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Young minds in distress: Exploring the global rise in youth mental health diagnoses

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Adolescence represents a critical neurobiological period marked by a developmental "mismatch" between early-maturing limbic systems and the later-maturing prefrontal cortex, conferring heightened vulnerability to the onset of psychiatric disorders. This review synthesizes global epidemiological trends, differentiates true increases in morbidity from diagnostic inflation, and integrates evidence-based intervention strategies. In high-income countries, youth depression, suicide mortality, and self-harm have risen substantially, supported by objective indicators of illness severity that extend beyond changes in diagnostic practices. Key environmental drivers include pervasive digital engagement, cyberbullying, sleep disruption, and academic pressure, with sleep disturbances emerging as a central transdiagnostic risk factor. The COVID-19 pandemic accelerated these pre-existing trajectories of mental health deterioration, with particularly marked effects on eating-disorder incidence and social-emotional development. To address these challenges, we suggest a three-tiered intervention framework. Universal approaches should emphasize regulation of digital environments, implementation of Social-Emotional Learning, and institutional support for regular physical activity. Selective interventions should target high-risk youth by proactively monitoring sleep health and mitigating achievement-related stress in academically competitive settings. Indicated care requires integrated delivery of evidence-based psychotherapies alongside structured return-to-learn protocols following psychiatric hospitalization. Ultimately, translating epidemiological risk into effective prevention demands a shift from reactive, diagnosis-centered models to proactive frameworks that prioritize early risk reduction and the reinforcement of protective factors. By fostering environments that promote circadian stability, physical activity, emotional regulation, and peer connectedness, youth mental health can be strengthened as a foundation for societal well-being, resilience, and adaptive functioning in an increasingly complex world.

Molecular Psychiatry; https://doi.org/10.1038/s41380-026-03884-x

INTRODUCTION

The transition from childhood to adulthood represents a critical developmental window marked by a neurobiological "mismatch" between early-maturing affective systems and the prolonged maturation of prefrontal networks involved in top-down cognitive control [1]. While limbic regions such as the amygdala mature relatively early, prefrontal circuitry continues to refine its structural and functional connectivity through adolescence and young adulthood. This developmental gap creates a period of heightened neuroplasticity and vulnerability, during which environmental stressors and protective factors exert a disproportionate influence on long-term psychiatric trajectories [2]. Accordingly, the peak age of onset for mental disorders is approximately 14.5 years [3], with nearly half of all lifetime cases emerging by age 20 [4].

Epidemiological evidence accumulated over the past two decades indicates a marked global increase in youth mental disorders [5, 6]. Although broadened diagnostic criteria [7], heightened awareness [8], and reduced stigma [9] have contributed to rising detection rates, converging data indicate genuine deteriorations in the mental health of more recent birth cohorts [5, 6, 10]. Importantly, these trends are not uniform across the global Socio-demographic Index (SDI) spectrum [11]. This review synthesizes current evidence on shifting epidemiological patterns, critically examines whether observed increases reflect genuine morbidity or prevalence inflation, and discusses implications for global mental health policy.

GLOBAL EPIDEMIOLOGICAL DIVERGENCE

The apparent rise in prevalence of youth mental distress reflects a complex interplay of social, cultural, and methodological factors that vary substantially across regions. Distinguishing secular trends in high-SDI countries from under-recognized and under-reported burdens in low-SDI settings is essential for an accurate global interpretation.

Secular trends in high socio-demographic index (SDI) countries

In high-SDI countries, including the United States, Denmark, and Australia, nationally representative surveys and registry-based studies consistently document increasing prevalence of adolescent depression and anxiety over the past two decades

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Received: 16 February 2025 Revised: 19 August 2026 Accepted: 2 September 2026
Published online: 12 September 2026

[5, 6, 10, 12, 13]. Cross-cohort analyses using psychometrically comparable instruments suggest that these increases reflect genuine generational shifts rather than changes in reporting or help-seeking alone [5, 13, 14].

In the United States, the 12-month prevalence of major depressive episodes among adolescents aged 12–17 nearly doubled from 8.1% in 2009 to 15.8% in 2019 [5]. Similarly, in Australia, the 12-month prevalence of anxiety and mood disorders among individuals aged 16–24 rose from 15.4% and 6.3% in 2007 [10] to 31.8% and 13.5% in 2020–2022 [6], respectively. Danish population registries reveal parallel increases across psychiatric diagnostic categories, with particularly pronounced rises among adolescents and young adults [13]. These trends are especially evident among female adolescents, contributing to a widening gender gap driven by accelerated increases in internalizing symptoms [11, 15, 16]. Concurrently, several high-SDI countries have reported rising suicide mortality [17–19] and self-harm rates [20] among adolescents and young adults.

The low-SDI countries perspective

While the youth mental health crisis is well documented in high-SDI countries, most of the global youth population resides in low-middle SDI countries, where the epidemiological landscape remains comparatively understudied. Although Global Burden of Disease (GBD) estimates suggest declines in age-standardized prevalence for conditions such as depression [11] or attention-deficit/hyperactivity disorder (ADHD) [21] in some low-middle SDI settings, these patterns may reflect socioeconomic influences. Still, they must also be interpreted cautiously in light of under-detection, limited access to mental health care, and persistent stigma shaped by health system constraints and cultural norms [11]. Moreover, the scarcity of large-scale, longitudinal epidemiological cohorts in low-middle SDI countries continues to limit the precise characterization of secular trends in youth mental health relative to high-SDI regions.

GENUINE MORBIDITY VERSUS PREVALENCE INFLATION

Rising rates of youth mental health diagnoses must be interpreted in the context of concurrent shifts in how psychiatric disorders are defined, measured, and perceived [22]. Revisions to diagnostic frameworks, most notably the transition to DSM-5, lowered thresholds and broadened case definitions, thereby expanding the population eligible for a diagnosis even when underlying symptom distributions change only modestly [7, 8]. For example, DSM-5 revisions to ADHD extended the age-of-onset criterion from 7 to 12 years and reduced the adult symptom threshold from six to five, facilitating diagnosis across late childhood, adolescence, and emerging adulthood [8]. Similarly, in obsessive-compulsive disorder (OCD), removal of the requirements for marked distress and for youths to recognize symptoms as excessive or unreasonable was associated with an approximately 10% increase in parent-reported prevalence [7]. Together, these institutionalized changes exemplify what Haslam terms "concept creep," encompassing both the vertical expansion of diagnostic categories to milder presentations and their horizontal extension to a broader range of experiences [22, 23].

