues. Instead, such behaviors were largely considered as moral failings, warranting punishment rather than treatment[3]. In the US, for instance, B. Rush, widely regarded as the first American psychiatrist, made no reference to children in his influential textbook *Medical Inquiries and Observations upon the Diseases of the Mind*, published in 1812[4].

However, "juvenile insanity" gradually gained widespread acceptance in the 19th century. This development mirrored the progressive interest in the child as a matter of clinical attention, reflected for instance in the foundation of the Hôpital des Enfants-Malades (Hospital for Sick Children), founded in Paris in 1802[5]. This was followed by the Great Ormond Street Hospital in London 50 years later[3]. By the late 19th century, most psychiatric textbooks included sections on children, and juvenile insanity began to be distinguished from conditions such as mental retardation and epilepsy[6]. For example, in the UK, Maudsley's 1895 publication *The Pathology of Mind*[7] included a chapter entitled *The Insanity of Early Life*, and the German psychiatrist Griesinger in 1867 recognized that conditions such as mania and melancholia could also affect children[8]. In 1887, another German psychiatrist, H. Emminghaus, published one of the earliest textbooks on child psychiatry, *Psychic Disturbances in Childhood*[9]. In contrast, Kraepelin's influential psychiatric classification system, introduced in 1883, entirely overlooked childhood-onset disorders[3].

Significant progress in the early 1900s laid the foundation for child psychiatry to evolve into the established discipline it is today. Key developments included: a) advancements in measurement techniques (e.g., the publication of the first standardized scale of intelligence, the Binet-Simon test, in 1905[10]); b) the rise of developmental psychology, following the publication of *The Mind of the Child*[11], in which the German psychologist W. Preyer presented his observations on the development of his own son from birth to the age of three; c) the rise of psychoanalysis, including the pivotal contributions of A. Freud and M. Klein, both of whom played a central role in founding child psychoanalysis; d) the influence of the mental hygiene movement, aimed at promoting mental health, preventing mental illness, and improving care for people with mental disorders by shifting focus from custodial care to proactive support; and e) the child guidance movement, started by the neurologist W. Healy in Chicago in 1906, that aimed to move the focus from the juvenile justice system to the family, school and neighborhood to support children with maladjustment, thus representing a "form of preventive medicine promoting children's mental well-being"[12]. Furthermore, the *encephalitis lethargica* epidemic, that spread worldwide after World War I, led to a substantial number of children developing behavioral issues such as hyperactivity, thus creating a greater demand for services. In response, specialized units were established, such as the children's unit at Bellevue Hospital in New York City in 1920[13].

From the academic standpoint, the first chair of child psychiatry was established in 1923 in Rosario, Argentina, and was held by the Italian neuropsychiatrist and psychoanalyst L. Ciampi. This development occurred before the founding of the first academic child psychiatry department in the US, which was set up by L. Kanner in 1930 at Johns Hopkins Hospital in Baltimore[3].

The second half of the 20th century, particularly following World War II, saw a surge in research that greatly expanded our understanding of childhood mental disorders – their nature, diagnosis, classification and treatment. This era was marked by major contributions from both psychological therapies (e.g., the development of family therapy, beginning in the late 1940s, with the emergence of several approaches in the 1960s, such as the Milan systemic model[14]) and psychopharmacology (e.g., the synthesis of methylphenidate in 1944, following the serendipitous discovery[15] in 1937 of the beneficial effects of amphetamines for what would later be termed attention-deficit/hyperactivity disorder, ADHD). Together, these advances helped solidify child and adolescent psychiatry as a recognized medical specialty.

In relation to classification systems, the ICD-6[16], released in 1948, for the first time included a section dedicated to mental disorders, but did not refer to child disorders. The DSM-I[17], published in 1952, did not specifically address childhood mental health disorders, although it did include a reference to "mental deficiency". However, the DSM-II[18], released in 1968, did feature a section on behavioral disorders in childhood and adolescence, categorizing

various types of "reactions", including withdrawal, excessive anxiety, running away, unsocialized aggression, group delinquency, and hyperactivity.

Regarding training, in some countries – such as Germany and the US – child psychiatry has developed as an independent medical discipline[3]. In others – including Australia, New Zealand, the UK, and Canada – it functions as a subspecialty within general psychiatry. In some other countries, child psychiatry has been formally established as a full specialty and recognized as a distinct field only recently – for example, in Spain in 2021[3]. However, in many low- and middle-income countries (LMICs) – where a relatively high proportion of the population are children and adolescents – child psychiatry has yet to be formally recognized as a distinct specialty[19].

Child and adolescent psychiatry also had to clarify its relationship to pediatrics. Historically, two separate perspectives have emerged. On the one side, child psychiatry has been supported as a field separate from pediatrics. For example, in the UK, A. Lewis, appointed in 1946 as the first chair of psychiatry at the newly established Institute of Psychiatry in London, strongly advocated for the independence of the field, emphasizing the need for specialized training[19]. This view significantly influenced M. Rutter, broadly considered the founder of modern child psychiatry, to pursue a career in that discipline. In contrast, D. Winnicott, a pediatrician trained in psychoanalysis, believed that pediatricians should also be trained as child psychiatrists, primarily through the practice of child psychoanalysis[19]. Building on these debates, in the 1980s, several institutions in the US established a five-year training program combining pediatrics, general psychiatry, and child and adolescent psychiatry, known as the "triple board certification"[20]. We also note that in a few countries (e.g., Austria and Italy[21]), child psychiatry training is combined with pediatric neurology, offering opportunities for a more comprehensive management of many conditions including both neurological and psychiatric presentations.

In terms of clinical services, in the 1960s-1980s, the bulk of care was delivered in specialist clinics or as part of adult psychiatric institutions, with limited coordination and often stigma attached to young people's mental health access[22]. By the 1990s and into the 21st century, specialized child and adolescent mental health services have emerged, with the development of dedicated policies and workforce initiatives[23].

Given this relatively recent and diversified history, it is not surprising that there are currently many challenges, but also opportunities and expected future developments, in child and adolescent psychiatry. In this paper, members of the European College of Neuropsychopharmacology (ECNP) Child and Adolescent Psychiatry Network[24] and the ECNP Prevention of Mental Disorders and Mental Health Promotion Network[25], alongside authors co-opted based on their expertise, discuss these challenges, possible solutions, and opportunities, grouped by specific thematic areas. The paper was conceived as a critical, rather than systematic, review. However, for the selection of the relevant literature, we prioritized meta-analyses or umbrella reviews over primary studies, whenever relevant.

CHALLENGES AND POSSIBLE SOLUTIONS IN CHILD AND ADOLESCENT PSYCHIATRY

The diagnostic process

The late 20th-century introduction of diagnostic categories based on operationalized criteria enabled standardized descriptions of mental disorders, including those in children and adolescents, supporting efficient communication among professionals and evidence-based practices[26,27]. Overall, DSM-5 field trials showed good inter-rater reliability for some categorical diagnoses in children and adolescents (e.g., autism, kappa: 0.69; ADHD, 0.61; bipolar I disorder, 0.52), but low kappa values for others (e.g., major depressive disorder, 0.28; disruptive mood dysregulation disorder, 0.25), even though the pragmatic design of these trials, with less standardization than in research settings, may have led to reduced reliability[28].

Categorical classifications provided the basis for (semi-)structured interviews that contributed to shifting child and adolescent psychiatry away from purely art-form assessments[29] (see Table 1 for a summary of the psychometric properties of three key semi-structured interviews[30-32] in child and adolescent psychiatry).

While the categorical diagnostic approach has contributed to increasing reliability in child and adolescent diagnoses, and despite the continuing evolution of diagnostic criteria, some scholars argue that this approach has reached the limits of its clinical utility[35], and this may particularly be the case in child and adolescent mental health[36], due to several reasons.

First, the validity of current categorical diagnoses is questionable and variable according to the type of disorder and validator. Regarding genetic validators, while some syndromes involving intellectual disability and severe problems in neurodevelopment, such as Rett syndrome, can be defined entirely based on the presence of genetic anomalies, this is not the case for the majority of the other disorders[36]. Of note, no genetic diagnostic biomarker

Table 1 Key psychometric properties of three semi-structured interviews used in child and adolescent psychiatry

Development and Well-Being Assessment (DAWBA)[30]	Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID)[31]	Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS)[32]
Fair agreement between DAWBA-based and routine clinical diagnoses (overall percentage diagnostic agreement for any disorder: 74%)[33]	Fair agreement between MINI-KID-assigned and expert consensus diagnoses (overall percentage diagnostic agreement for any disorder: 76.2%)[34]	High inter-rater agreement for both screening scores and diagnoses, ranging from 93% to 100%. Excellent or good test-retest reliability for present and/or lifetime diagnoses[32]

is supported by adequate levels of specificity and sensitivity to be used in clinical practice in child and adolescent psychiatry (e.g., for neurodevelopmental disorders[37]), even though genetic protocols including single nucleotide polymorphism or comparative genomic hybridization arrays, followed by whole exome sequencing, can identify alterations in 52-53% of cases in individuals with autism spectrum disorder and intellectual disability[38].

Biological indices beyond genetics provide accurate validation for some sleep disorders (e.g., narcolepsy and sleep disorder breathing), but weak grounds to validate many other diagnostic categories[36]. Regarding cognitive validators, while these represent a defining feature of learning disorders, they are only partially related to other diagnostic categories[36]. For instance, in ADHD, no neuropsychological test is considered diagnostic[39], and the only test cleared by the US Food and Drug Administration (FDA) and the UK National Institute for Health and Care Excellence (NICE) – the Quantified behavior (Qb) test, a combination of a performance task and motion tracking – is meant to support, rather than replace, a clinical categorical diagnosis, although it is not clear how exactly this test should support the clinical assessment[40].

Second, children and adolescents frequently exhibit concurrent symptoms – such as sleep disturbances, motivational shifts, and behavioral or mood fluctuations – that do not align clearly with categorical diagnoses. These symptoms often evolve across diagnostic boundaries and can lead to diverse clinical outcomes[41]. This is reflected in high levels of psychiatric comorbidity: by age 7, 6.4% of children fulfill two or more psychiatric diagnoses[42]; by age 11-15, 32% of children with a mental disorder have comorbid diagnoses[43]. Comorbidity cannot be fully attributed to shared symptomatology, as many comorbid diagnoses share no common criteria[44].

Third, existing classification systems such as the ICD and DSM are not designed to adequately reflect developmental symptom trajectories. Their categorical structure, based on stable cross-sectional diagnostic entities with clearly defined symptom clusters[45], fails to accommodate the dynamic syndromic shifts typical in child and adolescent psychiatric presentations[46].

Alternative approaches have been proposed to overcome these challenges.

Dimensional approaches have gained some traction, albeit also facing criticism[47]. They are based on latent theory models, including one prominent model that divides mental disorders into internalizing (e.g., anxiety, depression) and externalizing (e.g., ADHD, conduct disorder) spectrums[48,49]. Other models have added domains for thought disorders/psychosis[50,51], neurodevelopmental issues such as inattention and hyperactivity[52,53], and detachment[54]. The Hierarchical Taxonomy of Psychopathology (HiTOP) framework[54-58] is a prominent example of the dimensional approach, viewing mental health problems as nested dimensions related to extremes of psychological functions.

Of note, approaches resembling the HiTOP have been used for many years in child and adolescent psychiatry. Examples include approaches based on the Strengths and Difficulties Questionnaire (SDQ)[59], the Child Behavior Checklist (CBCL)[60], the Pediatric Symptom Checklist (PCS)[61], and the Ontario Child Health Study Emotional Behavioural Scales (OCHS-EBS)[62]. These dimensional approaches provide broadband assessments of symptoms that can be clustered into internalizing, externalizing, and attention problem domains, alongside sleep, thought, somatic, and peer problems[63].

Another approach, the network model, regards symptoms and their correlated features, such as risk factors, as components of a mutually reinforcing network. The network model has been influential in research within child and adolescent psychiatry, as it analyzes the ways in which symptoms change over development by modelling temporal networks[64]. Longitudinally, depressed mood, inattention and worry might be symptoms that increase the likelihood of presenting other symptoms in the future[65]. There have been studies reporting that some symptoms – including irritability, crying, and feelings of loneliness – could bridge internalizing and externalizing spectrums[63,66].

A tension between dimensional and categorical models may arise because clinical decisions often require categorical choices, such as whether to treat or not[36]. However, categories can be derived from dimensions using cut-off scores, when these are properly validated, and dimensions can be formed by scaling categories[36,67]. Diagnoses can typically be assigned when symptom severity crosses a threshold, similar to how conditions such as hypertension or diabetes mellitus are defined. For example, the CBCL uses T-scores, which standardize total scores around a mean of 50, with each 10-point increment representing one standard deviation. Scores above 70 suggest the need for clinical attention[63].

The development of further dimensional tools for children and adolescents with mental health challenges is ongoing. For instance, the Stavros Niarchos Foundation (SNF) Global Center for Child and Adolescent Mental Health, in partnership with the International Association for Child and Adolescent Psychiatry and Allied Professions (IACAPAP), is developing a culturally sensitive measurement tool to assess over 30 mental health domains among children and adolescents[68].

Approaches that heavily rely on neuroscientific constructs have also been proposed. The US National Institute of Mental Health (NIMH) Research Domain Criteria (RDoC)[69,70] is the prototypical example of this approach, focusing on six domains of functioning (arousal/regulatory systems, positive and negative valence, sensorimotor, cognitive, and social processes) measured across multiple levels, from molecular to behavioral. Since its introduction in 2010, the RDoC framework has been applied in many studies in child and adolescent psychiatry, including those on ADHD, autism and irritability[71]. However, despite rapid scientific progress, the clinical application of neuroscience research findings has not yet materialized, leaving RDoC-like models disconnected from everyday clinical practice.

The clinical staging framework highlights the developmental course and progression of mental disorder, not just the individual's current clinical state[72]. The goal is to identify the probability of progression from low-level risk (stage 0) to mild/subthreshold or nonspecific symptoms (stage 1), to a recognized clinical syndrome with some functional impairment (stage 2), moving to incomplete remission or a recurrent syndrome with functional impairment

and cognitive decline (stage 3), and then to a severe unremitting syndrome with functional impairment and cognitive decline resistant to treatment (stage 4)[63]. A specific clinical staging has been proposed as an adjunctive tool for classifying internalizing and externalizing syndromes that emerge in children aged 5-11 years[73].

When considering altogether the above alternative models to categorical diagnosis, it should be emphasized that, in order for them to stand as a viable substitute for ICD/DSM-based diagnostic systems, they would need to demonstrate two key qualities: a) sufficient feasibility for use in everyday clinical contexts, across different settings and by various types of professionals, and b) greater clinical value than current diagnostic models, particularly in terms of guiding treatment decisions and predicting patient outcomes[35]. At present, such supporting evidence has yet to be established[35]. It has been thoughtfully noted that, ideally, the field would require trials comparing the benefits of categorical diagnoses versus alternative approaches[47].

