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Telemental Health and Web-based Applications in Children and Adolescents

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Burden of Child and Adolescent Mental Disorders

In the last half-century, new techniques have substantially reduced the morbidity and mortality associated with “somatic” health problems: however, there is a “new morbidity” of behavioral and mental disorders on the rise.¹ The vast majority of mental disorders have an initial onset before age 24, and 20% of children have experienced a mental health disorder.^{2–7} Most mental disorders are characterized by a relapsing and remitting pattern over a lifetime (16.6% for major depression, 13.2% for alcohol abuse), and they are among the top 10 causes of lost disability adjusted life years^{5, 8 14 8–9}. Given this, reducing the burden of child and adolescent mental disorder is a major public health priority.¹⁰

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Need for Alternative Strategies to Address Child and Adolescent Mental Disorder Burden

Many promising diagnostic approaches and treatment strategies, including psychotherapy and pharmacologic approaches, have been developed to address the morbidity and mortality associated with mental disorders.¹¹ Psychotherapy interventions in both school-based treatment and preventive interventions have demonstrated small to moderate effect sizes and number needed to treat values in the 4–10 range.^{12–13} Despite these improvements, cost containment strategies for mental health have increased pressure on health care professionals to provide more services at lower costs.¹⁴ Many new approaches, such as collaborative care and dual treatment with antidepressant medications and psychotherapy, improve outcomes for patients, particularly for ethnic minorities, but at an additional cost.^{15–17} Telemedicine offers the prospect of facilitating such reconfiguration of services to address geographic and supply-based access issues.^{11, 19} While television has previously been used for psycho-education,²⁰ both the interactivity of web-based treatment and the ability to simultaneously deliver services to large numbers of clients make Internet interventions a particularly appealing model for prevention, first-step treatment, or as a companion to existing treatment. In addition, contemporary children and adolescents exhibit high levels of computer literacy, which leads us to believe that Internet interventions would be an effective way of providing children and adolescents with treatment.

Internet Intervention Models

Internet interventions are developed around theoretically grounded concepts and offer good prospects for improving health related behaviors. Several recent publications have summarized key concepts for Internet interventions, such as the importance of motivation of participants, participant participation, website design, and support for participation.^{21–23} Children and adolescents live and develop within an ecological context of family, school/peers and community experiences. They have much less control over their environment than adults do, and are also undergoing much more rapid developmental changes than adults are.¹⁰ Additionally, children and adolescents may be more likely to respond to alternative delivery strategies such as internet based video or games.^{24–25} People of this age also warrant special protection and concern with regard to use of the Internet. In short, we need to consider Internet intervention within the unique frame of child and adolescent ecology and experiences.

Evidence for Benefit of Internet Interventions for Health

A substantial body of literature supports the use of Internet-based approaches to treat a range of mental disorder symptoms in adults and somatic health problems in adolescents.^{19, 26–27} Several randomized trials have demonstrated efficacy in reducing depression and/or anxiety symptoms,^{26, 28} eating and alcohol abuse disorders,^{29–30} and improving knowledge/attitudes (psycho-education) in adults.³¹ Internet interventions have been developed to address somatic health problems in the youth population, including: obesity, smoking, HIV/AIDS risk, and sexual risk.^{32–38} Despite measurable improvements, Internet interventions remain dependent on contextual factors to spur motivation, with less than 10% of the population ready to engage a lifestyle change online at any given moment.^{39–40}

Internet Interventions, Ecological Context, Development and Social Capital Formation

We present an overview of this emerging literature of Internet-based interventions for child mental health within both a psychopathology (disorder based) and an ecological and

developmental framework (Figure 1).⁴¹ Internet-based interventions for child and adolescent mental health were conceptualized as fully integrated components of the ecological developmental process that leads to social capital formation.⁴² These include health promotion, prevention, and treatment interventions that work with and seek to influence the child through family, community and system contexts.¹⁰ For example, adolescents could be screened for risk of depression in primary care, and through the primary care provider be engaged with an Internet-based prevention strategy that includes a parent training component—a synergistic combination of treating the adolescent within family, Internet and community resources.^{43–45} We summarize progress in this area by disorder (as well as for general mental health promotion) and within an ecological and developmental context and also offer recommendations for future directions.

Review Methods

We systematically searched Medline and PsycInfo databases for unique intervention papers. The search was guided by MESH (for Medline) and subject terms (for PsycInfo) that covered the topics of “mental health” in combination with both “intervention” terms and “Internet” terms. These formal data base searches were supplemented by examining the citation lists of acquired articles, hand-searching abstract listings of two major conferences in Internet mental health held in 2009, and consulting a list of field experts. Data extracted from acquired articles focused on clinical measures of the disorders specific to each publication. Some data on psycho-education measures were also included. Individual effect sizes (ES, also known as standard mean difference) were calculated between intervention and control groups, and also pre- and post-intervention for disorder-specific measures (usually symptom measures). We chose to include pre/post effect sizes for the following reasons: 1) some studies were single arm pre/post design and 2) many randomized controlled trials utilized active controls that may have led to an underestimate of treatment effects. Not all of the studies included all measures required to calculate all effect sizes. Number needed to treat (NNT) values were calculated for dichotomous outcome data whenever it was available (not all studies included dichotomous outcomes). While individual effect sizes and NNTs are shown in table 1, the review also includes mean effect sizes and NNTs for each disorder category. The data for mean effect sizes and NNTs are not included in a reference table, but a more detailed description is available through the corresponding author. Where appropriate, psycho-education effects sizes were calculated.