These definitional shifts have occurred alongside rising mental health literacy [8] and reduced stigma [9], increasing the likelihood that distress is recognized and medically encoded rather than tolerated as normative developmental turbulence [22]. Labeling an expanded range of distress may also generate a "looping effect" [24], whereby youths internalize diagnostic identities that shape self-concept and behavior [22]. Younger people appear more likely to apply diagnostic labels to subclinical or ambiguous experiences [25], potentially producing a self-reinforcing increase in perceived morbidity [22]. Nevertheless, reporting inflation and psychological looping cannot fully account for the marked rise in severe morbidity indicators that transcend diagnostic labeling [18]. Objective outcomes largely insensitive to definitional shifts—including suicide mortality [18, 19] and emergency department visits or service contact for self-harm and suicide attempts among youths [15, 26, 27]—have increased in adolescents in high-income countries. These patterns indicate a genuine deterioration in youth mental health beyond diagnostic inflation alone. The most defensible interpretation is that diagnostic expansion and concept creep amplify an underlying rise in true morbidity, yielding prevalence estimates that reflect both real worsening and inflationary effects. Notably, these trends parallel escalating environmental stressors, including problematic digital and social media use [28, 29], cyberbullying [30], sedentary behaviors, sleep problems, academic pressures [31], and the COVID-19 pandemic [32].

TRENDS IN PSYCHIATRIC DISORDERS

To provide a clear overview of the evolving epidemiological landscape, Table 1 summarizes global prevalence estimates and regional variations across major psychiatric disorders in youth, along with a qualitative assessment of prevalence trends over recent decades. Detailed discussions for each disorder are presented in the subsections below.

Autism spectrum disorder (ASD)

ASD prevalence shows marked global variability. In Europe, prevalence among children aged 7–9 ranges from 476 per 100,000 in France to 3,130 per 100,000 in Iceland [33]. In 2017, prevalence in India was 400 per 100,000 [34], compared with lower estimates in Iran (63–160 per 100,000) and China (177 per 100,000) among children 6–18, and substantially higher rates in South Korea (2,640 per 100,000) [35, 36]. Although the GBD 2021 update indicates a relatively stable global age-standardized prevalence (788 per 100,000) [37], localized increases in high-SDI countries are largely attributable to improved diagnostic practices and expanded screening rather than a true rise in underlying pathology [38]. Accordingly, global public health strategies should prioritize reducing diagnostic and service disparities in under-resourced regions. In parallel, expanded identification must be matched with strengthened early intervention capacity to optimize functional outcomes.

Attention-deficit/hyperactivity disorder (ADHD)

A recent meta-analysis estimates global ADHD prevalence at 7.6% in children and 5.6% in adolescents, with substantial cross-national variation [39]. ADHD illustrates how diagnostic evolution and socio-demographic factors shape regional trends. In the USA, prevalence increased from 6–8% in 2000 to 11% by 2020, partly reflecting DSM-5 revisions that extended the age-of-onset criterion to 12 years and lowered adult diagnostic thresholds [40]. In contrast, global age-standardized estimates show declines of up to 8.75%, underscoring persistent detection gaps in low-middle SDI countries where access to services remains limited [21]. In regions undergoing rapid diagnostic expansion, clinical practice should emphasize rigorous assessment and multimodal interventions integrating behavioral therapies, educational accommodations, and parent training, rather than reliance on pharmacotherapy alone. Conversely, public health strategies must prioritize reducing detection and treatment gaps in under-resourced settings.

Intellectual disability

Globally, the prevalence of intellectual disabilities declined from 1990 to 2019, particularly among younger cohorts [41]. In contrast, high-income regions such as Sweden, Australia, and Taiwan have reported increasing prevalence of mild-to-moderate forms [42–44], a pattern likely reflecting heightened awareness and improved access to diagnostic assessment rather than true

Table 1. Characteristics of mental disorders and changes in prevalence over recent decades.

	Peak age at onset (years)	Prevalence	Trends in prevalence[b]	Note
Neurodevelopmental Disorders				
Autism spectrum disorder	5.5 [3]	0.79%[a] [37]	↔	Males:females = 2:1 [37]
Attention-deficit/ hyperactivity disorder	5–9 [21]	1.13% [a] [94]; 7.6% for children and 5.6% for adolescents [39]	Global ↓ USA ↑↑	Males:females = 2.5:1 [21] ↑driven by DSM-5 criteria expansion (onset age to 12)
Intellectual disability	6–17 [203]	1.74% [a] [41] Low-middle socio-demographic index (SDI) regions (2.42%) > high SDI regions (0.33%) [41]	Global↓ ↑Mild-to-moderate forms in high-income regions [42–44]	The increasing trend is associated with heightened awareness and increased access to diagnostic testing [42]
Tic disorders and Tourette syndrome	6–7 [204]	1.6% (Chronic) – 3% (Transient) [204]; Tourette syndrome: 0.5% [50]	↔ Global [50] ↑in Taiwan and Korea [51, 52]	Higher prevalence in youths, males, and low-income groups [50, 52].
Emotional / Internalizing Disorders				
Major depressive disorder	19.5 [3]	2.47% [a] [11]; 15.8% (US 12–17 y)	High SDI regions ↑ Low-middle SDI regions ↓ [11] USA ↑↑↑↑	Sharp rise in cohorts born post-1994 [13] Disproportionately greater increases among female youths [11, 15, 16]
Bipolar disorders	19.5 [3]	0.49% [a] [57]	↔ [57]	A trend towards earlier diagnosis in more recent birth cohorts [57]
Anxiety disorders	Specific phobia/Separation anxiety disorder 5.5; Social anxiety disorder/ Panic disorder/ Generalized anxiety disorder 14.5–15.5 [3]	3.78% [a] [94]; 9.2% (US adolescents) [59],	↑↑ [59, 60]	Females > Males
Obsessive-compulsive disorder	14.5 [3]	0.25% [63] to 2.7% [64] according to information provider	↔	Males:females = 1:1.5 [205] Increased by 10% under DSM-5 compared to DSM-IV [7]
Posttraumatic stress disorder (PTSD)	15.5 [3]	PTSD: globally 3.9% [206]; trauma-exposed youths 16% [68]	Variable	National variations in prevalence may reflect differing levels of violence, war, and child abuse across countries.
Behavioral / Externalizing / Other				
Eating disorders	15.5 [3]	0.17% [a] [94]	↑ [94]	Males:females = 1:2 [94] Exacerbated by COVID-19
Substance use disorders	19.5 [3]	17.3% in people aged 12 or older; 8% among individuals aged 16–24 years [6]	↓↓ (Conventional substance)	Males > Females ↓Traditional drugs; ↑E-cigarettes/ new psychoactive substances
Schizophrenia	20.5 [3]	0.29% [a] [88]	↔	Males:females = 1:1 [88]
Oppositional defiant disorder	< 8 [91]	3.3% among individuals aged 5 to 18 years [91]	↓ [93]	Males:females = 1.6:1 [91]
Conduct disorder	Childhood-onset type: <10; adolescent-onset type: >10	0.56% [a] [94]; 2–2.5% among school-aged children [95]	↑ [94]	Males:females = 2:1 [95]
Gaming disorder	16–18 [207]	3% [99]	↑↑ [99]	Males:females = 2.5:1 [99] Formalized in ICD-11