Crucially, it has been pointed out that models alternative to categorical diagnoses should not necessarily replace categorical frameworks, but could complement them by providing additional information that helps characterizing individual cases with respect to a variety of domains. These include relevant psychopathological dimensions, the current developmental stage of the disorder; antecedent factors such as family history of mental illness, perinatal and early environmental influences, psychomotor development, premorbid adjustment, and potentially polygenic risk scores; and concomitant factors such as personality traits, cognitive and social functioning, neurological soft signs, substance use, recent environmental exposures, and, in the future, possible biological markers[35]. Therefore, alternative approaches could be helpful for case formulation, which should be regarded as a central process in child and adolescent psychiatry.

Stigma around mental health

Stigma – defined as "an attribute that is deeply discrediting, turning a whole and usual person to a tainted and discounted one"[74] – can be related to non-concealable attributes, e.g., a physical disability, or predominantly concealable attributes, e.g., mental disorder. Stigma is commonly categorized into public stigma, which refers to the prejudice and discrimination faced by individuals with mental illness when societal stereotypes are accepted and reinforced by the general population, and self-stigma, which describes the feelings of shame and diminished self-worth that arise when individuals internalize these negative stereotypes[75].

While the impact of stigmatization of mental disorder has been thoroughly investigated in adults[76], less research has been conducted on stigma in child and adolescent mental health[77]. According to the *Perceptions of Youth Mental Health Report 2025* by the United Nations Children's Fund (UNICEF) across seven countries, 4 out of 10 people aged 14-25 perceived mental health stigma in school and working places[78]. There is also evidence that stigma is prevalent in younger children, particularly in some sociocultural contexts. For instance, in a survey of parents of children accessing child and adolescent mental health services in Sri Lanka, 44% of them reported that their children had been discriminated in education[79].

Compared to adults, the experience of stigmatization may be more challenging in youth, as they are in a phase of life marked by an intense need to fit in socially with their peers[77]. Children and adolescents with mental disorders can face stigma from various sources, including peers, their families, teachers, and even health care professionals[80,81]. Unlike non-psychiatric conditions, the pursuit of help and treatment for mental disorders may be a key contributor to stigma. In terms of specific issues, adolescents with autism, for instance, may be concerned about losing social relationships, "messing things up with people", experiencing rejection, and feeling "humiliated or embarrassed" in social situations"[82].

A meta-analysis[83] of 74 randomized controlled trials (RCTs) tested interventions aimed at reducing mental health stigma and improving help-seeking among children and young people (aged 10-24 years). The primary outcomes were stigma-related knowledge, attitudes and behaviors, overall stigma, and help-seeking attitudes, intentions and behaviors – further categorized into formal sources (e.g., health professionals) and informal sources (e.g., friends). Secondary outcomes comprised self-efficacy and empowerment. Overall, interventions involving social contact appeared more effective in changing stigma-related behaviors than educational approaches.

While the meta-analysis did not include separate analyses for school-aged children and older adolescents, previous evidence indicates that educational approaches tend to be more effective in school-aged populations[84], whereas social contact interventions are more effective among higher education students[85]. An observed decline in effect sizes over longer follow-up highlights the difficulty of sustaining the benefits of stigma-reduction interventions. This suggests that short-term programs alone may be insufficient for producing lasting change, and that ongoing efforts, booster sessions, or follow-up activities may be needed to maintain and strengthen initial improvements.

Given that interventions involving social contact tend to produce greater changes in stigma-related behaviors than educational approaches, future studies should include direct, personal interactions with children and young people experiencing mental disorder. Future RCTs could also benefit from mixed-methods designs to better capture the complexity of stigma and help-seeking behaviors, shedding light on the factors that influence them. Furthermore, few antistigma interventions for children and young people have been implemented so far in LMICs[86], pointing to a global priority need in the field. Expanding digital approaches – which are still rare in this field – may provide scalable and accessible solutions for young people around the world.

When assessing stigma in children and adolescents, it is crucial to consider that their parents/caregivers can also be stigmatized due to perceived responsibility for their children's symptoms. They often worry about their children's ability to adapt to and integrate into society while grappling with fears of stigmatization and discrimination in schools, health care, and broader social contexts [87,88]. These concerns can lead to a deep sense of isolation, with

caregivers frequently feeling ostracized and excluded from societal activities[89]. Therefore, regular mental health screenings integrated into children's medical appointments should be considered to identify caregiver burden and ensure timely interventions, even for those who do not actively seek support[90].

Overall, while significant strides have been made in understanding both public and self-stigma related to mental health problems in children and adolescents, there remains a critical need for evidence-based interventions that are developmentally appropriate, culturally sensitive, and applicable across diverse settings.

Access to care

Data from the Global Burden of Disease study indicate that the rates of disability-adjusted life years (DALYs) for mental disorders in children and adolescents increased from 803.8 to 833.2 per 100,000 between 1990 and 2019[91]. Furthermore, a meta-analysis showed a more than two-fold increase in the prevalence rates of anxiety and depression during the first year of the COVID-19 pandemic compared to pre-pandemic rates, with pooled prevalence estimates of clinically elevated depression and anxiety symptoms at 25.2% and 20.5%, respectively, and an even higher prevalence in older adolescents and girls[92].

Despite this increase in need, only a limited proportion of children and adolescents with mental health problems are accessing care, and even less receive evidence-based treatment, also in high-income countries. For instance, in the US, only 53% of individuals with a mental disorder aged 3-17 received treatment or counselling from a mental health professional in the previous year[93]. Even in nations with universal health care, such as the UK and Canada, delays are common. For instance, in England, during the 2022-2023 period, the average wait time for children accessing mental health services was 108 days, with some waiting for treatment over two years[94]. The situation is even more dire in LMICs, where it is estimated that 94% of children and adolescents with mental disorders receive no treatment at all[95].

A systematic review[96] of quantitative (22 studies) and qualitative (30 studies) research identified four primary types of barriers to access to care in child and adolescent mental health. Nearly all studies (96%) reported barriers related to individual factors in young people, such as limited mental health knowledge and general attitudes toward help-seeking. The second most frequently reported theme (92%) involved social factors, including perceived stigma and feelings of embarrassment. The third theme (68%) concerned young people's perceptions of the therapeutic relationship with professionals, encompassing issues such as confidentiality and the ability to trust unfamiliar providers. The fourth theme (58%) pertained to systemic and structural barriers and facilitators, such as the financial costs of mental health services, logistical challenges, and the availability of professional support. Further health system-related barriers include insufficient insurance coverage, long distances, long waiting times, unpractical consultation schedules, and restrictive intake procedures[97]. Paucity of policies, a shortage of child and adolescent mental health specialists, insufficient financial resources dedicated to child and adolescent mental health care, and a scarcity of culturally appropriate assessment tools have been identified as key barriers to care access particularly in LMICs[98].

Improving access to and utilization of appropriate mental health care for children and adolescents requires initiatives at multiple levels. As shown by an umbrella review[99], crucial elements to target should include: a) enhancing the sense of trust in professionals (intrapersonal level); b) support from close others for treatment (interpersonal level): c) cost (institutional level); d) availability (community level); and e) insurance (public policy level). Users' perceptions of adequate services pertain to their availability, including the possibility of self-referral, practitioners' qualities and expertise with relational continuity, personalized support tailored to actual needs, and the development of self-care skills and mental health literacy in parents and children[100].

A meta-analysis[101] of 34 RCTs evaluating interventions aimed at improving either supply-side elements of service accessibility (e.g., approachability, availability or affordability) or demand-side abilities of individuals (e.g., the ability to perceive the need for care, pay for services, or engage with treatment) found that universal school-based interventions for the general population significantly improved early steps in accessing care, with 80% showing effects on knowledge and 67% on attitudes, but had minimal impact on help-seeking (22%) or taking action (20%). Interventions targeting at-risk children already identified by health care systems showed stronger effects: 71% improved care access, and 80% increased satisfaction with care. Therefore, to produce broad, population-level improvements in access to care, a stepped or two-stage approach may be necessary – first identifying young people who require support, and then ensuring that they are effectively linked with appropriate services. However, the current evidence base for such models remains very limited[101]. Given that existing research does not yet justify large-scale mental health screening of children[102], rigorous RCTs are needed to evaluate screening strategies and weigh their potential benefits against possible harms[103].

Importantly, there is increasing recognition that structural and environmental changes – such as reforming policies, service infrastructure, and financing systems – may exert a stronger influence on help-seeking behavior than educational initiatives alone[104]. This highlights the need for more studies targeting contextual barriers to care. Crucially, attempts to remove a single barrier, for example by reducing financial costs, are unlikely to be sufficient if issues relating to availability, accessibility or acceptability remain unaddressed[104]. Emerging models that provide rapid assessment, including crisis or consultation services delivered by phone, show potential to support a shift toward more proactive and needs-based care. Longer follow-up periods are also required to determine whether improvements in access are sustained over time [105].

The additional challenges in LMICs – such as limited service infrastructure, more pervasive stigma, and low detection rates[106] – suggest that strategies effective in high-income settings cannot

simply be transferred without adaptation[107]. Further research is therefore essential to identify context-appropriate approaches for improving access to mental health services especially in these environments.

Funding and insurance limitations

Funding and insurance limitations represent significant barriers to the accessibility and quality of child and adolescent mental health care worldwide. These challenges affect both high-income countries and LMICs, although they differ in scale and nature across regions[106].

For instance, in the UK, while 30% of the mental health needs in the national health system (NHS) are related to children, children's mental health services receive only around 8% of the total budget[108]. As to LMICs, an analysis focusing on 15 countries in the Western Pacific Region[109] found that spending for child and adolescent mental health ranged from 0.01% of the total health expenditure in Cambodia to 1.06% in Mongolia, with seven countries spending less than 1%. Notably, in LMICs, from 2007 to 2015, only a negligible share of global development assistance for health – about 0.1% – was directed toward child and adolescent mental health[110]. In the years 2016 to 2021, funding for adolescent mental health rose only slightly to 0.32%[111].

However, the economic case for investing in mental health of children and adolescents is becoming increasingly compelling. In fact, there is strong and growing evidence that supporting the mental well-being of children and young people not only enhances their quality of life, but also generates long-term economic benefits. These include lower health care and public service costs, as well as greater future productivity and earnings[112]. For example, an economic analysis conducted across 36 countries found that implementing a package of mental health care interventions for adolescents produced a return on investment of 23.6, at a cost of $102.9 per DALY averted over 80 years[112].

Addressing the current systemic barriers requires different strategies in high-income countries and LMICs. In the former, despite more advanced health care systems, insurance policies often place mental health services, in particular those for children and adolescents, as secondary to other medical needs. Moreover, insurance policies may limit the number of covered sessions or require high out-of-pocket costs, making it difficult for families to access consistent, long-term care. This issue is particularly pressing for families from lower socioeconomic backgrounds, who face financial barriers even in the context of public health insurance. Therefore, high-income countries must expand insurance coverage to fully include child and adolescent mental health services and promote their integration into primary health care.

Encouraging successful initiatives, albeit with some caveats, are available. For instance, in the US, access to mental health care has been increased in recent years through expansions in public health insurance (i.e., the State Children's Health Insurance Program). There is evidence that these programs have led to an increased mental health coverage for children in older age groups, including those with a family income under 300% of the federal poverty line[113].

LMICs should prioritize the development of mental health service infrastructure, workforce training, and policy integration. Engaging with governments, non-governmental organizations, and research institutions at the global level can offer crucial support. For instance, in Bosnia and Herzegovina, ongoing financial and technical partnerships contributed to the strengthening and expansion of existing mental health care systems. Between 2010 and 2022, the Swiss Agency for Development and Cooperation played a key role in this process through a program designed to enhance and scale up services without establishing parallel structures[114]. Nevertheless, collaborating with global partners requires careful attention to potential challenges: short-term, project-based funding can hinder long-term planning; narrowly targeted initiatives may divert scarce national resources from building comprehensive services; and approaches that restrict the involvement of local professionals and policy makers can limit their ability to shape and oversee their own systems.

In sum, overcoming funding and insurance limitations is essential for advancing equitable, sustainable and effective child and adolescent mental health care worldwide, requiring coordinated policy reform, long-term investment, and international collaboration.

Shortage of mental health professionals

The number of child and adolescent psychiatrists varies significantly across countries, with figures ranging worldwide between 0.1 and 3.4 per 100,000 inhabitants aged 0-19 years, although data are not readily available for many countries[115]. A UK workforce survey indicated that, in 2023, the rate of vacant positions in child and adolescent psychiatry was the highest among all psychiatric subspecialties (34.8%)[116]. In the US, from 2007 to 2016, the ratio of child and adolescent psychiatrists per 100,000 children has increased by over 20%[117], but regional maldistribution is significant, with more than 70% of US counties, especially those with lower levels of income and education, having no child psychiatrists at all. Additionally, in 2018, in the US, there were only sufficient child psychiatrists to treat 17% of children with severe mental health problems[118]. This number is projected to increase only to 27% by 2030[119].

The situation in the UK and US is emblematic of a global trend. Notably, the median number of child psychiatrists per 100,000 population is 0.1-2 in LMICs[95]. Importantly, even when staff is available, a sizable portion of them may experience burnout and low levels of well-being, which are exacerbated by being overburdened and constantly facing urgency, the increasing complexity of presenting cases, insufficient collaboration with schools, and the advancing digitalization with all its associated challenges[120].

The shortage of child and adolescent mental health professionals has been associated with many adverse outcomes, with one of the most important being completed suicide of children and adolescents[121]. The lack of funding for training programs and low

salaries for mental health professionals further exacerbate this issue, discouraging new generations of physicians from entering the field.

Various strategies have been proposed to address this workforce crisis. Examples of specific successful initiatives include the following.

Summer Immersion Programs provide medical students with early exposure to child and adolescent psychiatry, fostering interest and encouraging pursuit of this subspecialty. Evaluations of such programs show that they led to successful recruitment of students into child and adolescent psychiatry, with up to 80% of participants expressing increased interest in the field and over 60% pursuing psychiatry residencies afterward[122].

Mentorship Networks are structured mentorship programs for medical students, that have been shown to increase recruitment into child and adolescent psychiatry by offering guidance, professional support, and exposure to subspecialty practice. A study[123] based on qualitative interviews of nine program directors and 29 medical students or graduates across 14 medical schools in the US indicated that mentorship participation has the potential to increase the likelihood of entering child and adolescent psychiatry by approximately 40%, demonstrating the value of sustained professional relationships.

Loan Forgiveness and Training Expansion offer financial incentives and additional training positions to attract and retain child and adolescent mental health professionals. Programs providing loan repayment[124] and stipends may lead to an increase in residency retention in child psychiatry, reducing barriers to entry and promoting long-term workforce sustainability.