Intervention for Specific Mental Disorders

Depression

We found articles describing two main interventions for childhood depression, MoodGym and Project CATCH-IT (Table 1).^{44–48} Both interventions include a focus on Cognitive Behavioral Psychotherapy approaches, but CATCH-IT also incorporates Interpersonal Psychotherapy components. The MoodGym studies are done in schools, while in CATCH-IT the adolescents are engaged via a primary care encounter. The mean between-group effect sizes for depression intervention are small (Mean ES= 0.20). The pre/post effect sizes also fall into the smaller range (Mean ES= 0.26). The average number needed to treat is moderate (Mean= 9.88). MoodGym uses animation as a teaching adjunct, while CATCH-IT utilizes adolescent narratives. Pre/post effect sizes are larger for samples with depression symptoms (such as “indicated prevention (those with early symptoms, but not have full criteria and subgroups of symptomatic persons within “universal” prevention model studies (entire school exposed to interventions) than for samples with of largely asymptomatic adolescents (universal prevention).

MoodGym (moodgym.anu.edu.au) uses modules based on cognitive behavioral therapy (CBT) both to provide pertinent information and to directly address depressive symptoms in a youth population.^{46–48} The program comprises five modules, focusing on prevention, education, and treatment using CBT, and has undergone three randomized clinical trials comparing it to routine health class participation alone. In the largest (male and females) randomized controlled trial (1477 participants, mean age 14.34 (SD=0.75)), the MoodGym program was compared with a wait-list control group (received health class).⁴⁶ Post-intervention, the total Center for Epidemiological Studies Depression Scales (CES-D) scores for the intervention group were slightly reduced (Effect Size = 0.15), but the difference was significant for male participants, yielding a larger CES-D effect size (ES = 0.40). Results from the two smaller randomized controlled trials for the mood gym were found in single-gender school setting contrasted with the larger, mixed-gender study.^{47–48} Effect sizes for CES-D scores for the all-male study were small to moderate (depending on participation level), and not significant, but there was a significantly lower likelihood of being classified as at risk for depression (NNT=9.1).⁴⁷ The other was an all-female study with 157 participants where effects size were small immediately post study, but moderate at 20 week follow-up.⁴⁸

Project CATCH-IT (<http://catchit-public.bsd.uchicago.edu>) is a primary care-based interventional website that focuses on the prevention of adolescent depression and uses principles based on CBT, Interpersonal Psychotherapy (IPT) and Behavioral Activation (BA).^{44–49} The 84 participants were recruited via screening in primary care. These participants had a mean age of 17.39 years (SD=2.04), and were randomized to either a motivational interview group (MI, 5–10 minute physician interview) to a brief advice group (BA, 1–2 minutes) in preparation for Internet site use. While the MI group demonstrated greater participation, both group engaged the Internet site substantially and between group differences were small. However, both groups demonstrated moderate pre/post effect sizes for depressed mood and the MI group had significantly fewer depressive episodes at 3 month follow-up.⁴⁴

Anxiety

Three interventions were identified focusing on anxiety and one on both depression and anxiety. The studies include one pre/post⁵⁰ design and three randomized clinical trials,^{46–51–52} with both wait list and health class control groups (mean between group effect size ES=0.24 and a mean pre/post ES =0.64). The three interventions without direct face-to-face therapeutic contact report small effect sizes, while the study done in a clinic setting, as a component of a standard intervention, reports moderate effect sizes. All the interventions except one (Spence) use animation to illustrate CBT concepts, while one (Climate schools) uses animated narratives. Interestingly, the intervention with the least interactivity (Spence) also had the largest effect size.

BRAVE Online (brave.psy.uq.edu.au) is a program designed to treat childhood anxiety issues and provide participants with psycho-educational information.⁵¹ Child sessions contain modules based on CBT and anxiety reduction strategies. Parent sessions are focused on psycho-education regarding child anxiety, and strategies for overcoming it. The study included 73 participants with pre-existing anxiety disorders, ages 7–12 (mean age of 9.45 years (SD=1.37)). Participants were recruited through public announcements. The children and families were randomly assigned to either an intervention group or a non-treatment control group. There are small, non-significant differences between group effect sizes, while the intervention arm did demonstrate moderate and significant effects sized for improvement in anxiety (pre/post analysis).⁵¹