[a]Age-standardized point prevalence rates.
[b]Trends in prevalence over the past two to three decades:
↔ : increase or decrease less than 5%
↑ or ↓ : increase or decrease 5–20%
↑↑ or ↓↓ : increase or decrease 20–50%
↑↑↑ or ↓↓↓ : increase or decrease 50–80%
↑↑↑↑ or ↓↓↓↓ : increase or decrease by more than 80%

incidence growth [42]. Beyond cognitive impairment, affected youths face elevated risks of child maltreatment [45] and bullying victimization [46] compared with neurotypical peers. Psychiatric comorbidity is common, affecting approximately 30% to 50% of individuals [47], with ADHD (30%), conduct disorder (3–21%), and anxiety disorders (7–34%) most frequently observed [48]. These vulnerabilities underscore the need for comprehensive educational and mental health support for both youths and their caregivers [49].

Tic disorders and Tourette syndrome

While the global prevalence of Tourette syndrome has remained relatively stable [50], nationwide population-based studies from Taiwan and Korea report a rising incidence of tic disorders and Tourette syndrome, particularly among youths [51, 52]. Tic disorders are more common in males and frequently co-occur with ADHD and rage attacks, whereas females more often present with comorbid anxiety and mood disorders [53]. Despite their primary motor manifestations, tic disorders are associated with substantial psychosocial burden, with tic severity closely linked to depression, anxiety, explosive behaviors, and emotional dysregulation [54]. This high burden of psychiatric comorbidity highlights the importance of early identification and comprehensive, multidisciplinary interventions that address not only the primary motor symptoms but also co-occurring emotional and behavioral difficulties.

Depression

Depression in adolescence represents one of the most pronounced increases in genuine psychiatric morbidity in high-income regions [5, 16]. The 12-month prevalence of major depressive disorder (MDD) in high-SDI regions has nearly doubled over the past two decades, with US adolescent rates increasing from 8.1% in 2009 to 15.8% in 2019 [5]. A Danish longitudinal population-based study similarly demonstrated higher incidence in more recent birth cohorts during adolescence and early adulthood [13]. Disease burden has worsened, particularly among cohorts born after 1980 [11], with an earlier age of onset [13], and disproportionately greater increases among female youths [11, 15, 16]. Although earlier clinical presentation may partly reflect enhanced mental health literacy and prevalence inflation rather than a purely biological shift in disease pathology, these factors alone cannot account for the magnitude of observed increases. In contrast, declining trends in lower-income regions likely reflect under-detection, persistent stigma, and limited access to mental health services, shaped by health system constraints and cultural attitudes [11]. A recent meta-analysis estimated that approximately one in five children under 18 years experiences MDD or clinically significant depressive symptoms [55]. In low-resource settings, priorities should include reducing stigma and expanding basic screening capacity. In high-income regions, attention should extend beyond youths meeting full diagnostic criteria to include those with subthreshold depressive symptoms, as these individuals may also experience significant functional impairment [56]. Such efforts should be implemented in feasible and context-appropriate ways, with careful assessment to minimize the risks of overdiagnosis and misdiagnosis.

Bipolar disorders

Although age-standardized prevalence of bipolar disorder has remained relatively stable, global incident cases have increased approximately 51% since 1990, with the highest risk now observed in adolescents aged 15–19 years [57]. These trends underscore the need for clinical screening protocols that prioritize early identification of subsyndromal manic symptoms, which often precede the onset of full manic episodes. Early detection and timely, targeted interventions during this prodromal phase are critical to optimizing treatment trajectories and reducing long-term functional impairment and disease burden into adulthood [58].

Anxiety disorders

Anxiety prevalence has increased across developmental stages, particularly among females. In the USA, anxiety in children and adolescents rose from 7.1% to 9.2% between 2016 and 2020 [59], while prevalence among young adults increased more sharply from 8% to 14.7% between 2008 and 2018 [12]. Generalized anxiety among adolescent females increased from 15.5% in 2013 to 19.7% in 2019, whereas a slight decline was observed in males during the same period [60]. Similarly, high-level social anxiety symptoms doubled among female Finnish adolescents between 2013 and 2021 [61]. Across regions, anxiety disorders remain disproportionately prevalent among females and transgender youths, with consistently higher rates in females than males [15, 62] and elevated risk among sexual minority youths compared with heterosexual peers [62]. These consistent gender disparities and rising trends, beyond diagnostic expansion alone, support the need for sex- and gender-informed assessment and prevention strategies. Proactive support and preventive interventions should focus on groups with elevated vulnerability, including female adolescents, transgender youths, and sexual minority youths.