Peer Workforce Expansion aims to integrate youth peer workers (i.e., young persons, typically adolescents or young adults, who have lived experience with mental health challenges, emotional difficulties, or other related struggles, and who are trained to provide support to their peers facing similar issues) into mental health services, enhancing outreach and service delivery. Qualitative research using data collected through semi-structured interviews highlighted that programs incorporating peer support can successfully improve engagement and mental health outcomes[125].

Child Psychiatry Access Programs are programs offering rapid remote pediatric mental health consultation to primary care providers. These have emerged as a promising option to address the shortage of child and adolescent mental health workforce. A systematic review[126] assessing the impact of these programs found 33 studies, none of which was randomized. The programs showed year-over-year growth in adoption and were generally well-received by providers and caregivers. Health care provision costs varied widely. No study reported changes in patient mental health outcomes using validated measures. As such, these programs require further investigation[126].

Collectively, these initiatives demonstrate that a multifaceted approach – combining early exposure, mentorship, peer integration, financial incentives, and collaborative care – can significantly expand and strengthen the child and adolescent psychiatry workforce.

Evidence-based treatments

Pharmacological treatment

Global pharmacoepidemiological data indicate a rising trend in the use of psychotropic medications among children and adolescents over the past two decades. A study across 65 countries reported that total sales of psychotropic drugs for both children and adults increased between 2008 and 2019, with an average annual growth rate of 4.08% (95% CI: 2.96-5.21)[127].

A substantial number of RCTs, synthesized in large-scale umbrella reviews, indicate that medications used to treat various mental health conditions in children and adolescents show moderate to high effect sizes[128] (see Table 2) and overall good tolerability[129].

Despite the availability of various psychotropic medications, many challenges – as well as potential opportunities – related to child and adolescent psychopharmacology were recently highlighted in a Position Paper by the ECNP Child and Adolescent Neuropharmacology Network, in collaboration with representatives from the European Medicines Agency (EMA) and associations of people with lived experience[24].

A first challenge is that there are several disorders for which no evidence-based pharmacological treatments exist, or existing interventions have not been thoroughly studied. Notably, in many instances, medications are used off-label, with studies suggesting that up to 55% – and, when excluding medications for ADHD, as much as 95% – of psychotropic prescriptions for children are off-label[130]. This exposes children and adolescents, especially those more vulnerable – such as those with intellectual disabilities – to possible harm[130].

A survey among members of the above-mentioned ECNP Network[24] identified multiple conditions requiring further pharmacological development. Ranked by the number of votes (priority), these conditions were: autism spectrum disorder (core symptoms); emotional dysregulation/irritability; anorexia nervosa; depression; suicidal behaviors; conduct disorder/aggressiveness; addiction to drugs or alcohol; negative symptoms of schizophrenia; insomnia/sleep disorders; anxiety; rare diseases such as Prader-Willi syndrome; borderline personality disorder; eating disorders other than anorexia nervosa; obsessive-compulsive disorder; body dysmorphic disorder; cognitive dysfunction in intellectual disability; somatoform symptoms; and ADHD comorbid with cocaine or methamphetamine addiction.

Additional challenges include the following: a) most compounds have been tested only in single placebo-controlled trials, underscoring the need for further studies that directly compare two or more active medications, focus on children and young people who do not respond to initial treatments, or address those who cannot tolerate first-line options; b) the predominant research focus is on core symptoms, while the impact of medications on other important outcomes, such as functional abilities, remains underexplored; and c) there is limited understanding of long-term effects, both beneficial and harmful, of psychotropic medications on the developing brain and body.

Table 2 Efficacy of medications approved by the US Food and Drug Administration for indications in child and adolescent psychiatry (vs. inactive controls)[128]

	Age (years)	Effect size (95% CI)
Attention-deficit/hyperactivity disorder		
Amphetamine/dextroamphetamine mixed salts	3-17	
Amphetamine/dextroamphetamine mixed salts, extended release	6-17	
Dextroamphetamine	3-17	–1.02 (–1.19 to –0.85)
Dextroamphetamine, sustained release	6-16	
Lisdexamfetamine	6-17	
Methamphetamine	6-17	
Atomoxetine	6-17	–0.56 (–0.66 to –0.45)
Clonidine, extended release	6-17	–0.71 (–1.17 to –0.24)
Guanfacine, extended release	6-17	–0.67 (–0.85 to –0.50)
Methylphenidate	6-17	–0.78 (–0.93 to –0.62)
Dexmethylphenidate	6-17	
Viloxazine	6-17	NA
Generalized anxiety disorder		
Duloxetine	7-17	–0.09 (–0.27 to 0.09)
Escitalopram	≥7	NA
Autism spectrum disorder		
Aripiprazole	6-17	–0.24 (–0.40 to –0.08) (aggressive behavior)
Risperidone	5-17	–0.29 (–0.48 to –0.11) (aggressive behavior)
Bipolar disorder (depressive episodes)		
Lurasidone	10-17	NA
Olanzapine/fluoxetine combination	10-17	NA
Bipolar disorder (manic or mixed episodes)		
Aripiprazole	10-17	–1.08 (–1.32 to –0.85)
Asenapine	10-17	NA
Olanzapine	13-17	NA
Quetiapine XR	10-17	NA
Risperidone	10-17	NA
Lithium	12-17	NA
Conduct disorder		
Risperidone		–0.48 (–0.71 to –0.24)
Depressive disorder		
Fluoxetine (major depressive episode unresponsive to psychotherapy)	8-18	–0.51 (–0.84 to –0.18)
Escitalopram	12-17	–0.17 (–0.88 to 0.54)
Obsessive-compulsive disorder		
Clomipramine	10-17	–0.31 (–0.64 to 0.02)
Fluoxetine	7-17	–0.24 (–0.47 to –0.01)
Fluvoxamine	8-17	–0.21 (–0.49 to 0.06)
Sertraline	6-17	–0.24 (–0.46 to –0.03)
Schizophrenia		
Aripiprazole	13-17	–0.43 (–0.63 to –0.24)
Brexpiprazole	13-17	NA
Lurasidone	13-17	–0.48 (–0.71 to –0.25)
Olanzapine	13-17	–0.74 (–1.05 to –0.44)
Paliperidone	12-17	–0.42 (–0.66 to –0.18)
Quetiapine	13-17	–0.42 (–0.65 to –0.19)
Risperidone	13-17	–0.62 (–0.89 to –0.34)
Tourette syndrome		
Aripiprazole	6-17	NA

NA – not available

Furthermore, a survey of experts with lived experience (644 participants from 13 countries)[24] identified knowledge gaps related to safety and tolerability, including concerns about medication addictiveness, as major unmet needs. The survey also highlighted the need for a better understanding of the respective roles of pharmacological and non-pharmacological interventions.

Possible solutions and opportunities in child and adolescent psychopharmacology to address these challenges include: a) the development of novel medications; b) applying lessons learned from failed RCTs; c) improving understanding of placebo effects and minimizing them; d) assessing outcomes beyond core symptoms; e) considering developmental windows; f) conducting trials that compare pharmacological and non-pharmacological treatments; g) moving beyond standard placebo-controlled RCTs; h) advancing precision medicine and stratification approaches (including biomarker research and therapeutic drug monitoring); i) investigating, researching and implementing digital technologies such as ecological momentary assessment; j) focusing research on individuals who have not responded to initial treatments; k) innovating regulatory and legislative frameworks; and l) transforming how research is conducted, reported and disseminated. These possible solutions and opportunities are further detailed in Table 3.

While the field eagerly anticipates the development and testing of novel compounds, a prudent strategy remains to implement evidence-based practices and critically evaluate the use of medications lacking supportive evidence in child and adolescent psychopharmacology. In this context, the Umbrella-Review, Evaluation, Assessment, and Communication-Hub (U-REACH) approach [153-156] – which implements evidence from umbrella reviews with the creation of open-access online platforms that make these findings accessible to diverse stakeholders in a user friendly way – represents an innovative and promising opportunity.

Table 3 Key challenges and possible solutions/opportunities in the field of child and adolescent psychopharmacology

Developing novel psychotropic medications

- No ground-breaking medications in child and adolescent psychiatry have been introduced in the past decades, and no major developments are ongoing[131].
- While pre-clinical animal studies are a major bottleneck in drug development, cell-based *in vitro* models for efficacy and safety testing could help address these challenges (e.g., induced pluripotent stem cells)[132].

Randomized controlled trials (RCTs)

- RCTs remain the gold standard for assessing medication efficacy and tolerability, but challenges such as poor recruitment and drug supply issues can threaten their success.
- Involving people with lived experience in the study design is essential and aligns with European Clinical Trials Regulation. Sharing study results with participants is a regulatory requirement once the trial is completed[133].
- Regional research networks can enhance recruitment, especially from non-university hospitals and community services.

Understanding and minimizing the placebo effects

- Placebo effects can confound the interpretation of trial findings and lead to reduced effect size of active compounds[134-136].
- Placebo effects and drug-placebo differences depend on trial design, conduct and participant factors[134-136].
- Effective strategies to minimize placebo effects include recruiting from fewer sites, avoiding open-label lead-in, conducting longer trials, using validated assessments, and including more severely affected participants, and those with a first episode or shorter illness duration[137]. However, these recommendations are based on evidence mostly from adult studies; youth-specific research is still needed.

Assessing outcomes beyond core symptoms

- The bulk of available RCTs focus on outcome measures related to core symptoms.
- Trials should be incentivized to include outcomes beyond core symptoms, such as functional measures[138]. Notably, the European Medicines Agency (EMA) supports adding quality of life and functional outcomes alongside symptom ratings[24].
- Valid, age-appropriate functional and cognitive measures in child and adolescent psychiatry are urgently needed.
- Cognitive outcomes should be used more broadly, with developmentally sensitive norms similar to those we have for growth and blood pressure.

Consideration of developmental windows

- Extrapolating results from trials in adults may be misleading.
- Research should consider age-related differences in medication response and adapt study design accordingly.
- Timing interventions to developmental stages and assessing effects on normative development are crucial.

Trials comparing pharmacological and non-pharmacological interventions

- Inferring the comparative efficacy and tolerability of pharmacological and non-pharmacological treatments from trials focusing only on pharmacological or non-pharmacological treatments may be misleading, due to differences in control conditions[139].
- Methodological advances, such as including both placebo and sham arms, should be encouraged to compare interventions rigorously.

Moving beyond standard placebo-controlled randomized trials

- RCTs have limitations for studying real-world patients, rare events, and long-term outcomes.
- Pharmacoepidemiologic studies leveraging large datasets to detect rare adverse effects should be encouraged.
- Self-controlled methods[140] and emulation of target trials[141,142] should be encouraged.
- Stepped wedge cluster randomized trials[143], platform trials[144], and *in silico* trials may provide unprecedented opportunities[145].

Moving towards precision medicine / stratification approaches

- One-size-fits-all approaches limit personalized treatments.
- Biomarker research is limited by lack of incorporation in pharmacological trials and scarce academic funding.
- Future success likely depends on multi-level biomarker approaches validated in independent samples and tested for cost-effectiveness[146].

Therapeutic drug monitoring (TDM)

- TDM helps guide compliance, dosing and interactions, and combined with pharmacogenetics supports personalized medicine.
- Wearable sensors offer promising on-body monitoring.

Implementation of digital technologies

- Digital tools, including artificial intelligence and real-world data, can enhance diagnostics, recruitment, and drug safety monitoring.
- Remote and decentralized clinical trials using secure digital platforms can increase flexibility and inclusivity[147].

Ecological momentary assessment

- Traditional self-reports are prone to recall bias, while ecological momentary assessment captures real-time data in natural settings.
- Ecological momentary assessment can track dynamic patterns across various disorders and support transdiagnostic, dimensional assessment approaches[148].
- Problems with feasibility in ordinary clinical practice and patient engagement need to be addressed.

Focusing on individuals who have not responded to initial treatment

- Treatment-resistant individuals are often excluded from trials[149], limiting evidence-based options after initial non-response.
- More trials are needed in this group, exploring augmentation strategies and the possible role of non-pharmacological adjuncts.

Table 3 Key challenges and possible solutions/opportunities in the field of child and adolescent psychopharmacology *(continued)*

Need for innovations in regulatory and legislative framework

- Small market size and ethical challenges limit robust evidence for pediatric psychopharmacology.
- Psychiatry accounts for only 2.4% of pediatric trials[24], despite regulatory frameworks (i.e., pediatric investigation plans in Europe[150]) which outline how a medicine should be tested in children to ensure that it is safe, effective and appropriately dosed for pediatric use.
- Including adolescents in adult trials or running parallel trials in adults and adolescents/children with conditions that have significant unmet needs at young ages may accelerate access to treatments for youth.

Innovation in the way research is conducted, reported and promoted

- Brain research in youth remains underfunded despite its strategic importance.
- Stronger academia-industry collaboration is needed for drug development.
- Research should involve people with lived experience to improve relevance, access and impact.
- Individual participant data meta-analyses, especially when coupled with real-world data[151], can inform on efficacy or tolerability in subgroups of individuals with more heterogeneous characteristics.
- Current nomenclature in child and adolescent psychopharmacology can be confusing (e.g., "antipsychotic" for tics), and may be replaced by classifications based on mechanisms of action[152].

Reducing stigma related to child and adolescent psychopharmacology

- Stigma related to psychopharmacologic treatment is common.
- Education for families, school staff, and the public - ideally involving people with lived experience - is vital to reduce stigma around mental illness and psychotropic medications.

Psychological treatments

Psychological treatments in children and adolescents have been studied for over 50 years. A meta-analysis[157], including 447 trials spanning four decades of research on a range of psychotherapies across disorders, found an overall effect size (g) of 0.46. The pooled effect size was highest for the treatment of anxiety (g=0.61), followed by conduct problems (g=0.46), ADHD (g=0.34) and depression (g=0.29), with age generally not being a significant moderator of effect.

These results should be interpreted in the light of possible caveats. Notably, pooled studies were highly variable in relation to the type of control and rater of symptoms. It should be considered that, while "usual care" provides a notably strong comparison, other passive conditions, such as clinical monitoring or waitlist, represent easy-to-beat controls[139]. Type of rater of outcome may also influence the effect size, possibly due, at least in part, to expectancy effects, but also to setting-dependent behaviors.

For instance, a seminal meta-analysis of non-pharmacological interventions for ADHD showed that the effects of behavioral parent training were significant and large when considering symptom scores from raters proximal to the delivery of the intervention (typically, parents) (effect size of 0.40). In contrast, the effect became non-significant when relying on scores from distal raters (likely blinded, such as teachers) (effect size of 0.02)[158].

In relation to the specific type of intervention, the following were found superior to control conditions in an umbrella review of meta-analyses[128]: social skills training and behavioral therapy in ADHD; social skills training, parent-child interaction therapy, intensive behavioral therapy, and cognitive behavioral therapy (CBT) in autism; combined parental and child behavioral interventions for conduct disorders; interpersonal therapy, problem-solving therapy, family therapy, CBT, and interpersonal therapy for depression; CBT for anxiety disorders; group CBT, behavioral therapy, and behavioral therapy with exposure and response prevention for obsessive-compulsive disorder; group CBT for post-traumatic stress disorder (PTSD); and family therapy for anorexia nervosa.