Obsessive-compulsive disorder (OCD)

Childhood OCD prevalence ranges from 0.25% [63] to 2.7% [64], varying by age, diagnostic thresholds, and informant source [63, 64]. Despite its strong genetic and biological underpinnings and relatively stable global distribution [65], diagnostic revisions have influenced reported prevalence. DSM-5 expanded OCD criteria by removing the requirements for marked anxiety or distress [7] and for recognition of symptoms as excessive or unreasonable across all ages [7, 66]. Consequently, parent-reported prevalence of OCD in youths increased by approximately 10% under DSM-5 compared to DSM-IV [7]. Given this broadened diagnostic scope, clinical evaluation should emphasize rigorous symptom validation and functional impairment assessment to avoid overpathologizing normative developmental variations and unnecessary medicalization.

Post-traumatic stress disorder (PTSD)

Cross-national variation in PTSD prevalence reflects differences in exposure to violence, war, and child maltreatment. Interpersonal traumas, including rape, sexual assault, and stalking, confer particularly high PTSD risk [67]. A meta-analysis estimated that 16% of trauma-exposed youths develop PTSD, with rates reaching 33% among girls exposed to interpersonal trauma [68]. Additional risk factors include low social support, family dysfunction, social withdrawal, and comorbid psychological conditions [69]. Importantly, PTSD is independently associated with suicide attempts, even after accounting for depression and substance abuse disorders [70]. Given these severe clinical trajectories, trauma-informed screening in high-risk settings, early implementation of trauma-focused cognitive behavioral therapy (TF-CBT), and integrated suicide prevention strategies are essential to support trauma-exposed youths.

Eating disorders

The peak onset of anorexia nervosa and bulimia nervosa occurs around age 15, with approximately 80% of cases developing before age 25 [3]. Between 1997 and 2017, the global prevalence of eating disorders increased by an average of 0.65% annually [71]. In the UK, hospitalizations for eating disorders among individuals under 25 rose by 84% from 2015 to 2021, a trend amplified during the COVID-19 pandemic [71]. Similarly, in 2020, the USA reported a 15.3% increase in anorexia nervosa cases relative to pre-pandemic levels [72], while UK incidence among girls aged 13–16 and aged 17–19 exceeded expected rates by 42% and 32%, respectively,

between 2020 and 2022 [71]. Rising incidence across Eastern Europe, Asia, and Latin America—often linked to urbanization and industrialization—underscores the role of environmental stressors in driving genuine morbidity beyond diagnostic artifacts [73].

Eating disorders are associated with markedly elevated mortality, with nearly sixfold higher risk in anorexia nervosa patients and twofold higher risk in bulimia nervosa [74]. Deaths related to anorexia nervosa frequently result from severe medical complications, including endocrine dysfunction, metabolic disorders, and organ failure [75]. The convergence of rising incidence, heightened suicide risk, and significant physical comorbidity underscores eating disorders as a critical public health concern. Multidisciplinary management, including early detection, intensive medical and nutritional stabilization, and family-based therapy targeting both psychological and medical domains, is essential [71].

Substance use disorders (SUDs)

Globally, age-standardized incidence and prevalence of SUDs declined between 1990 and 2021 [76]. Among youths, the prevalence of alcohol use disorders decreased since 2000, whereas trends in drug use disorders have fluctuated [76]. High-SDI countries continue to bear a disproportionate share of disability-adjusted life years, while under-detection likely persists in low-SDI settings [77]. Notably, declining trends in alcohol and tobacco use are offset by the rapid emergence of new psychoactive substances, electronic cigarettes, and the downstream effects of marijuana legalization. By 2020, more than 1,000 novel psychoactive substances had been identified, posing substantial challenges for surveillance and toxicological screening due to their evolving chemical structures [78]. In the USA, marijuana legalization has been associated with higher suicide rates among youths aged 12–25, particularly among females, even after adjustment for multiple covariates [79].

Early initiation of substance use substantially increases the risk of developing chronic SUDs [80] and may disrupt maturation of frontal executive-control systems, perpetuating cycles of binge use and cognitive impairment [81, 82]. Adolescent alcohol use correlates with increased depression in adulthood [83], while cannabis use during adolescence is associated with depression, anxiety, and other psychiatric disorders [81]. Emerging substances confer additional risk: electronic cigarette use is associated with a 2.5-fold increase in suicide attempts [84], and alcohol dependence elevates the risks of non-suicidal self-harm fourfold and life-threatening suicide attempts ninefold among adolescents with conduct disorder [85]. These risks are further amplified in youths engaging in polysubstance use behaviors [86]. Collectively, these findings indicate that despite declining diagnostic prevalence of traditional SUDs in some regions, the converging threats of neurobiological disruption and suicidality constitute a growing and genuine risk to youth mental health. Public health responses must include school-based substance education, targeted prevention addressing novel substances and e-cigarettes, and integrated SUD intervention incorporating suicide risk assessments. Furthermore, expanding global cannabis legalization necessitates targeted psychoeducation regarding its psychiatric risks [87].

Schizophrenia

Global age-standardized incidence and prevalence of schizophrenia remained largely stable from 1990 to 2019 [88]. During this period, prevalence increased modestly ($\approx$3%) in high-SDI countries, whereas no significant changes were observed in middle- and low-SDI regions, suggesting persistent under-detection in low-resource settings [88]. Early-onset psychosis is strongly associated with genetic vulnerability and premorbid neurodevelopmental abnormalities, often resulting in more severe negative symptoms and poorer outcomes [89]. Within this overall stability, however, the proportion of cases attributable to cannabis use disorder has grown substantially. A large population-based cohort study in Canada reported that this attributable fraction nearly tripled from 3.7% in the pre-legalization period to 10.3% following nonmedical cannabis legalization, with the highest attributable risk (18.9%) observed among males aged 19 to 24 years [90]. This pattern reflects meaningful shifts in modifiable risk exposure. To address these challenges, clinical frameworks should prioritize early recognition of prodromal symptoms to enable timely intervention [89]. Furthermore, integrating cannabis use screening into first-episode psychosis assessments and providing targeted psychoeducation on the psychotogenic risks—particularly for youths with genetic susceptibility—are essential.

Oppositional defiant disorder (ODD) and conduct disorder (CD)

The average population prevalence of ODD is approximately 3.3% among youths aged 518 years, with higher rates in males [91] and 1.8 times more common in primary than secondary school students [92]. In the USA, ODD diagnoses within public mental health systems declined between 2013 and 2021 [93]. In contrast, the GBD Study identifies CD as the most burdensome mental disorder among children aged 0–14 years, exceeding ADHD [94]. CD affects approximately 22.5% of school-aged children worldwide, with a twofold male predominance [95], and its prevalence has increased slightly between 1990 and 2019, particularly in high-income North America [96]. Evidence-based interventions primarily emphasize parenting and family-based psychosocial approaches [95]. Beyond behavioral manifestations, CD is associated with neurobiological alterations in emotion processing and reinforcement-based decision-making [93], with atypical antipsychotics reserved for short-term management of severe symptoms [97] and stimulants demonstrating efficacy in comorbid CD and ADHD [95]. Framing CD as a public health priority and shifting from stigma toward early recognition and intervention may substantially improve long-term outcomes.

Gaming disorder

Internet gaming disorder was introduced in DSM-5 (2013) as a condition warranting further research [98], and subsequently recognized as a diagnosable disorder in ICD-11 (2019), reflecting growing clinical concern [99]. Meta-analytic evidence indicates a global prevalence of approximately 3%, with a clear upward trajectory from 2009 to 2017 [99]. This increase likely reflects the convergence of standardized diagnostic criteria, widespread high-speed internet access, and increasingly immersive game designs optimized for sustained engagement [98, 99]. Gaming disorder is associated with marked functional impairment, including disruptions of daily routines, neglect of self-care, academic decline, and social withdrawal [98]. Affective distress and emotional dysregulation upon gaming restriction further parallel features of substance use disorders. Collectively, these patterns suggest a genuine escalation of behavioral pathology in the digital era, underscoring the need for integrated, multidisciplinary prevention and intervention strategies [99].

Suicide

Suicide is among the leading causes of death in adolescents and young adults, and constitutes one of the most objective indicators of a genuine deterioration in youth mental health [100]. Although global suicide mortality has declined overall, several high-income countries have reported marked increases in recent years, particularly among adolescents and young adults [101]. In the USA, suicide rates for 10–24-year-olds increased by 62% from 2007 to 2021, rising from 6.8 to 11.0 deaths per 100,000 [18]. Comparable increases have been observed in Australia, where suicide rates rose by 52% among those aged 15–17 (from 6 to 9.1 deaths per 100,000) and by 46% among those aged 18–24 (from

10.3 to 15 deaths per 100,000) between 2009 and 2021 [102]. In Taiwan, suicide rates among ages 10–24 have increased by approximately 12% annually since 2014 [19], while China has reported annual increases of 18% and 15% in the 10–14 and 15–19 age groups, respectively, between 2017 and 2021 [103]. Historically, suicide rates have been higher among males aged 10–24, except in South Asia, where female rates predominate [101]. However, recent data from the USA, Australia [101], and Taiwan [19] indicate a disproportionate rise in female youth suicide, underscoring the urgency of sex-specific prevention strategies.

These trends parallel increases in self-harm [20], problematic internet use [19], and mental health conditions, including depression, anxiety, and sleep disturbance [104]. Prior self-injurious thoughts and behaviors remain the strongest predictors of suicide, conferring more than a twofold increase in risk of suicide death [105]. However, up to two-thirds of youth suicides occur without documented prior suicidal behavior [105, 106], highlighting the limitations of relying solely on past self-harm history for risk assessment. This underscores the need to identify early warning indicators and upstream risk factors to inform more effective preventive interventions [107].

DECONSTRUCTING THE RISK FACTORS

To move beyond descriptive trends, we examine mechanisms linking contemporary environments to the developing brain of youths [108]. The risk factors highlighted in this review were selected based on robust epidemiological, longitudinal, and neurobiological evidence. Importantly, these factors are highly interconnected. For example, sleep disruption, cyberbullying, and sedentary behavior are often mediated by problematic technology use, including smartphones and social media. Recognizing these interdependencies is critical, as interventions targeting a single behavioral domain may be insufficient without addressing the broader technological and environmental drivers.

Digital integration and social media

One of the most profound shifts in contemporary youth experience is the pervasive integration of digital media into everyday social, academic, and leisure domains. Earlier studies linking screen use to poorer emotional well-being relied largely on cross-sectional designs, limiting causal inference [28, 109]. In contrast, large-scale longitudinal cohorts, including the Adolescent Brain Cognitive Development (ABCD) study, demonstrate that greater baseline screen time prospectively predicts increases in depressive, conduct, somatic, and ADHD symptoms over a two-year follow-up, strengthening causal interpretation when coupled with biological plausibility [110]. These longitudinal associations are partly explained by the "displacement hypothesis," which posits that excessive screen use crowds out protective behaviors, such as sleep [111] and physical activity [112], producing downstream mental health effects [110]. Supporting this framework, a randomized controlled trial showed that a two-week, family-based reduction in leisure screen time led to improvements in youths' emotional symptoms and peer interactions [113], underscoring the mental health benefits of actively managing screen exposure.

Importantly, digital media effects are heterogeneous and context-dependent. General digital activities, including educational and creative uses, show neutral or even beneficial associations with cognitive development [111], whereas social media platforms demonstrate more consistent links to adverse outcomes [29]. Cross-sectional studies associate social media exposure with elevated risks of depression [114], social anxiety [115], and loneliness [116], and several longitudinal studies report worsening psychiatric symptoms and negative affect with increased use over time [117, 118]. Nonetheless, other evidence suggests these relationships may be mediated or confounded by factors such as reduced self-esteem, interpersonal distrust or sleep disruption, rather than reflecting a simple causal dose–response effect [119–121].

Particularly concerning is problematic social media use, defined by compulsive engagement despite negative consequences, which is robustly associated with emotional distress, anxiety, depression, and social withdrawal [122]. These risks are especially pronounced among female adolescents, for whom social media use more frequently involves maladaptive social comparison and body image concerns [123]. Such evidence has prompted unprecedented policy responses, including Australia's 2024 legislation requiring platforms to prevent account creation by children under 16 by December 2025 [124]. Alongside regulatory approaches, strengthening digital literacy, resilience, and help-seeking skills among youths remains a critical strategy for mitigating harm and promoting healthier engagement [125].