Despite advances in treatment development, a significant research-practice gap persists. A low proportion of trials have examined candidate mechanisms of change, with small study samples resulting in low power to detect mediation effects[159]. In addition, many evidence-based treatments still leave a portion of youth clinically impaired post-treatment, and some conditions (e.g., early-onset eating disorders[160]) are often treated with therapies not supported by research.

Notably, treatment effects for anxiety disorders and ADHD have not improved over time, while effects for depression and conduct problems have declined[161]. This may be partly due to evolving study designs, with early trials often using waitlist or no-treatment controls, potentially inflating efficacy estimates[159]. Moreover, although 90% of the world's youths live in LMICs, fewer than 10% of youth RCTs have been conducted in these settings[162], pointing to the need of scalable interventions. Finally, possible side effects of therapies are rarely assessed[163].

These challenges underscore key opportunities. Dismantling studies can compare specific treatment components or sequences to identify active ingredients. These studies are currently limited in youth, but show promise (e.g., parent involvement in CBT improves anxiety outcomes)[164]. Furthermore, experimental therapeutics targeting and manipulating specific risk factors/processes (e.g., cognitive biases in anxiety[165]) can provide useful information.

Treatment personalization will be key to move beyond the one-size-fits-all approach that is associated to suboptimal effect sizes. The synthesis of participant data from multiple RCTs using advanced meta-analytic methods is a promising avenue to inform decisions about treatments for individual patients[166]. Moreover, sin-

Table 4 Additional key challenges and solutions related to psychological treatments for children and adolescents

Better representation of and treatment development for all youth

- Most participants in randomized controlled trials (RCTs) are White, middle/upper class[169], limiting generalizability.
- Intervention adaptations for diverse cultural and socioeconomic groups are mixed in effectiveness[170].
- New efforts should aim to develop/adapt interventions for marginalized groups via co-creation of contextually grounded, affirming and accessible models[171].

Sustained implementation of evidence-based interventions in delivery settings

- Effective psychotherapies for children and adolescents are often not implemented in real world[172].
- Implementation science frameworks help tailor treatments for frontline providers and community settings[173].
- Integration of social determinants of health may improve fit of interventions[174].
- Training and organizational support are key to uptake and sustainment of evidence-based treatments[175].
- Feedback loops from real-world practice to research can close gaps in accessible, effective intervention delivery[176].
- Incorporating core RCT elements (targets, measures, mechanisms) into practice can advance implementation science[177].

Balancing between rigorous clinical science and service delivery access

- There is tension between rigorous testing and the realities of service delivery[178].
- Engaging stakeholders (youth, families, providers, systems) in intervention design can promote better dissemination[179].
- Systems and policy changes, alongside collaborative development, can reduce the research-practice gap[178].
- Long-term innovation must integrate precision medicine with real-world application, addressing both established and novel treatments in diverse populations[180].

gle session therapies have been found effective in a meta-analysis of 50 RCTs[167] (effect size of 0.32), with effects stronger for anxiety (effect size of 0.56) and conduct problems (effect size of 0.54), suggesting that brief scalable interventions, which could be implemented in LMICs, might complement traditional multisession treatments, which are often started but not completed.

Other meta-analytic evidence[168] shows similar effects for in-person and online-delivered therapies in youth for some conditions (e.g., anxiety and conduct problems), although not all (e.g., ADHD and prison populations), suggesting that at least some individuals with specific conditions may benefit from online scalable interventions.

Table 4 details other challenges and solutions in relation to psychological treatments for children and adolescents.

Neuromodulation

A comprehensive umbrella review, covering the effects of neurostimulation across mental health conditions in children and adolescents, found only evidence of small effects of neurofeedback for ADHD, with low reliability, and not confirmed when analyses were restricted to probably blinded raters[128].

However, two neurostimulation therapies have been cleared by the FDA for children and adolescents: a) external trigeminal nerve stimulation for individuals with ADHD (aged 7-12), based on a pilot RCT[181], but not confirmed by a later definitive RCT[182]; b) transcranial magnetic stimulation as add-on treatment for depression in youth aged 15-21, based mainly on analyses of observational data, compounded by meta-analytic evidence from six RCTs[183].

Overall, neuromodulation represents an area that deserves more dedicated funding to establish efficacy, safety and age-appropriate protocols, understand underlying neural mechanisms, identify biomarkers to predict treatment response, improve accessibility, and address ethical and regulatory considerations.

Physical exercise

Physical exercise has been associated with moderate to high effect sizes across several disorders in umbrella reviews, but the level of evidence is often unclear or low, for example, in anxiety/depression[184] and ADHD[155] in youth. As such, recommending it as a specific intervention in guidelines awaits further evidence.

Treatment adherence

Treatment adherence refers to the extent to which patients and their families follow prescribed pharmacological treatments, therapy sessions, behavioral interventions, or lifestyle modifications[185]. In child and adolescent mental health, adherence presents unique challenges due to developmental, social and familial factors[186]. Non-adherence remains a critical obstacle to the effective implementation of evidence-based mental health treatments.

Barriers to adherence in children and adolescents with mental health issues often arise from developmental immaturity, limited resources, and pervasive stigma surrounding mental health[187]. Family dynamics and attitudes, in particular, play an essential role in fostering adherence, particularly through managing medications, attending or facilitating therapy sessions, ensuring consistency with treatment plans, and implementing changes in the home, including parenting practices, that are necessary to support recovery[188].

Recognizing the broader family context is essential to addressing adherence challenges effectively. Adherence can be affected by erroneous beliefs of parents and young people, such as the belief that mental disorder does not warrant the use of medication, or that use of psychotropics is dangerous, or that medications should not be used for maintenance care.

According to a meta-analysis of 28 studies, only about 65.9% of youth with severe mental illness adhere, on average, to prescribed medications[186]. Risk of non-adherence was significantly higher among youth with comorbid ADHD (odds ratio, OR=0.61), substance use disorders (OR=0.66), or more severe illness (OR=0.44), whereas adherence to pharmacological treatment was strongly associated with engagement in psychotherapy (OR=5.70), positive patient attitudes (OR=3.41), and supportive family beliefs about

treatment (OR=2.82)[186].

Age, sex/gender and socioeconomic status did not significantly moderate the rates of medication adherence, but studies with a higher percentage of female participants found that older children were more likely to be adherent, compared with studies with fewer female participants. Medication type was not a significant predictor of adherence overall; however, in studies of youth with psychotic disorders, antipsychotic medications were linked to a higher risk of non-adherence than other medications[186].

The complexity of the medication regimen was not a significant predictor of non-adherence overall. However, when analyses were stratified by diagnosis, regimen complexity was linked to a higher risk of non-adherence specifically among patients with bipolar disorder[186]. Finally, family attitudes toward psychiatric treatment were significantly associated with rates of adherence, wherein youth from families with more positive attitudes experienced higher levels of medication adherence[186].

Regarding factors specifically associated with dropout from psychotherapy, data collected on 1,177 intakes from a large sample of children and adolescents (aged 5-18)[189] suggested that ethnicity (specifically being African American) was a significant factor increasing dropout. Residing in a single-caregiver household, living with a non-biological family, receiving state-funded low-income insurance support, having lower parent-reported youth functioning, undergoing a routine (rather than urgent) intake, and experiencing longer wait times were additional factors associated with dropout, with varying levels of significance depending on the dropout definition used[189].

Strategies have been tested to improve adherence to treatment in child and adolescent mental health services, building on the evidence provided by the aforementioned studies. Adherence to pharmacotherapy has been found to benefit from recognizing the larger context of the family, allowing time for parents and children to change their attitudes toward treatment, ensuring easy access to medications and support systems, and enhancing motivation through targeted education and encouragement. Respecting the preferences of patients and families, while guiding them towards evidence-based interventions, has been shown to foster cooperation and build trust within the therapeutic process[190].

Examples of evidence on strategies to improve adherence include: a) meta-analytic evidence[191] (six RCTs) showing the effectiveness of strategies to improve ADHD medication adherence (pooled OR=2.39), including behavioral approaches (e.g., rewards, reminders or counseling), educational programs (e.g., psychoeducation or skills training), and technology-based interventions (e.g., mobile apps or electronic reminders); b) a systematic review[192] of 17 studies showing that brief, intensive interventions that directly addressed families' practical and psychological barriers were effective in improving early session engagement in parent and child mental health programs. Additionally, long-term improvements in engagement and retention were achieved by interventions that combined motivational interviewing, family systems approaches, and enhanced support for family stress and coping throughout treatment[192].

Digital tools and technologies present substantial opportunities to address adherence challenges. Mobile apps, wearable devices, and telehealth platforms offer real-time monitoring, reminders, and motivational tools to support adherence. Moreover, these innovations can extend access to care for underserved populations, addressing geographical and logistical barriers while collecting valuable data for treatment optimization[193,194].

In conclusion, improving adherence among children and adolescents with mental disorders will require multi-level innovation. Future efforts should integrate family-centred and developmental-sensitive strategies alongside patient education. Embedding digital tools (such as reminders, apps and telehealth) and behavioral supports (motivational interviewing, contingency management) shows promise. Enhancing collaboration between caregivers and youth, tailoring interventions by age and diagnosis, and embedding adherence promotion into routine care pathways are vital. Robust prospective trials targeting high-risk groups, implemented in real-world settings and evaluating long-term outcomes are critical to translate evidence into sustained practice.

Parental participation/engagement

Parental participation/engagement (PPE) refers to parents' active involvement in various processes, including help-seeking for their child, gathering information about their child's condition, participating in therapeutic decisions, facilitating attendance to visits, and implementing treatment components in the clinic or at home [81,195].

Additionally, certain clinical situations in children and adolescents necessitate parent-mediated therapy, which seeks to implement behavioral strategies such as contingency management or adequate eating behaviors, as in family-based treatment for eating disorders. In intensive family-centered programs, such as family systems therapy and multisystemic therapy, therapeutic alliance and PPE are core elements of the intervention.

PPE has consistently been linked to improved outcomes in child functioning across various mental health conditions, although results are more variable at the symptom level[195]. Meta-analytic evidence from twenty RCTs showed that interventions involving parents had a significantly greater impact on adolescent psychopathology compared to interventions focused solely on adolescents (g=–0.18)[196].

PPE is often assessed through homework completion by parents. In a review of the literature[195], the average completion rate was 49%, with a broad range from 19% to 89%. Generally, mothers are at the forefront of seeking health care and implementing treatment. In interventions for child mental health disorders, studies show that mother-led is significantly higher than father-led involvement, with mother participation exceeding 90%[195]. When examining health care seeking attitudes of self-referred families, on average 12.6% of referrals were from fathers, and 87.4% from mothers[197].

Parents often face psychological barriers (such as their own mental health problems or low motivation) which reduce their capacity to engage meaningfully. One study found that poorer par-

ent mental health predicted lower session attendance and lower therapist-rated engagement[198]. Moreover, situational and structural factors – such as competing demands (work, other children), inconvenient scheduling, transportation issues, or service location – create barriers to access that disproportionately affect low-income or marginalized families[199]. In addition, relational and attitudinal factors impact engagement: parents may feel judged, blamed or not listened to in therapeutic settings, reducing their willingness to participate actively[195].

To improve PPE in interventions for children and adolescents with mental disorders, services need to adopt a multi-pronged, flexible strategy that addresses both practical and relational barriers. One effective approach is tailoring intervention delivery to parents' lives by offering flexible scheduling, varied formats (e.g., digital/web components, brief modules), and integration with existing family routines, thus reducing the burden of competing demands and enhancing accessibility[200].

Strengthening knowledge and awareness is also crucial: parents may not engage simply because they lack clear information about the intervention's purpose, their role, or expected outcomes. Notably, a systematic review found that PPE strategies based on established theories – such as the health belief model (which suggests that people's participation depends on how strongly they believe that they are at risk of a problem) and the theory of planned behavior (which proposes that behavior is driven by intention, shaped by attitudes, social norms, and perceived control) – may help increase parents' engagement[201].

Services should therefore invest in clear orientation, transparent communication and building parents' self-efficacy (helping them feel confident and competent in their role), consistent with motivational frameworks of parent/child engagement that emphasize hope, readiness and self-efficacy[202]. Further, employing community-based outreach (for example, via community health workers in underserved settings) can enhance engagement by building trust and aligning interventions with families' lived contexts[202]. Lastly, interventions should deliberately involve all relevant caregivers (including fathers) and be culturally sensitive and inclusive.

Together, these strategies can make parental participation not merely a required "add-on", but a central and supported component of youth mental health intervention efforts.

Integration between clinical care and support provided in schools

As primary environments in which children and adolescents spend much of their time, schools represent a critical setting for collaboration between mental health professionals and educational personnel to more effectively identify psychological difficulties that hinder learning and to implement strategies that promote both mental well-being and academic achievement[203].

The World Health Organization (WHO) underlines the inseparable nature of learning and mental health and the fact that mental health issues can disrupt learning[204]. As an example, a study from the UK[205] showed that educational attainment for youth with depression declined significantly compared to unaffected peers (estimated z-score change = –0.52). According to another study conducted in Chile[206], mental health issues significantly decreased students' end-of-year grade point averages (d=0.25) and the percent of school days attended.

There are multiple ways in which schools can support youth mental health and, vice versa, mental health professionals can support learning. Schools can be a vehicle to deliver preventive strategies, including for bullying, inadequate use of substances, and youth suicide, and identify emerging issues that warrant early intervention. Further, as young people with diagnosable mental disorders are entitled to high-quality/intensified education programs, this may require input from mental health professionals to appropriately adapt the curriculum and provide accommodations.

Despite these opportunities, child and adolescent psychiatry has historically often been poorly integrated with schools and education systems. For instance, the National Evaluation of Targeted Mental Health in Schools 2008 to 2011, commissioned by the UK Department for Children, Schools and Families, highlighted that the relations of schools with child and adolescent mental health services were poor and limited at the start of the evaluation, even though they improved over the three years of the study[207].

Several challenges can explain this lack of integration. These include a shortage of child and adolescent psychiatrists, as previously discussed. Consequently, there may be concerns of being overwhelmed by demands if these psychiatrists work within schools[208,209]. Additionally, training for mental health professionals on how to effectively work within complex systems, particularly the education system, is often inadequate[210,211].

A frequent barrier to integrating child and adolescent psychiatry in schools is the perspective of schools and education systems. Child and adolescent psychiatrists are seen as a costly resource in what is often a resource-poor environment[212]. Furthermore, a systematic review[209] found that, when child and adolescent psychiatry is integrated, there are often issues of poor engagement at all levels of schools. When mental health practitioners are present in schools, their role is often limited to conducting assessments or providing one-on-one counselling for students[209].