The rise of cyberbullying

Digital integration has fundamentally reshaped peer victimization, shifting interpersonal conflict from the school setting to online environments. While traditional school bullying has declined [126], cyberbullying has emerged as a persistent and escalating threat, affecting approximately 15% of youths globally [30]. Its digital nature enables continuous exposure, absence of physical safe boundaries, and potentially large audiences, collectively exacerbating the psychological harm [127].

The psychiatric consequences of bullying involvement are substantial and long-lasting, often extending into adulthood [128]. Victims of bullying face a 2.8-fold increased risk of depression, rising to 3.2-fold among those in bully-victim roles [129]. Involvement in bullying, whether as a victim, perpetrator, or both, is consistently associated with non-suicidal self-injury [130], suicidal thoughts [131], anxiety, depression, and sleep disturbances [132]. Although traditional and cyberbullying often co-occur, cyberbullying victimization is uniquely linked to more severe functional outcomes, including heightened risks for suicide attempts and acute emotional distress [133, 134], particularly among female adolescents, who exhibit greater vulnerability to cyberbullying-related internalizing symptoms [127].

Vulnerability is disproportionately concentrated among children with disabilities, neurodevelopmental or psychiatric conditions, and sexual minority status [135, 136]. This risk is bidirectional: pre-existing anxiety and depression increase susceptibility to bullying, which in turn exacerbates psychiatric morbidity [137]. Importantly, protective factors, especially strong parental, teacher, and family support, can mitigate depression and anxiety associated with cyberbullying [138, 139]. These findings highlight the need for targeted, school-based interventions that both reduce exposure to bullying and strengthen supportive environments to enhance emotional resilience among high-risk youths [140].

Sleep problems and circadian rhythms

Youth mental health is increasingly compromised by disruptions in sleep and circadian regulation, which form a critical interface between neurodevelopment and environmental exposures [141]. Adolescence is marked by delayed sleep timing, circadian phase shifts, and changing sleep needs, with insomnia affecting 30–40% of youths and an eveningness chronotype present in approximately 20% [142]. These developmental changes heighten vulnerability to misalignment with early school schedules and other environmental demands [141]. Nocturnal screen exposure exacerbates these challenges via dual mechanisms: cognitive arousal that delays sleep onset and blue-light-induced melatonin suppression that further shifts the circadian system toward eveningness [111, 143].

Longitudinal studies indicate that sleep disturbances are not merely comorbid symptoms but antecedent risk factors for later psychopathology [142, 144]. Insomnia disrupts overnight emotional recalibration, impairing stress adaptation and increasing psychiatric vulnerability [141]. Longitudinal data from the ABCD cohort identify sleep disturbance as one of the strongest predictors of subsequent adolescent mental health risk, underscoring sleep and circadian regulation as key targets for early intervention [142, 145]. Consistent with this, meta-analytic evidence demonstrates that improving sleep confers broad, cross-diagnostic benefits for mental health, depression, anxiety, and rumination [146]. Collectively, these findings position sleep and circadian disruption as important neurobiological targets for youth mental health prevention and intervention [144].

Physical activity, fitness, and sedentary behaviors

The global decline in youth mental health parallels a marked displacement of physical activity by screen-based sedentary behaviors. World Health Organization data show that 81% of adolescents worldwide fail to meet the recommended 60 minutes of daily moderate-to-vigorous physical activity [147]. Mechanistically, physical activity is a potent modulator of neuroplasticity [148]. Higher cardiorespiratory and muscular fitness are associated with structural characteristics of brain regions supporting executive function [149] and automatic emotion processing [150], providing a biological basis for the relationship between physical health and psychiatric resilience.

Cross-sectional studies and meta-analyses consistently demonstrate positive associations between physical activity and youth emotional well-being [151]. Cardiorespiratory fitness shows a robust inverse relationship with depressive symptoms [152], while muscular fitness is positively correlated with self-esteem [153]. Exercise interventions also alleviate depressive and anxiety symptoms [154], with particularly pronounced cognitive and psychological benefits among children and adolescents with neurodevelopmental disorders [155].

Longitudinal and population-based studies further support temporal precedence. Higher cardiorespiratory and muscular fitness levels in childhood and adolescence predict reduced risk of subsequently developing ADHD, depression, and anxiety [156, 157]. Conversely, prolonged sedentary behavior—especially screen-based—independently exacerbates depressive symptoms and displaces experiences essential for healthy brain maturation [117]. The secular decline in youth cardiorespiratory fitness over recent decades thus represents a biologically meaningful contributor to rising psychiatric morbidity [156–158]. Collectively, these findings prioritize physical activity as a core public health intervention for enhancing resilience during a neurodevelopmentally sensitive period [159, 160].

Academic pressure and schoolwork stress

Beyond digital and lifestyle shifts, intensifying academic competition has emerged as a major socio-environmental driver of youth psychiatric distress. Over the past two decades, adolescents' perceived schoolwork pressure has increased substantially [31], closely paralleling the rise in internalizing disorders [161]. Academic pressure is one of the most salient stressors for school-aged youths, and longitudinal data indicate that high perceived academic demands predict more severe depressive symptoms and psychological distress over time [162, 163]. These effects are particularly pronounced in academically selective tracks and high-achieving school environments [164, 165], where sustained, high-stakes academic performance expectations may engender anxiety and hopelessness among students who struggle to meet escalating standards [161].

The causal salience of academic pressure is further supported by pronounced seasonality in youth suicidality. Large-scale studies show that suicide attempts and mortality decline during summer and winter breaks, but increase sharply following school term onset [166, 167]. These temporal patterns suggest that while schools are central to social development, they may also function as potent stressors that precipitate acute crises in vulnerable youths. Collectively, these findings implicate structural features of modern educational systems as contributors to the rising burden of youth mental health disorders [161].

The impact of COVID-19 pandemic

The COVID-19 pandemic acted as an unprecedented global catalyst that accelerated pre-existing increases in youth mental distress [168]. Rather than introducing novel etiologies, it magnified existing vulnerabilities [169] through the convergence of social deprivation and sensitive neurodevelopmental periods [170, 171]. A central mechanism was the abrupt loss of peer interaction at a developmental stage critical for maturation of neural systems supporting social cognition and emotion regulation [169, 171]. School closures and suspension of extracurricular activities, combined with increased screen exposure and disrupted circadian rhythms, further amplified developmental risk [168, 170].

The pandemic's clinical impact was most evident in eating disorders, with hospitalizations and incidence of anorexia nervosa rising well above expected levels across multiple high-income regions following lockdowns [71, 72]. Contributing factors likely included social isolation, family stress, and increased exposure to appearance-focused social media content [71]. Furthermore, the rapid shift from school-based to home-based learning placed substantial strain on family systems, with elevated parental distress and economic instability cascading into youth emotional difficulties [172, 173]. As societies navigate the post-pandemic period, insights from this global naturalistic experiment provide a critical evidence base for designing long-term public health strategies and support systems to mitigate youth psychiatric morbidity [174].

Social determinants of mental health

A comprehensive understanding of youth mental health must extend beyond individual behavioral risks to encompass broader social determinants, including economic disadvantage, childhood adversity, migration stress, loneliness or social isolation, and discrimination [175]. Youth facing socioeconomic disadvantage exhibit 2-3 times higher mental health risks, with early adversity accounting for nearly 30% of the population-attributable risk for psychiatric disorders. These individual vulnerabilities are further shaped by wider social environments. Urbanization, shrinking family structures, increased parental separation, and rising individualism have weakened traditional support systems, while secularization has contributed to the erosion of community- and faith-based resilience resources. Consequently, neighborhood disadvantage, low social capital, social fragmentation, suboptimal physical environments, and increasing climate-related distress further amplify psychological burdens [175]. Furthermore, these socioenvironmental risks are interconnected and mutually reinforcing, disproportionately affecting marginalized populations and exacerbating systemic inequities. Addressing these disparities requires a multi-level primary prevention framework, as proposed by Kirkbride et al., to target structural inequalities and strengthen community resilience [175].

TRANSLATING RISK FACTORS INTO INTERVENTION STRATEGIES

Translating identified risk factors into effective clinical and public health action requires a paradigm shift from reactive, diagnosis-centered care toward a proactive framework emphasizing early risk mitigation and the strengthening of protective factors [176]. Intervention strategies should operate across three tiers: universal prevention for all youths, selective interventions for high-risk

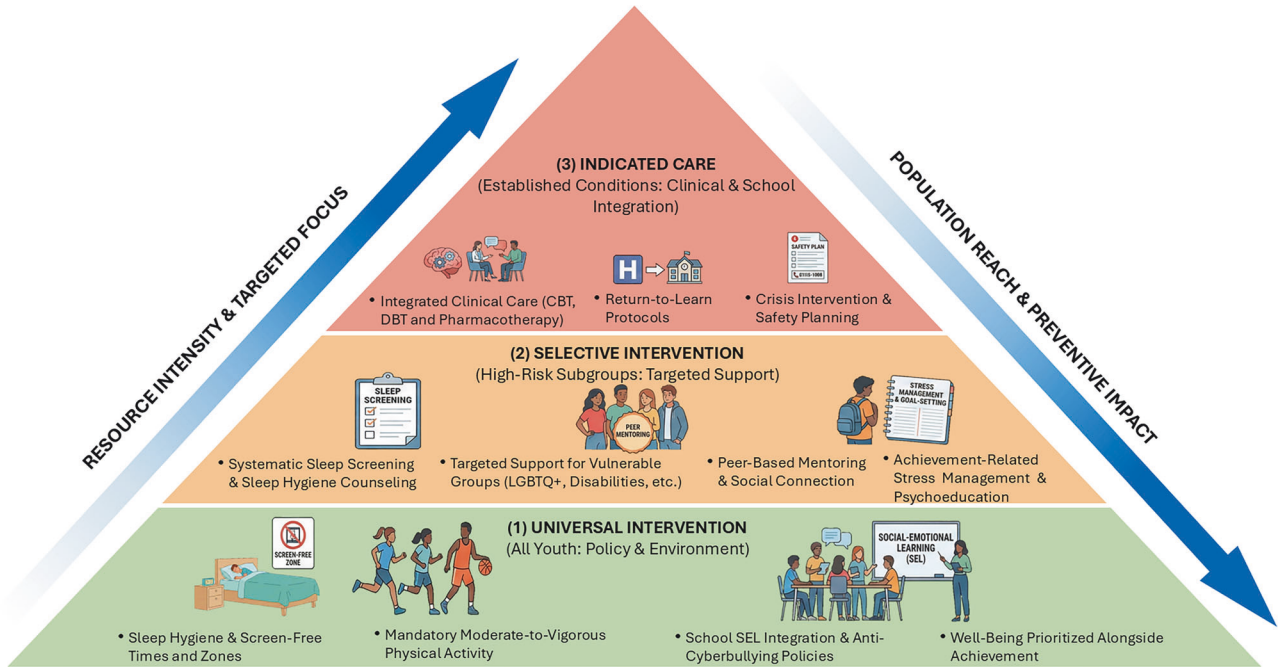


Fig. 1 A proactive three-tiered framework for youth mental health. The pyramid model organizes intervention strategies into three hierarchical levels. (1) Universal intervention (base): Policy-level changes targeting the general population, focusing on digital literacy, mandatory physical activity, and Social-Emotional Learning (SEL) within school curricula. (2) Selective intervention (middle): Targeted interventions for high-risk subgroups through clinical vigilance for sleep disturbances, achievement pressure and peer-support scaffolding. (3) Indicated care (top): Integrated evidence-based therapy, crisis intervention, emphasizing Return-to-Learn protocols to ensure functional recovery and academic reintegration. CBT, cognitive behavioral therapy; DBT, dialectical behavior therapy.

subgroups, and indicated care for individuals with established clinical disorders [177]. This stepped model is supported by public health implementation evidence and enables efficient resource allocation while maximizing population-level impact (Fig. 1).