Although any model needs to be adaptive to meet local needs and resources[210], it would be advisable that child and adolescent psychiatrists – and other highly skilled mental health practitioners such as psychologists, social workers, nurses and case managers – interact directly with stakeholders at every level of the school[208]. This approach would allow the development of skills and knowledge in evidence-based practice, so that teachers and school well-being staff can effectively implement universal mental health promotion and mental health literacy programs.

A common problem encountered with mental health programs in schools is the lack of fidelity in implementation (i.e., the intervention is not implemented as it was originally designed)[213,214]. Therefore, the role of mental health professionals could also include providing training, support and feedback to teachers to accurately identify students who need assessment and support for their

mental health, and to manage and accommodate various mental health and neurodevelopmental needs within the classroom.

Both school staff[215] and health practitioners[216] have argued that integration of mental health into schools would require some level of on-site support. However, given the flexibility afforded by technology, this on-site presence could be minimized to ensure that the psychiatry support is used as effectively and efficiently as possible[209]. This would be particularly valuable in rural locations and LMICs where mental health professionals are scarce[209,217,218].

Notably, another critical barrier identified by child and adolescent psychiatrists regarding their willingness and capacity to work within schools is a lack of training on how to navigate the ethical issues involved[210,211]. For example, there are challenges related to balancing confidentiality and meeting young people's needs. It has been reported[211] that more than 75% of adolescents and parents wanted minimal information to be shared with school, whereas 95% of school staff wanted as much information as possible to understand a student's challenges and how to accommodate those needs most appropriately.

While some psychiatric training programs include school consultations, the depth of coverage varies, and not all programs do so[210]. For child and adolescent psychiatric programs, it would be highly beneficial to include specific training about the school environment and how to work and consult effectively and ethically within educational systems. Indeed, in a study based on interviews to child and adolescent mental health practitioners in UK[219], it was found that, after receiving such training, psychiatrists were able to effectively work with schools and develop partnerships between schools and families to support the mental health needs of students.

A successful example of an initiative aimed at enhancing the mental health of students and teachers is the European Union-funded Promoting Mental Health at School (PROMEHS) project[220]. This is a school-based, universal mental health promotion program, aimed to: a) develop an evidence-based, universal curriculum for mental health in schools, targeting students aged 3-18; b) provide training for teachers and school staff, involving parents and school leadership, and integrate it into educational policy and practice; c) promote social-emotional learning and resilience, while preventing behavioral, emotional and social problems among students.

This project demonstrated effectiveness in improving the mental health of both students and teachers across all six European countries where it was implemented[220]. Most parameters reflecting social emotional learning improved significantly ($p<0.001$ for most domains). The project was also able to reduce mean internalizing and externalizing difficulties scores, and improve prosocial behavior scores from pre- to post-test ($p=0.006$)[220].

In sum, strengthening communication channels, developing shared care plans, and providing joint training for clinicians and school personnel can ensure that interventions are consistent, timely, and tailored to each student's needs. This integrated approach has the potential to improve early identification, continuity of care, and overall mental health outcomes for students.

Digital influences and cyberbullying

Digital technologies have profoundly transformed childhood and adolescent development, bringing with them unprecedented opportunities for learning, connection and creativity[221]. Despite the undisputed benefits, the pervasive integration of digital technologies into daily life has introduced significant mental health risks, associated with the way children and adolescents use digital media[212]. Excessive screen time has been linked to sleep disturbances, reduced physical activity, and poor academic performance[222,223].

Importantly, it has also been associated with social isolation. For instance, a recent study by the National Society for the Prevention of Cruelty to Children in the UK found a significant decline in daily in-person play among children: only 25% of children engaged in face-to-face play daily, with this figure dropping to 21% among teenagers aged 12 to 16[224]. In young people aged 15 to 24, the time spent in-person with friends has decreased by 70% from 150 min per day in 2003 to 40 min per day in 2020[225,226].

Furthermore, the phenomenon of "social comparison", in which users compare their lives to curated and idealized representations of others, can erode self-esteem and fuel feelings of inadequacy[227]. This is particularly evident in adolescents, whose self-image is still developing and is highly sensitive to peer evaluation[228]. This drive for social validation is further reinforced by immediate gratification through the rewarding effect of browsing, e.g., likes and comments, and continuous streams of novel content on social media, which stimulates the dopaminergic system, reinforcing prolonged engagement and addictive behaviors[229].

Overall, longitudinal research suggests a bidirectional relationship between use of digital technologies and mental health in children and adolescents: while poor mental health may lead to increased engagement with digital media as a form of escape, excessive and problematic use of digital platforms may, in turn, precipitate or exacerbate mental health difficulties[230]. Crucially, it is important to appreciate that the amount of time spent on screens is not the main factor influencing mental health outcomes. Instead, the "quality" of how individuals use their devices – their online experiences, interactions, and how these relate to other lifestyle factors such as physical activity and sleep – has the greatest impact[231].

A particularly pressing issue related to digital influence is cyberbullying, a form of peer aggression that uses digital platforms to harass, intimidate, or socially exclude others. Without time or place constraints, it can occur at any time, violate the perceived safety of one's home, and reach a large audience[232]. For instance, in a large survey of more than 10,020 UK participants aged 12-20, 42% of them were found to have experienced cyberbullying on Instagram, 37% on Facebook, and 31% on Snapchat[233].

The architecture of social media platforms – with algorithms that amplify sensational or emotionally charged content – can escalate the scope and impact of harmful consequences, including increased rates of anxiety, depression, self-harm, and suicidal ideation, particularly among adolescents, who already face the complex developmental challenges of forming personal and social

Table 5 Directly actionable advice to promote healthy digital device usage[237]

For adolescents

- Use built-in smartphone features (e.g., "Do Not Disturb", notification controls) to reduce distractions rather than relying on timers alone.
- Focus on *replacing* screen time with alternative engaging activities (especially ones involving friends/family) so that social, physical and mental health behaviors are supported, rather than simply restricting usage.
- Shift from passive consumption (e.g., endlessly scrolling feeds) to more intentional online engagement (e.g., content creation, supportive interactions, goal-oriented digital activity).

For parents and families

- Familiarize yourselves with device and app settings (notifications, screen-tracking, privacy controls) so that you can guide usage habits and model healthy behavior.
- Create structured "screen-free" times or zones (especially around bedtime) to protect sleep and promote real-world social interaction and physical activity.
- Encourage and facilitate device use that aligns with your child's interests, goals and positive behaviors (e.g., online communities around hobbies, or creating content) rather than only emphasizing limitation.

identity[234].

A number of factors predispose to a greater risk of cyberbullying. Compared with controls, children and adolescents with neurodevelopmental disorders are over two times more likely to be victims of cyberbullying (OR=2.85), due to difficulties in oral and/or social communication that could lead to a misinterpretation of the behaviors of online communication partners, while difficulties in controlling frustration and impulsivity could increase the likelihood of being involved in negative online interactions[235,236].

Regarding ways to tackle these issues posed by digital technologies, a multidisciplinary team of experts in child and adolescent mental health, social media research, behavior change interventions, and public health recently reviewed the available guidelines, recommendation articles, online resources, and reports from independent think tanks. Based on this review, they provided directly actionable recommendations in this journal[237], summarized in Table 5.

Clinicians can play a critical role in guiding families toward healthy digital habits, promoting balance rather than abstinence, and advocating for systemic changes that prioritize children's online safety. Collaboration with educators, policy makers, and technology developers is essential to create environments that support positive digital engagement and protect against digital harm[238].

Regarding more specifically cyberbullying, current interventions fall into two main types[239]: a) programs that have evolved from traditional bullying interventions or other mental health initiatives, providing multifaceted prevention and intervention strategies; b) programs specifically designed for cyberbullying, including both preventive measures and post-incident harm reduction, such as school education programs, peer support initiatives, group counseling, and online interventions.

A meta-analysis of 33 longitudinal programs[239] found that interventions targeting adolescents aged 10-19 produced a significant but small effect (g=–0.169). Programs were most effective in modifying behavioral outcomes, with no significant impact on cognition or psychological states. Moreover, intervention effectiveness was influenced by factors including proportion of female participants, cultural context, program type, intervention strategy, delivery method, and duration.

Despite availability of interventions and strategies, challenges persist. The rapid evolution of digital technologies often outpaces the development of evidence-based guidelines and public health policies. The role of clinicians, particularly those working in child and adolescent psychiatry, is essential in this context. Routine assessment of digital media use, including exposure to cyberbullying, should be integrated into mental health assessments[240]. Future research should prioritize longitudinal studies that clarify causal pathways, explore moderating factors, such as personality traits and family dynamics, and evaluate the effectiveness of targeted interventions.

In conclusion, although digital technologies have become an integral part of modern childhood and adolescent life, their influence on mental health is complex and multifaceted. Addressing this challenge requires a comprehensive, multidisciplinary approach that keeps pace with novel digital developments and balances the opportunities afforded by digital interaction with proactive strategies to prevent and mitigate its risks.

The impact of war and forced displacement

The number of children and adolescents exposed to war globally has been estimated to be approximately 400 million between 1989 and 2015[241]. In recent years, the international community has witnessed an escalation of violence affecting multiple regions, including Ukraine, Sudan, Israel, Gaza and Lebanon. In Gaza alone, as of October 2025, at least 20,000 children have reportedly died since the onset of the conflict[242].

The risks posed by war, displacement, and forced migration to children and adolescents are multifaceted, with traumatic experiences, loss of family members, loss of cultural identity, gaps in education, and poor physical and mental health care, leading to potential lifelong consequences for their physical, mental and social well-being. The adverse effects on children's health stem not only from direct violence but also from insufficient health care, malnutrition, infectious diseases, and the distress experienced by their families[243].

Children exposed to war or displacement exhibit a wide range of stress-related reactions in the short-term, including specific fears, clingy behavior, prolonged crying, disinterest in their surroundings, psychosomatic symptoms, and aggressive behaviors[244]. Children's responses to violent experiences vary based on their developmental stage, making it crucial to interpret these reactions within the context of their social, emotional and cognitive development[244]. In the longer-term, a meta-analysis of eight studies on child and adolescent refugees and asylum seekers reported a prevalence of 22.7% for PTSD, 13.8% for depression, and 15.8% for anxiety disorders[245].

A meta-analysis of risk factors for PTSD in youth highlighted

that pre-trauma factors and the objective nature of the event itself had small to moderate effects. However, medium to large effect sizes were associated with subjective experiences of the event and modifiable post-trauma variables, such as low social support, perceived life threat, social withdrawal, poor family functioning, and thought suppression[246]. These findings emphasize the critical role of adequately addressing peri-traumatic and post-traumatic factors to mitigate the development, severity and chronicity of PTSD in youth.

Another major consequence of war and displacement is the loss of safety. Prolonged exposure to danger disrupts children's cognitive schemas of social safety, which are crucial for their development. These schemas, shaped by a child's experiences and the narratives constructed by their caregivers, influence their long-lasting self-perception, view of the world, and outlook on the future[247].

The significant psychological burden outlined above underscores the need for sustained mental health care beyond the initial period of resettlement. Interventions aimed at supporting war-affected youth must be comprehensive, sustainable, and free from harm[247]. Such interventions should adopt multisystemic and multilevel strategies that integrate individual, family and community support, while advocating for the cessation of armed conflicts and the promotion of political justice.

However, to date there is a limited evidence base for treating large numbers of war-affected children and adolescents, especially those who remain inside the conflict zones. A recent scoping review[248] identified six relevant studies: one study examined digital mental health interventions for children and adolescents impacted by war, while five studies focused on those affected by disasters. The majority of interventions were aimed directly at young people and their parents or caregivers, and were designed to be self-guided. About a quarter of these interventions had been evaluated through RCTs. However, since most interventions had not been adapted for specific cultural or linguistic contexts, their feasibility for implementation remains uncertain.

Expert recommendations[248] highlighted that future research should focus on building up interventions that are culturally and developmentally appropriate, engaging affected communities – especially young people – and delivered in locally spoken languages. Interventions should be rigorously tested, including via RCTs in war-affected settings, particularly for those targeting severe conditions. Content should address war-related issues such as parental separation, concern for family on the battlefield, and ongoing grief. Studies should anticipate implementation barriers, including cost, data protection, and digital access, and explore how digital interventions can be integrated with existing scalable psychosocial support in humanitarian contexts.

OPPORTUNITIES AND FUTURE DIRECTIONS

Focus on early identification and intervention

Decades of research have demonstrated that early identification and intervention in people aged 14-25 (thus crossing the transitional cutoff at around age 18) are the most cost-effective approach to reducing the economic burden and poor long-term outcomes of mental disorders, while at the same time fostering educational, social and functional development[249].

Indeed, in response to the growing crisis of youth mental health and the associated societal burden, the WHO advocates for evidence-based, rights-focused strategies to early identification and intervention in children and adolescents, as well as for their families[250]. These goals can be met by leveraging recent conceptual and methodological innovations that are detailed below.

First, over recent years, child and adolescent mental health has increasingly moved toward a transdiagnostic approach, emphasizing shared mechanisms and risk factors across different psychiatric conditions[251-253], rather than focusing strictly on categorical diagnoses with unclear boundaries and questionable clinical significance. The transdiagnostic approach to early detection and intervention offers several advantages: it aligns more closely with the heterogeneous and overlapping symptom profiles often seen in youth; facilitates earlier intervention by targeting broad vulnerabilities, and can inform the development of more flexible, scalable prevention and treatment strategies[72].

At the same time, a transdiagnostic approach also presents challenges. Transdiagnostic literature often carries the same biases that it claims to correct, such as poor reporting and tautological reasoning[254], and is frequently based on loose psychopathological knowledge and definitions[255,256]. As such, it may risk overlooking disorder-specific features that are critical for accurate diagnosis and tailored treatment, such as the differentiation of non-affective vs. affective psychoses in young people. Moreover, by de-emphasizing categorical distinctions, this approach may inadvertently contribute to further delays in the early detection and treatment of certain conditions, such as bipolar disorder in young people, which is already associated with a mean diagnostic delay of almost a decade[257].

With these limitations in mind, early detection and intervention need to place greater emphasis on transdiagnostic targets that cut across multiple psychiatric conditions in young people. Among the most pressing is suicidality, which is a major driver of mortality in young people regardless of diagnosis[258]. Early detection and intervention for suicidality in children and adolescents requires systematic screening for depression, anxiety, trauma, bullying, and self-harm across schools, primary care, and community settings[259-261].

Strengthening protective factors, including supportive relationships and community engagement, is essential. Expanding access to mental health services, by training gatekeepers such as teachers[262,263] and primary care providers, ensures timely intervention, particularly in the global South. School-based programs focused on resilience, crisis intervention, and technological tools for monitoring further enhance early detection and intervention efforts[264].

Substance abuse is another transdiagnostic factor that should be targeted by early detection and intervention in young people. An early onset of this abuse in children and adolescents is associated with poorer clinical outcomes and an increased risk of suicidality. Substance use can mask or mimic core psychiatric symp-

toms, thereby delaying appropriate diagnosis and care[265]. Yet, it frequently remains under-detected in routine child and adolescent mental health assessments[266]. The frequent lack of integration between substance misuse and child and adolescent mental health services contributes to this poor detection. Addressing this issue requires integrating systematic screening and early detection for substance use and related risk behaviors, and implementing early intervention frameworks in health care settings.

An early use of cannabis, in particular high-potency cannabis such as synthetic cannabinoids, has been shown to trigger the onset of psychotic disorders, accelerating trajectories that might otherwise have developed later or remained subthreshold[267]. Specialized clinical services are now being implemented, taking care of young people with comorbid psychosis and cannabis use[268].

There is a pressing need for expanding preventive approaches to children and adolescents, encompassing both targeted (i.e., clinical high risk, CHR, or family risk) and universal (i.e., population-level) interventions[269]. A central challenge lies in the currently limited capacity for early detection of CHR individuals, especially during the vulnerable transition from adolescence to early adulthood. This period is often marked by service discontinuity, as young people face abrupt transfers from child to adult mental health services, which can interrupt care and increase the risk of poor outcomes[270]. Preventive frameworks must be "transitional", age-flexible, to provide continuity of care across the age-18 threshold. Such models can ensure that vulnerable youth are not overlooked or underserved within existing services and that early interventions are sustained at the very moment when they are most needed[270]. On the other side, there are no established universal approaches that can substantially reduce the incidence of the most severe mental disorders, such as psychosis[271,272]. This is an area that needs to be addressed by future research.

It is important to recognize that early detection and intervention cannot be achieved by mental health services alone. Effective early identification depends on a multi-layered approach spanning community, primary and specialist care. This requires coordinated efforts across sectors to reduce fragmentation, extend the reach of detection strategies, and ensure that risk indicators are systematically recognized. There is also a pressing need to adapt early detection and interventions for settings with less resources[106].

In sum, early identification and intervention in child and adolescent mental health are crucial for improving long-term outcomes. Integrating transdiagnostic approaches together with more targeted strategies and interagency collaboration can create more effective, equitable and sustainable systems to support youth and their families. In the next section, we focus more specifically on prevention programs focusing on resilience as an essential building block of sustained mental health.

Focus on resilience

Resilience is defined as a "multisystemic dynamic process of successful adaptation or recovery in the context of risk or threat"[273]. According to the WHO, the promotion of resilience represents a central pillar in the prevention of mental disorders, including those in children and adolescents[274]. Notably, the conceptualization and study of resilience initially emerged from research on children at high risk for severe psychopathology[275].

A meta-analysis of 19 studies in individuals aged 10-25 (17,746 participants)[276] found a moderately negative correlation between resilience and levels of perceived stress, anxiety, burnout and depression (r=–0.391). The same analysis found a moderately strong positive correlation between resilience and mental well-being, quality of life, life satisfaction and self-efficacy (r=0.499). Therefore, promoting resilience within clinical practice has the potential to support mental health across childhood and adolescence, functioning not only as a protective factor against the onset of mental disorders, but also as a means of attenuating the severity of such conditions when they do occur.

Interventions designed to foster resilience typically target specific factors, such as active coping, cognitive flexibility, self-esteem, and social support[277]. The most recent meta-analytic evidence[278], based on 68 RCTs, found a moderate effect of mindfulness-based interventions (standardized mean difference, SMD=0.32), a moderate effect of sport-based interventions (SMD=0.49), and no significant effect of CBT (SMD=0.12) on resilience.

School-based programs designed to build resilience have also been increasingly implemented. Resilience interventions can take many forms, including structured lessons within the curriculum or broader initiatives that enhance a school's ability to leverage internal and external resources to strengthen protective factors. They vary in duration, frequency, facilitator involvement, and delivery method, such as in-person or online sessions. Most of these initiatives are universal in scope, targeting entire student populations rather than focusing solely on individuals at risk of mental health problems. Research in children aged 5-10 has shown small benefits for reducing anxiety (SMD=0.25) and general psychological distress (SMD=0.13). In adolescents, similar programs have demonstrated small positive effects on internalizing problems (SMD= 0.19)[279].

Despite progress, important research needs remain to be addressed in this field. The bulk of available studies is cross-sectional. However, since resilience is a dynamic process, additional prospective studies in children and adolescents are needed[280]. Another research need is around understanding which resilience factors to target, as children and adolescents differ in exposure to adversity, making one-size-fits-all approaches inappropriate[281]. Additionally, multilevel interventions may yield better outcomes than single-level ones, but are more complex and costly, requiring assessment of cost-effectiveness[282]. Determining the optimal intervention length is also challenging, since childhood adversity is often chronic, yet resources in affected communities may limit sustainability. These factors complicate designing effective, practical resilience-based programs[283].

While future research should address these outstanding issues, current evidence can already inform clinical practice and public health initiatives. From a clinical point of view, because higher levels of resilience are clearly linked to a child's well-being and the surrounding context plays a significant role, incorporating resilience assessment into standard clinical care should be rec-

ommended[273]. Children and families with lower resilience may require additional therapeutic support and closer monitoring compared with those who have higher resilience and a stable, supportive environment[273].

From a public health standpoint, child and adolescent mental health professionals can play an important role in guiding policies and health care systems toward evidence-based resilience strengthening strategies. This process should include coordinated efforts among educators, health care professionals, social workers, and community organizations to create supportive environments that foster mental well-being[284]. Future work should prioritize the refinement of theoretical models, the rigorous evaluation of evidence-based interventions, and the implementation of longitudinal studies to ensure the effectiveness of resilience-based approaches across diverse developmental stages.

Finally, cross-cultural factors should be taken into account. Western contexts favor individual-focused strategies, emphasizing self-efficacy and self-esteem, while Eastern contexts benefit more from family and social support[285]. Tailoring interventions to these cultural differences can enhance effectiveness in helping individuals manage stress and build resilience[278].

Integrated multidisciplinary care

As mental health conditions in children and adolescents impact multiple aspects of life – academic, social, emotional and occupational – an integrated interdisciplinary approach is crucial[286]. Interdisciplinary collaboration can bring together a broad group of health care professionals – including child and adolescent psychiatrists, psychologists, pediatricians, general practitioners, nurses and occupational therapists – as well as educators and social workers. An interdisciplinary team-based approach can offer a wide range of benefits both to the patient and the health care system. These include improved communication and information sharing among professionals, patients, families, and support networks; the integration of diverse perspectives; a broader range of ideas and approaches; more comprehensive problem solving, and enhanced decision-making[287].

Benefits of integrated models can be expected at every stage across the clinical journey. General practitioners, nurses, psychologists, and allied health professionals, if properly trained and supported, can all contribute significantly to comprehensive mental health assessments. Medication initiation and optimization obviously require a prescriber, yet non-prescribing nurses can provide valuable support. Similarly, well-trained non-medical staff can ensure high-quality monitoring of medication effects and adverse outcomes. While psychological therapies have traditionally been delivered by psychologists and psychiatrists, there is now strong clinical support for including trained nurses and other allied health clinicians in these roles[288].

To date, true interdisciplinary care remains uncommon in routine child and adolescent mental health practice globally, due to barriers related to organizational, cultural and structural factors (i.e., health care organizations often lack the necessary infrastructure and culture to support interdisciplinary collaboration), resource constraints, and the lack of supportive policies and governance models.

However, evidence suggests that integrated interdisciplinary mental health care can be both safe and highly effective. A systematic review[289] covering 15 studies, six of which were included in a meta-analysis, evaluated the effects of integrated care on clinical outcomes and health care utilization for individuals aged 12-25 with any mental health condition in community-based settings. Compared with standard care, integrated care was associated with a significantly greater reduction in depressive symptoms at 4-6 months (SMD=–0.26). Among the seven studies that assessed access or engagement, all found higher rates in the groups receiving the integrated care intervention. The most commonly reported elements of integration were multidisciplinary team involvement (13 of 15 studies), collaborative treatment planning (11 of 15 studies), and workforce training within the integrated care model (14 of 15 studies).

However, despite compelling arguments for interdisciplinary child and adolescent mental health care, the evidence base remains limited regarding optimal implementation, particularly in rural and remote settings or in LMICs. Further research is necessary to refine these approaches and extend their reach.

Integration between mental health and primary care

Integration between child and adolescent mental health and primary care encompasses a variety of models, including approaches in which behavioral health professionals provide consultation via in-person, digital or telephone-based means; the physical co-location of mental health providers within primary care practices; and structured, team-based collaborative care frameworks[290].

A meta-analysis of 31 RCTs evaluating integrated mental health and primary care in children and adolescents[291] demonstrated a significant improvement in behavioral health outcomes compared with usual primary care (d=0.32). Further analyses revealed that the effects were stronger in treatment-focused trials addressing specific diagnoses or elevated symptoms (d=0.42) than in prevention-focused trials (d=0.07).

The extent of integration between child and adolescent mental health and primary care is influenced by health care infrastructure, cultural attitudes toward mental health, and financial constraints. In the US, studies show that up to 75% of children with mental disorders are seen in primary care settings, yet only about 22% receive mental health care in those settings[292]. A 2023 American Academy of Child and Adolescent Psychiatry report noted that less than one-third of pediatricians in the US feel adequately trained to manage common childhood mental health problems[293].

Insurance and reimbursement limitations are another barrier. For example, a US national survey found that only 43% of pediatricians reported being reimbursed for mental health consultations, limiting the feasibility of sustained integration[293]. However, the US, but also countries such as the UK and Canada, are making

significant progress by embedding mental health professionals, including psychologists and psychiatrists, into pediatric teams. This approach not only ensures comprehensive care but also reduces the stigma associated with seeking mental health treatment[292,294]. For instance, in the US, the Centers for Medicare & Medicaid Services launched in 2024 the Innovation in Behavioral Health Model to promote coordinated care through value-based payments and infrastructure support for providers[295].

In LMICs, the integration of mental health with primary care is even more critical, but faces more substantial barriers. Many countries have fewer than 0.1 psychiatrists per 100,000 population, with most lacking any child and adolescent psychiatrists[95]. Mental health stigma is a major deterrent: in some regions, over 60% of parents report reluctance to seek help for their children due to cultural taboos[296]. A WHO review found that more than 80% of LMICs lack formal systems for integrating mental health into pediatric or primary care[294]. To address this issue, the WHO Mental Health Gap Action Programme (mhGAP) has trained over 100,000 primary health workers in more than 90 countries to identify and manage priority mental health conditions, including in pediatric populations[294].

Overall, integrating child and adolescent psychiatry with primary care is essential for improving global mental health outcomes. While high-income countries have made advances, gaps in training, reimbursement and service coordination persist. In LMICs, the need is urgent, and innovative, scalable models are trying to bridge critical workforce and access gaps.

Novel community-based rehabilitation programs

Over the past few decades, adolescent-oriented community-based rehabilitation programs have been launched in several countries, including Australia, Canada, Ireland, and the UK[297]. A 2023 scoping review[298] found 27 types of community-based rehabilitation programs for adolescents with mental health conditions, grouped into leisure recovery programs, integrated recovery programs, and advocacy recovery programs.

Leisure recovery programs provide adolescents with opportunities to engage in social and recreational activities within the community, addressing their age-appropriate need for self-definition and socialization with peers. Evidence shows that adolescents' unwillingness to receive professional help may be related to their fear of being stigmatized by their peers. Therefore, adolescent-friendly facilities can increase their engagement in programs and are perceived as less stigmatizing when they are located in the community rather than in a mental health institution[299]. Additionally, research indicates that participation in leisure activities can foster empowerment, a sense of purpose, and stronger social connections with peers and the broader community[300]. Also, allowing adolescents to choose their own activities is crucial, as it can boost both engagement and subjective well-being[301]. In recent years, an increasing number of programs have incorporated peer support into their services[302,303].

An example of a leisure recovery program is the Young People's Outreach Program (YPOP) in Australia[304], which provides peer support, mentoring users aged 17-25 in life skills such as housing, employment, and maintaining healthy routines and relationships. Building on YPOP's success, the Youth Community Living Support Service (YCLSS) was launched in 2016 in New South Wales, funded by the state government[305]. YCLSS promotes community engagement, education and employment while providing psychosocial support, case management, and early interventions at users' locations for adolescents and young adults aged 16-24.

Another example of a leisure recovery program is the Transitional Age Youth (TAY) program in Canada[306], which serves youth aged 14-26 with mental health challenges and/or complex conditions such as substance use or physical health issues. Staff promote personal recovery through peer support, life skills and social groups, education and employment support, three youth wellness "drop-in" hubs in Toronto, and outreach case management. TAY is part of LOFT (Leap of Faith Together), a mental health charity established in 1953 and funded by the Province of Ontario and several donations[306].

Integrated recovery programs offer a holistic approach, combining leisure and social activities with physical and mental health services for users. One example in youth is the Headspace National Youth Mental Health Foundation[307], established in 2006 by the Australian government, which operates over 100 centers across Australia, providing a "one-stop-shop" for youth aged 12-25. The centers collaborate with schools and social services, and host community events such as concerts, skating and gaming. Headspace also cultivates young opinion leaders, including volunteers and program graduates, who provide feedback, support peers, and engage in advocacy to reduce stigma. Evaluations show high satisfaction among adolescents and families, with nearly half of users reporting reduced mental distress after treatment[308].

Another example is offered in France by the Association Nationale des Maisons des Adolescents[309], established in 2004, which runs 104 centers offering psychosocial and medical care for youth aged 11-25. The centers host various leisure activities (e.g., arts, music, sports, cooking, gardening and literature), and provide youth-friendly spaces with seating areas, gardens, cafés and libraries.

Advocacy recovery programs seek to raise awareness of mental health issues by involving youth with mental health challenges in campaigns that reduce stigma and empower participants. In the UK, the YoungMinds movement[310], founded in 1993, offers four main programs for users aged 14-25: Youth Panel, YoungMinds Activist, YoungMinds Blogger, and YoungMinds App Tester. Youth Panel allows users to advise and co-influence the organization's operations, campaigns and fundraising. YoungMinds Activist trains users with mental health experience in campaigning, facilitation and presentation skills while connecting with peers. YoungMinds Blogger enables users to share personal stories and advice online, and App Testers contribute to app development, content, campaigns, and policy influence.

Another example of an advocacy recovery program is provided by the Youth MOVE National program[311], established in 2007, which stands for "Motivating Others through Voices of Experience" and aims to promote participants' rights through commu-

nity engagement across 60 branches in 35 states in the US.

Overall, while these novel community-based rehabilitation programs have received positive feedback from users, they have not been formally assessed in terms of effectiveness in studies reported in academic publications[298]. This is a major need in the field.