Universal strategies should prioritize systematic regulation of digital, physical, and educational environments to better align with adolescent neurodevelopmental needs. School systems must move beyond passive monitoring toward active empowerment by integrating digital literacy curricula that enable youths to recognize algorithmic bias, manage online risks, and proactively navigate support systems when digital harms occur [178]. Families should be supported in establishing screen-free times (e.g., during the in-bed period) and zones (e.g., bedrooms) to protect sleep integrity [179]. Mandatory daily physical education emphasizing moderate-to-vigorous physical activity requires curricular restructuring and environmental adaptations to ensure inclusive participation [160]. Public health messaging should explicitly frame physical activity as a core neurobiological intervention for youth mental health rather than an optional lifestyle behavior [180].

Equally critical is reforming school culture to prioritize well-being alongside academic achievement. Policies should reduce assessment stakes, incorporate academic accommodations for students with mental health difficulties, and normalize flexible learning pathways [181]. Embedding Social-Emotional Learning (SEL) throughout the school day may help youths develop competencies in emotion regulation, behavioral control, and adaptive coping [182]. A landmark meta-analysis of 570,000 students found that SEL interventions improved social functioning, school climate, and long-term academic outcomes [182]. However, substantial heterogeneity across intervention content and implementation contexts suggests that these benefits are not uniform, underscoring the need for careful and context-sensitive implementation rather than an indiscriminate approach [182]. Safeguarding the social environment further requires explicit anti-cyberbullying policies, structured empathy and bystander training, and trauma-informed staff responses to provide psychological safety for distressed youths [183].

Selective interventions

Selective interventions target subgroups with elevated vulnerabilities through focused screening, monitoring, and risk-reduction strategies [184]. Sleep disturbance warrants particular attention, as longitudinal evidence identifies it as one of the strongest predictors of future adolescent psychiatric risk [145]. Given its transdiagnostic role in amplifying symptom severity across multiple psychiatric conditions [185], systematic screening of youths presenting with sleep problems offers an efficient means of identifying those at heightened risk for anxiety, depression, and academic stress [186]. Sleep interventions should extend beyond generic recommendations to include structured stimulus control, consistent sleep–wake scheduling, and graduated reduction of bedtime screen exposure to restore circadian stability and emotional regulation [187]. Similarly, structured physical activity programs should be prioritized for psychologically vulnerable youths, given robust evidence for their efficacy in reducing symptoms of depression, anxiety, and distress [180].

Proactive monitoring is also essential for youths at elevated risk of cyberbullying and social exclusion, including those with disabilities, neurodevelopmental conditions, LGBTQ identities, social anxiety, and other psychiatric conditions [188, 189]. Prompt identification of bullying dynamics should be followed by structured peer-based interventions, such as mentoring and facilitated social engagement, which have demonstrated effectiveness in reducing isolation and strengthening protective social networks [190]. These approaches shift school climates from passive observation to active, empathetic support [191], mitigating the cumulative trauma of victimization during sensitive developmental periods [176].

Finally, selective strategies must address the distinctive pressures faced by students in high-achieving academic environments, who are increasingly recognized as vulnerable to maladaptive perfectionism and achievement-related anxiety [192]. School-based programs should emphasize adaptive goal-setting, stress management, and the decoupling of self-worth from academic performance [193]. Crucially, these efforts must extend to families through psychoeducation that promotes emotionally supportive home environments, thereby interrupting cycles of chronic performance-driven stress [192, 194].

Indicated care

Indicated care constitutes the most intensive tier of intervention, targeting youths with established psychiatric disorders or subthreshold symptoms conferring high risk for progression to full-syndrome disorders. At this level, the emphasis shifts to delivering evidence-based clinical treatments that are tightly integrated with school-based support systems [195]. Specialized psychotherapies, including cognitive behavioral therapy (CBT) for internalizing disorders and dialectical behavior therapy (DBT) for chronic suicidality or emotional dysregulation, should be prioritized to strengthen advanced coping and emotion-regulation capacities [196, 197]. Indicated care also requires institutionalized crisis intervention and suicide prevention protocols within school settings. For students at elevated suicide risk, clinicians and school personnel should collaboratively develop individualized safety plans incorporating lethal means restriction, identification of early warning signs, and rapid access to emergency psychiatric resources [198]. Professionally facilitated peer support can further reduce stigma and social isolation associated with severe mental illness [199].

A critical yet frequently overlooked component of indicated care is the implementation of structured return-to-learn protocols for students re-entering school following psychiatric hospitalization or prolonged mental health–related absence [200]. These protocols should extend beyond academic accommodations to include a phased reintegration that aligns educational demands with the student's current cognitive and emotional capacity. Effective implementation requires coordinated communication among clinical teams, educators, and families [201]. When pharmacotherapy is indicated, close collaboration between clinicians and school staff is essential to monitor treatment response and adverse effects, ensuring that symptomatic stabilization is supported by an appropriate learning environment [201]. Ultimately, the goal of indicated care extends beyond symptom reduction to the restoration of functional capacity, preventing psychiatric illness from constraining long-term educational and developmental trajectories [202].

CONCLUSION

Future research should prioritize longitudinal cohorts to elucidate modifiable risk factors over time. Large-scale epidemiological surveys in low- and middle-income countries are also essential to advance understanding of global trends and region-specific determinants across diverse sociocultural contexts. Translating these insights into practice requires integrating youth mental health into educational and social policy frameworks. Amid pervasive digital, academic, and social stressors, societies must deliberately shape environments that support sleep, physical activity, and emotional regulation to promote resilience and long-term well-being.

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AUTHOR CONTRIBUTIONS

Huey-Ling Chiang: Conceptualization, writing original draft & editing. Yi-Ling Chien: Writing original draft. Susan Shur-Fen Gau: Conceptualization, writing, and critical review and editing.

FUNDING

This work was supported by the National Science and Technology Council, Taiwan (MOST111-2314-B-418-001-MY3 and NSTC 115-2314-B-418-005 to HL Chiang; NSTC112-2314-B-002-106-MY3 to SS Gau), and the National Health Research Institute, Taiwan (NHRI-EX113-11002PI and NHRI-EX114-11002PI to SS Gau).

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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