Innovative community-based strategies

Innovative strategies, such as outreach and mobile mental health units, have been developed to reach underserved populations in the child and adolescent mental health field. Mobile services provide flexible, on-the-ground support, ensuring that mental health care is accessible to young people who might not otherwise seek help in traditional clinical settings[312]. By offering services in familiar, non-clinical environments, mobile units can reduce stigma, and improve engagement and outcomes.

Evidence shows that children and young people feel more comfortable accessing mental health support in these settings, leading to better participation and reduced dropout rates[313]. Such initiatives can be particularly valuable in rural or deprived areas, where access to conventional mental health care is limited.

Home visiting programs are interventions delivered in the home environment to support families with young children, high vulnerability and complex needs, as part of a continuum of care[314]. Delivering interventions at home reduces attrition, fosters rapport, and involves the whole family. Providers range from health professionals and para-professionals to trained volunteers[314].

A meta-analysis[315] of 22 home visiting programs aimed at improving caregivers' mental health and psychosocial outcomes, as well as developmental outcomes for children aged 0-4 years in high-risk families, found mean standardized effect sizes ranging from –0.31 to 0.20. Only one of the four outcomes – socioemotional and/or behavioral development – showed a statistically significant effect (SMD=–0.31). Future research should expand rigorous evaluations, reduce bias, assess diverse child and parent outcomes, and clarify which program elements are most effective for different family needs.

A potentially relevant development for community-based programs is their combination with digital interventions (see next section). Digital platforms such as *LINA*[316], an augmented reality game, have shown promise in enhancing peer connection and mental health awareness among early adolescents. These innovative approaches highlight the importance of integrating community engagement and technology to address the mental health needs of youth. Future research should focus on evaluating the scalability, cultural adaptability, and long-term impact of such interventions to inform evidence-based practices in diverse settings.

Telepsychiatry

Telepsychiatry is typically described as the delivery or support of psychiatric care through electronic communication and information technologies, allowing services to be provided remotely[317]. Typically, telepsychiatry includes the use of remotely-delivered consultations through platforms such as MSTeams or Zoom to conduct assessment or to provide online psychotherapy or medication advice[318,319].

These approaches may be particularly helpful for children and adolescents, as this population is generally comfortable with digital technologies and may engage more effectively with support delivered through familiar platforms such as smartphones and online tools[320]. Indeed, telepsychiatry has been used, particularly in the last decade, to deliver care to children and adolescents in various countries[321], with significant increase triggered by the COVID-19 pandemic. In the US, for instance, the use of telepsychiatry among children enrolled in Medicaid increased by 829.6% from 2019 to 2020, with ADHD, trauma-related disorders, anxiety disorders, depression, and behavior/conduct disorders being the most prevalent psychiatric diagnoses among children using telehealth services[322].

The most obvious benefit that telepsychiatry offers is improving access to mental health care, especially in rural and remote areas where patients are often forced to travel long distances to reach the referral center[323,324]. Children and adolescents suffering from conditions such as autism that make it challenging for them to leave their homes could also benefit from better accessibility through virtual health care services[318]. Another benefit is greater privacy for patients, who are less exposed to stigmatizing attitudes and beliefs of others[318,325].

However, telepsychiatry has limitations and difficulties that have not yet been fully overcome[326]. Lack of digital devices, lack of knowledge of digital technology, and poor Internet connectivity represent significant barriers to the use of telepsychiatry in part of the population[326,327]. It should also be considered that a child or adolescent accessing a telepsychiatry service, particularly if he/she has cognitive, sensory or behavioral problems, may have greater difficulty than an adult in communicating his/her symptoms to the person on the other side of the screen. Moreover, for children and adolescents with hyperactivity, it may be difficult to sit in front of a screen for long periods of time. In these cases, the use of a remote pan-tilt-zoom camera may be preferable to the fixed integrated cameras used with adults[328,329]. It is also important to avoid assessment in settings that are not considered neutral for children and adolescents, such as a hostile home environment[321].

Organizational barriers include the cost of acquiring and maintaining technology and security systems[324], and adequate training for the implementation of telemedicine and virtual software platforms[326]. Furthermore, financial and reimbursement barriers represent a major challenge. The confusing patchwork of government regulations and insurance policies have led to significant limitations in the reimbursement of telemedicine services[326,330]. In some countries, these services are reimbursed by the public health system, while in others they are partially covered by health insurance[331].

Regarding the use of telepsychiatry for treatment purposes in children and adolescents, when considering specifically depression and anxiety, a systematic review and meta-analysis of 26

studies[332] found that telepsychiatry interventions produced large pre-post improvements (Hedges' g=0.83 for depression, 1.15 for anxiety) and moderate effects versus waitlist controls (g=0.54 for depression), pointing to strong potential, but also variable methodological quality.

In ADHD, a systematic review[333] reported low-quality but consistent evidence that digital interventions – such as game-based training, cognitive exercises, and neurofeedback – reduced inattention (SMD≈–0.25) and improved executive function, though heterogeneity was high and adverse effects were occasionally noted. For social anxiety disorder, a systematic review and meta-analysis[334] pooled 21 RCTs involving youth aged 10-25 years, finding a medium effect (Hedges' g=0.51) favouring digital CBT and exposure-based programs over any control condition.

Overall, future research and implementation efforts of telepsychiatry in children and adolescents should explore developmentally appropriate frameworks tailored to the cognitive, emotional and social maturity of these users[335,336]. Safeguarding mechanisms, such as pre-session safety planning, clear protocols for managing risk remotely, and involvement of caregivers or trusted adults where appropriate, should be embedded in telepsychiatry practice[337]. Finally, policies should promote training for clinicians in child-specific telepsychiatry competences, including engagement strategies, digital rapport-building, and cultural sensitivity, to ensure effective and ethical virtual care for children and young people[335,336].

Use of other digital technologies for assessment and treatment purposes

Beyond telepsychiatry, other digital technologies can be used to support assessment and treatment in child and adolescent psychiatry.

Technologies that can be used to aid and improve assessment include wearable devices that passively collect continuous data (digital phenotyping); and active methods, such as ecological momentary assessments, which involve users completing brief in-the-moment questionnaires, reducing recall bias and improving ecological validity. These latter active methods can be used to investigate, for instance, daily emotional dynamics of child and adolescent depression, such as negative affect variability[338]; sociability, including patterns of interactions with peers and parents[339]; and how the use of substances or social media influence young people's mood[340].

An umbrella review[341] encompassing 30 reviews (19% in children and adolescents, 29% in adolescents and young adults, and 52% in young adults) summarized studies on passive data tracing (33%), ecological momentary assessments (29%), or both (38%), finding that only 43% of the reviews reported the presence of control groups. In addition, only 52% of the reviews reported that data were validated using traditional assessments with standardized tools. Therefore, overall, the use of these digital technologies requires additional testing and stronger evidence.

Despite such limitations, advances in machine learning and artificial intelligence (AI) methods have led to the development of softwares and devices that are currently implemented in some clinical contexts. For instance, the FDA-approved *Canvas Dx* implements algorithms on data received from parents/caregivers, video-analysts, and health care professionals, informing about a possible diagnosis of autism. This tool demonstrated excellent sensitivity (98.4%) and good specificity (78.9%) among participants for which the tool was able to make a decision (<50% of the sample)[342]. This makes *Canvas Dx* a good example of promising applications of digital technologies to support the diagnostic assessment of autism spectrum disorder.

With regard to technologies used for treatment purposes, examples include mobile applications, virtual reality, serious games, and social robotics. The objectives of employing digital therapeutics in children and adolescents are multifold: a) enhancing social communication: many digital tools are tailored to improve social interaction, emotional recognition, and non-verbal communication[343]; b) improving behavioral functioning: through structured interventions, digital platforms help reduce maladaptive behaviors and promote adaptive skills, often by providing real-time feedback[344]; c) increasing accessibility and personalization of mental health care: digital platforms facilitate remote delivery of care, thereby reaching underserved populations, and are designed to adapt to the specific needs of the user, offering personalized experiences based on real-time data[345]; d) complementing traditional therapies: by serving as an adjunct to conventional interventions, digital therapeutics can reinforce treatment effects and provide additional layers of support[346]; and e) increasing learning: many digital tools are tailored to improve performance on specific cognitive domains (e.g., reading, attention, working memory, writing)[347].

Strong cognitive effects of virtual reality-based attention training (SMD from –1.07 to –1.50) have been documented in ADHD (ages 8-18)[348]. In depression, a moderate pooled effect (Hedges' g=0.49) has been reported for immersive virtual reality programs integrating relaxation and cognitive exercises (ages 13-24)[349]. For autism spectrum disorder, a 2024 meta-analysis[350] found large improvements in social skills (SMD=1.43) following virtual reality-based social training (ages 6-18).

Regarding serious games, it is worth highlighting that in 2020 the FDA approved *EndeavorRx*, the first prescription video game for children with ADHD, to specifically improve attention through engaging, adaptive gameplay. The pivotal RCT[351] supporting FDA clearance showed significant improvements in attention measures compared to controls, with a medium effect size (Cohen's d ≈ 0.36) for overall attention, but not in behavioral symptoms of ADHD.

Regarding robotics, a meta-analysis of 12 RCTs in children and adolescents (<18 years) with autism showed that robot-mediated interventions significantly improved social functioning (g=0.35), but not emotional or motor outcomes[352]. Far from replacing humans, therapists used robots to engage children and youth in case they found human interaction challenging, leading to an increased number of interactions with humans[352-354].

Overall, the collective evidence from meta-analyses and systematic reviews supports the transformative potential of digital

therapeutics in child and adolescent psychiatry. However, despite moderate/high effect sizes across various modalities, critical gaps remain in study quality, personalization, and long-term monitoring of outcomes. Clinicians need more education on integration of digital treatments into their practice. Research should prioritize evidence-based digital interventions that complement rather than replace traditional face-to-face care. Further, research involving both youth and clinicians in the co-design and testing of these tools is essential to ensure that they address specific needs and preferences[355].

Studies should evaluate adherence with privacy and ethical standards when designing digital interventions. Transdisciplinary collaboration among mental health professionals, researchers, digital therapeutics developers, and policy makers should be encouraged[356-358]. Lastly, promoting policies that facilitate the incorporation of digital therapeutics into health care frameworks will assist their usage and support sustainability[359].

Precision child and adolescent psychiatry

Current clinical practice in psychiatry – including child and adolescent psychiatry – often relies on trial-and-error approaches to intervention and has limited ability to predict outcomes, underscoring the need for more targeted, or at least stratified, approaches[360]. The emergence of precision psychiatry represents a possible paradigm shift, with the vision to tailor diagnosis, prognosis and treatment to the unique genetic, biological, environmental, psychosocial and ecological profiles of each patient[361].

Moving away from the traditional "one-size-fits-all" model, this aspirational approach aims to enhance diagnostic accuracy, optimize treatment efficacy, and minimize adverse effects[193]. Drawing inspiration from successful applications in oncology[362], precision child and adolescent psychiatry aims to integrate genetic, epigenetic and neurobiological insights as well as emotional, cognitive and behavioral data into the clinical care of children and adolescents with mental disorders.

However, the multifactorial and heterogeneous nature of mental disorders presents unique challenges, especially in children and adolescents, in whom developmental factors significantly influence neurobiological processes[363] and affect illness expression, diagnosis, prognosis, and treatment response[193]. This situation is further complicated by a limited understanding of normative brain development, less stable diagnoses over time, and increasing psychosocial complexity, which suggests that models trained on adult populations may translate poorly to childhood and adolescence[364].

The successful implementation of precision psychiatry depends heavily on the development, validation and implementation of multivariable clinical prediction models designed to support diagnosis and predict prognosis or treatment outcomes[365]. Although numerous models have been developed in psychiatry, their application in real-world settings remains very limited, as shown by a systematic review of 308 prediction models, with the potential utility in clinical practice being tested in one model only[365].

Child and adolescent psychiatry reflects this gap even more. A systematic review of prediction models published between 2018 and 2021[360] retrieved 100 eligible studies in children and adolescents. Of these studies, 41 focused on developing a new prediction model, 48 on validation of an existing model, and 11 included both development and validation. Among the 52 newly developed prediction models, 6 (11%) targeted suicidal outcomes, 18 (35%) focused on future diagnoses, and 5 (10%) addressed child maltreatment. Other outcomes included violence, crime, and functional impairments. Eleven models (21%) were specifically developed for high-risk populations. However, only one-third of the development studies were adequately powered, and this proportion was even lower among validation studies. Model performance, assessed via the C-statistic, ranged from 0.57 (low) – reported for a tool predicting ADHD diagnosis in an external validation sample – to 0.99 (high) for a machine learning model predicting foster care permanency. None of the models was tested in terms of practical implementation.

To provide an example restricted to a specific disorder, in a systematic review of 100 prediction models in ADHD[366] (88% diagnostic, 5% prognostic, and 7% on treatment response), internal validation was performed for 96% of the models, whereas only 7% underwent external validation. None of the models had been implemented in clinical practice. Only 8% of the models were rated as having a low risk of bias, while 67% were considered at high risk of bias. Clinical, neuroimaging and cognitive predictors were incorporated in 35%, 31%, and 27% of the studies, respectively. Models that included clinical predictors demonstrated higher predictive performance compared with those that did not.

Overall, none of the available multivariable models can currently be recommended for clinical practice, due to a series of barriers including limited model accuracy, very few implementation studies, high costs, clinician biases, and ethical concerns. Datasets used for algorithm generation are often not representative of clinical populations; data from minority groups are systematically excluded; and there are concerns about data privacy and potential risks derived from providing diagnostic and prognostic information. These challenges are especially important in the pediatric population, where ethical considerations must prioritize safeguarding vulnerable individuals. Addressing these barriers requires clinicians with a broad set of skills, covering scientific, ethical and legal domains, and who are able to communicate effectively with patients and their caregivers, taking into account the developmental stage of the youth.

Looking ahead, some possible avenues are worth exploring in child and adolescent psychiatry. Pharmacogenomics and biomarker-driven interventions show initial potential to guide pharmacological treatment. For instance, pharmacogenetic data on genes such as *CYP2D6* and *CYP2C19* could guide dose selection, reducing side effects and improving efficacy in treating ADHD when using atomoxetine[367], and in depression[368]. Additionally, biomarkers such as neuroimaging findings and inflammation markers could help identify early risk for conditions such as autism spectrum disorder and depression, enabling timely interventions[369]. However, replicated pharmacogenomic and neuroimag-

ing data supporting treatment decision-making in children and youth are still very limited.

Beyond pharmacology, precision psychiatry could support tailored psychosocial and behavioral interventions. CBT, for example, can be adapted to a child's developmental stage and cultural context to improve engagement and adherence. Early identification of at-risk individuals through genetic screening and comprehensive assessments may further support preventive measures, including psychoeducation and lifestyle interventions tailored to individual needs[370].

Ethical considerations are central to the development and implementation of precision child and adolescent psychiatry. Transparency in clinical prediction models, data privacy, equitable health care delivery, and effective communication of risk estimates are essential for building trust with patients and families [371]. Collaboration between patients, families and clinicians must occur throughout the development and deployment of these tools [372]. The lived experiences of youth with mental health conditions, as well as input from their families and caregivers, are invaluable for addressing potential ethical challenges and ensuring responsible use of predictive tools[372].

Future efforts must prioritize bridging the gap between research and practice. Investments in multi-omic approaches, digital health tools, and cost-effectiveness studies are crucial for scaling precision psychiatry across diverse health care systems. Real-time data from electronic health records[373], wearable devices[374], and smartphone applications[375] offer new avenues for dynamic treatment adjustments. However, these innovations also raise privacy concerns, necessitating robust safeguards and ethical oversight[376].

While precision psychiatry often focuses on genes and neurobiological underpinnings, one should not underestimate, particularly in children and adolescents, the crucial role of the environment. This role is reflected in the concept of *exposome*, which encompasses not only exposure to environmental stressors, but also factors such as the physical and built environments, socioeconomic conditions, access to health care, and individual life habits and behaviors[377]. Longitudinal cohort data, showing that genome-by-exposome models – based on 133 variables at the family, peer, school, neighborhood, life event, and broader environmental levels – explained up to 63% of variance in internalizing and externalizing symptoms in children aged 9-10, seem promising[378].

Fully personalizing diagnosis, prognosis and treatment based on the complex interplay of genes and exposome may not be achievable in the near future. However, stratifying treatment based on clinical characteristics (such as comorbidities) and, importantly, personal preferences (for example, attitudes toward medication side effects) seems more attainable. For instance, efforts are underway to apply approaches currently being tested in adult psychiatry – such as the PETRUSHKA[151] project – to child and adolescent psychiatry, notably in the context of ADHD[379].

PETRUSHKA aims to develop and test an online decision-support tool that uses machine learning and large-scale data (electronic health records and clinical trials) to help personalize antidepressant treatment for adults with depression. It does so by combining patient characteristics (age, gender, symptom severity, treatment history) and patient preferences (e.g., concerns about side effects) to generate a ranked list of recommended antidepressants, thereby facilitating shared decision-making between clinician and patient.

To potentially realize the benefits of precision psychiatry, collaborative research initiatives modeled on successful programs in other fields of medicine, such as the Children's Oncology Group, which promote multisite collaborative clinical studies, could be highly valuable. These initiatives may help foster shared expertise and infrastructure, supporting more equitable access to advancements in precision psychiatry for all children and adolescents[369].

Development and application of artificial intelligence

AI is a collection of technologies that combine large scale data, algorithms and computing power, in which machines conduct operations comparable to those of humans, including learning and logical reasoning[380].

In child and adolescent mental health, there is hope that the development and application of AI will lead to algorithms which will improve diagnosis and treatment. Machine learning techniques[381], a subfield of AI, are helping progress from identifying group-level statistical associations to predictions at the individual level. These techniques are able to test many potential predictors simultaneously and assess non-linear relationships, which is especially relevant when evaluating complex bio-psycho-socio-ecological interactions in the context of neurodevelopment[382].

Machine learning algorithms have been studied across child and adolescent mental disorders[383], addressing questions relevant to diagnosis, treatment selection and prognosis. A systematic review[384] of studies on the use of machine learning in clinical practice in child and adolescent psychiatry found 33 relevant studies. Most examined ADHD and autism. The majority of studies focused on diagnostic applications. Results varied widely, reflecting differences in algorithms, datasets and outcome measures, with predictive performance ranging from moderate to high. Key limitations included small sample sizes, insufficient external validation, and the risk of overfitting.

AI also has the potential to help boost access to care[385] and strengthen therapeutic alliance[386]. This is particularly relevant in children and adolescents, in whom engagement with care providers is variable, and technology use is higher and more integrated into daily lives, while the anonymity provided by a digital environment[387] may help circumvent stigma. For instance, there is evidence suggesting that some adolescents are more likely to disclose sensitive information to a chatbot than to a human doctor[388].

In terms of clinical implementation, as mentioned, the tool *Canvas Dx* has received FDA approval to support the diagnosis of autism[342]. However, caution is warranted prior to clinical translation[389]. The rights of children and adolescents when developing emerging technologies need special consideration[380,390]. They can lack insight into what can be harmful, and are at risk of being more easily hurt by biased or unfair advice by AI technologies seeking

to exploit rather than assist them[391-393]. Based on recommendations from the United Nations and UNICEF[394], AI systems used for child and adolescent psychiatry must put the minor at the centre of ethical requirements such as data protection and transparency. Mental health professionals should make sure that the AI tools are compliant with the European Union General Data Protection Regulation, that sets standards for security, privacy and consent[395].

Considering future research developments, AI models aimed to support clinical practice for children and adolescents with mental health issues will need to be properly trained, and show adequate validation performance on an external test set, using data from relevant child and adolescent populations, prior to implementation. Of note, most available AI models have been trained on adult populations and could not learn the specific biological and psychological distinctions between children/adolescents and adults[396].

It is crucial to assess differential performance across vulnerable subgroups (e.g., race and ethnicity, gender, different age groups, poverty, living in metropolitan or rural areas, intellectual disability), and include users' point of view by participatory modelling approaches. All this could reduce potential discrimination and biases[397-399] that could lead to erroneous AI-based diagnoses and inaccurate treatment recommendations[392,400].

Generative AI also allows for chatbots that can discuss symptoms and provide information on resources. However, AI chatbots can sometimes "hallucinate", meaning that they provide incorrect information while presenting it confidently as if it were accurate[401]. This poses a particular concern for young populations. Such errors should be rare and non-harmful, and AI systems must undergo thorough testing before being implemented. Even after deployment, ongoing monitoring is essential, including regular random checks by humans, to detect and address any instances of AI-generated misinformation[402,403].

Literacy in AI must be developed in professionals working in child and adolescent mental health services, as well as in patients and families. If the outputs from the AI system are made available to the patient by the health care professional in an intelligible and interpretable manner, and the youth can understand how an automatically deployed decision was made, this could enable an empowerment of the patient and a real shared decision-making process[404,405]. This interpretability and explainability are key in allowing the modern black-box AI tools to complement clinicians in the task-sharing delivery of care, rather than replacing them.

Overall, the presence of AI in child and adolescent mental health management should not interfere with but rather strengthen their developmental process in a safe and beneficial way for their health. Implementation studies, following good practice guidelines[390,406] and embedded in regulatory frameworks[407], will likely help advance the field.

Cultural diversity and training in cultural competence

In response to mounting clinical and service delivery challenges, cultural competence has become one of the core principles of the children's community-based systems of care[408].

Cultural competence in child and adolescent psychiatry is regarded as the ability – streaming from a combination of behaviors, knowledge and attitudes – to effectively work with youth and families from diverse cultural backgrounds, understanding and respecting their beliefs, values and practices[408]. By addressing implicit biases and cultural barriers, culturally competent care ensures that services are tailored to meet the needs of diverse populations, leading to better communication, trust and outcomes in health care settings.

However, addressing cultural diversity through culturally sensitive care in child and adolescent psychiatry faces several challenges. First, training programs in cultural competence may inadvertently reinforce stereotypes by overgeneralizing cultural traits[409]. Second, there is a lack of consistency in defining and implementing effective training[410]. Third, many frameworks fail to address systemic inequalities and the influence of privilege and power imbalances in patient-provider relationships[410]. Fourth, the lack of a standardized approach to integrating cultural competence into clinical practice creates variability in care quality across settings. Fifth, evaluating the effectiveness of training and its impact on patient outcomes remains challenging, and the slow pace of demographic change within the professional workforce continues to affect the delivery of culturally competent care.

These challenges are compounded by a lack of robust research examining the long-term benefits of cultural competence on mental health outcomes for diverse youth and adult populations. Lower-resource environments also struggle to prioritize these initiatives due to competing demands, further exacerbating disparities in access to culturally informed care.

Transitioning from cultural competence to cultural humility in child and adolescent psychiatry represents a pivotal shift in improving care for diverse populations and may be a way to address the above challenges[411-413]. Unlike cultural competence, which focuses on acquiring specific knowledge about cultures, cultural humility emphasizes ongoing self-reflection, acknowledging biases, and maintaining a willingness to learn from the lived experiences of others[414]. This approach recognizes and seeks to address power imbalances in patient-provider relationships, fostering collaboration that empowers patients and nurtures trust[415].

By promoting lifelong learning and valuing diverse perspectives, cultural humility ensures that health care providers engage with individuals through openness and respect for personal differences[416]. This approach enhances communication and understanding, facilitating the development of more authentic, empathetic and patient-centered care. While the culturally competent psychiatrist may strive to master culture, the culturally humble psychiatrist embraces the process of not knowing, reframing it as an essential and empowering element of clinical practice[412]. Over time, this shift could strengthen the therapeutic alliance with youth and their families, reduce disparities, and support equitable health care practices across diverse communities.

One essential component of modern training in culturally sensitive child and adolescent psychiatry is a focus on cross-cultural aspects of developmental cultural neuroscience, which examines how cultural contexts influence the brain's structure, function and

maturation over time[417]. Incorporating such knowledge into psychiatric training may equip clinicians to interpret neurodevelopmental patterns through a cultural lens, allowing them to identify behaviors that may be adaptive in one cultural context but misunderstood or pathologized in another. This approach may not only improve diagnostic accuracy, but also foster culturally attuned treatment strategies that resonate with the lived experiences of diverse patients and families.

Equally important is equipping psychiatrists with the skills to effectively integrate culture-related information into both diagnostic assessments and treatment plans. For instance, a Dutch study revealed that many psychiatrists and residents were unfamiliar with the Cultural Formulation Interview, a structured set of questions in mental health care designed to help clinicians understand a patient's cultural background, beliefs and experience[418].

Moreover, training must prioritize ethnopsychopharmacology[419], a field that examines ethnic and racial variations in the pharmacokinetics and pharmacodynamics of psychotropic medications. Recognizing how genetic, environmental and cultural factors influence drug metabolism and response is essential for tailoring treatments to diverse populations.

In parallel, integrating cross-cultural evidence-based psychotherapies into training curricula ensures that clinicians are prepared to deliver interventions that are both empirically validated and culturally attuned[420,421]. Research shows that culturally adapted treatments tend to be more effective than non-adapted ones[422]. However, one challenge in assessing the empirical evidence for cultural adaptation lies in the fact that most trials of psychological interventions in LMICs fail to thoroughly document the specific adaptations made.

Cultural adaptation typically involves systematically modifying interventions and training materials to account for language, culture and context, aiming to align them with the users' cultural patterns, meanings and values[422]. To preserve fidelity to evidence-based treatments, it is generally recommended to retain the core components of the intervention, while making other adjustments to enhance acceptability, comprehensibility, relevance and completeness[423].

In sum, embracing cultural competence and humility promotes continuous professional development, helping psychiatrists adapt to evolving cultural dynamics. It also positions them as advocates for systemic changes to address health care disparities and foster equity. This approach enhances outcomes and empowers young patients and their families.

CONCLUSIONS

Mental disorders in children and adolescents are common conditions that can have a huge long-term negative impact on psychosocial functioning, overall health, and quality of life, especially if they go unrecognized and untreated. These disorders must be prioritized in public health, which is far from the current reality, even in high-income countries.

For instance, in the US, funding for child and adolescent mental health services and intervention research in the fiscal year 2015 accounted for only 2.1% of the total NIMH budget authority, and mental health research funds declined by 42% between 2005 and 2015[424]. In the UK, the Royal College of Psychiatrists estimated that, in the 2016/17 financial year, less than 5% of the total mental health budget was allocated to services for children and young people in many areas of the country[425].

Determinants of mental health in children and adolescents must be examined at multiple levels, with some factors extending beyond the individual and the health care system, requiring input from sociology and political sciences. For instance, the socioeconomic context of the family can either offer favorable opportunities for development or expose individuals to significant risks of potentially traumatic events or criminogenic environments. A neighborhood may be well-equipped with leisure, social and health services, or it may suffer from deprivation. There is a need to also consider the political conditions influencing individual choices to understand the barriers to changing individual behaviors, whether within a family system or at a personal level[426].

The existence of a sufficient and appropriate workforce in services involved in the prevention, diagnosis and management of youth mental health problems is another crucial aspect dependent on health policies and priorities, as well as on university and professional training, alongside students' motivation to pursue these careers. In certain countries, promotional campaigns for child and adolescent psychiatry have been launched to generate interest in these professions[427].

In recent years, initiatives from advocacy groups and patient participation in shaping the health care environment have noticeably increased. This trend is particularly significant in the context of autism spectrum disorder, and has spurred progress across research, therapeutic efforts, and broader social areas, including education and professional life. Awareness among the general public has grown. However, significant unmet needs remain for conditions such as conduct disorder, which are largely overlooked worldwide, as well as psychotic disorders, that continue to face persistent misrepresentations and stigma, leading to serious delays in recognition and care. Notable initiatives include the involvement of children and young people in mental health research and the development of health services. Still, there is a pressing need for the operationalization and evaluation of this involvement[428].

On a global scale, there is an urgent need to rebalance research funding, expand workforce training, and support interventions for children and adolescents with mental health problems. We hope that this paper, identifying and addressing the core challenges, possible solutions, opportunities, and future directions in child and adolescent psychiatry, will contribute to increase the public awareness of the urgent need for action in this field.

ACKNOWLEDGEMENTS

S. Cortese is funded by the UK National Institute for Health and Care Research (NIHR) (grants nos. NIHR203684, NIHR203035, NIHR130077, NIHR128472, RP-PG-0618-20003) and by the European Research Executive Agency (grant no. 10109556 8-HORIZONHLTH-2022-DISEASE-07-03). C. Aymerich is supported by the A. Kop-

lowitz Foundation. M. Chetouani and D. Cohen are funded by the European Commission under the ERA PerMed project "Personalised Medicine: Multidisciplinary Research Towards Implementation". D. Coghill is supported by the Financial Markets Foundation for Children, the Australian National Health and Medical Research Council, and the Australian Medical Research Futures Fund. R. Iniesta is supported by the NIHR Maudsley Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London. S. Mezinska is funded by the FAMILY project under the European Union's Horizon Europe research and innovation program. G. Sugranyes is supported by the Spanish Ministry of Health, the Instituto de Salud Carlos III Health Research Fund, the FAMILY project under the European Union's Horizon Europe research and innovation program, the Brain and Behaviour Research Foundation, the Canadian Institute of Health Research, the A. Koplowitz Foundation, and P. Bartran and M. and N. Cunillera legacies. C. Moreno is supported by the Spanish Ministry of Science and Innovation, the Instituto de Salud Carlos III, the Madrid Regional Government, the European Union H2020 Program, the US National Institute of Mental Health, the Fundación Familia Alonso, and the Fundación A. Koplowitz. The views expressed in this paper are those of the authors and not necessarily those of the funding bodies.

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DOI:10.1002/wps.70044