In another randomized controlled trial, Spence combines Internet interventions with traditional clinical treatment within a mental health clinic setting.⁵² Among the participants were 72 children and adolescents (mean age=9.93 years (SD=1.74)) with pre-existing anxiety disorders.⁵² After recruitment from the clinic, they were randomly assigned to either clinic-only treatment with face-to-face counseling, or to treatment which has half of the sessions via the Internet. The modules of intervention are based on CBT and psycho-education. Comparisons of post-treatment anxiety scores for children and adults yield small-to-medium effect sizes between groups (SCAS-C, ES=0.09; SCAS-P, ES= 0.48 and NNT=2.57) for likelihood of having an anxiety diagnosis.⁵²

A final study addresses anxiety using the ClimateSchools program.⁵⁰ This intervention is delivered within the school setting in place of normal health classes, and is offered as preventative intervention. The study was organized with a pre/post design. ClimateSchools focuses on psycho-education and presents its content in an online, cartoon format. 653 eighth graders were included in the study, and participants were randomly assigned to either the treatment group or health class as usual. As stated by the authors, there were no significant differences observed between groups. Due to the fact that raw data were not reported, effect sizes could not be calculated. The authors did report an effect size of 0.36 between the interventions pre- and post-treatment anxiety knowledge.⁵⁰

Eating Disorders

Two eating disorder preventative interventions were identified: My Body, My Life; Body Image Program for Adolescent Girls and the Student Bodies Program.^{53–54} The mean between-group effect sizes is in the small to moderate range (ES= 0.29), and the pre/post effect size is the same (ES= 0.29). Both programs used CBT elements and discussion formats, but My Body, My Life focuses on synchronous online group psychotherapy, while the Student Bodies Program is built around self-directed learning behavior change and an asynchronous discussion board. (53–54)

My Body, My Life is a program developed to prevent eating disorders in adolescents.⁵⁴ CBT-based treatment is given at home, via an Internet site. Sessions were moderated online by a therapist. In this intervention, participants work through an online manual addressing body image and eating issues. Eighty-three female adolescents with self-identified body image concern (mean age of 14.4 (SD= 1.53)) were recruited online and randomly assigned to either a delayed treatment group or to active intervention. At the conclusion of the program, there were moderate effect sizes between groups for both bulimia (EDI-Bulimia, ES= 0.45) and depression scores (Beck Depression Scale, ES= 0.43).⁵⁴

The Student Bodies program, an intervention for adolescent eating disorders, utilizes a combined CBT and psycho-educational website, and focuses on both adolescents and their parents in a school setting.⁵³ The website also includes a patrolled social networking aspect that allows participants to express issues and share stories. 153 adolescents (mean age of 15.1 (SD=0.4)) and 69 parents were assigned to either active intervention or wait-list control. Small-to-medium effect sizes were observed for both adolescent and parent outcomes. Intervention group adolescents showed an effect size of 0.13 for bulimia and 0.64 for knowledge at post-intervention as compared to wait-list participants. Intervention group parents showed improvement in healthy outlook (ES= 0.29).⁵³

Substance Abuse

The ClimateSchools program for prevention of substance abuse is an interactive website which uses animated narratives focusing on substance abuse education.^{55–56} Participants learn important information about the perils of alcohol and cannabis. The intervention group

completes the program in place of their normal health class. 763 adolescents participated in the study. The mean age for all participants was 13.08 (SD= 0.58).^{55–56} Small-to-moderate effect sizes were observed between groups for knowledge of alcohol and cannabis and their use. Effect sizes of 0.78 and 0.77 were shown for alcohol and cannabis knowledge (data not shown in table), respectively. Small effect sizes were seen for weekly alcohol consumption (0.25) and frequency of cannabis use (0.25, data not shown in table).^{55–56}

Health Promotion

A series of Internet interventions have been developed to provide broad mental health promotion in children and adolescents. We identified four such interventions in the published literature: Kindertelefoon (www.kindertelefoon.nl), YooMagazine (www.Yoomagazine.net), Ciao, and ReachOut (www.reach-out.org).^{57–61} These interventions primarily focus on providing health education, problem-solving strategies, and sources where users could seek help. With the exception of one pre/post observational study.⁵⁸, these articles are surveys that outline modalities, describe frequencies of use, and display user satisfaction with the programs.^{57, 59–61} Half of the survey articles provide some form of social support, and one also utilizes a CBT-based game. In post-use surveys, the majority of interventions are ranked as either helpful or useful by users. The YooMagazine study design demonstrated that when offered a public health amenity, about a quarter of adolescents will engage it⁶¹. All the interventions demonstrated some evidence for the promotion of mental health seeking and users' satisfaction with information provided.^{58–61}.

The Kindertelefoon program was studied with a pre/post design.⁵⁸ Users who log on to the website are given the opportunity to interact with a trained health care volunteer via chat and an interactive forum. Intervention strategies were based upon providing children with an opportunity to express their emotions, problems, and situations as well as a space for problem solving. Each conversation has five elements: 1) establishing contact, 2) clarifying the child's story, 3) determining the goal of the conversation, 4) developing the goal of the conversation and 5) closing the conversation. Each volunteer has 40 hours of training and fifteen hours of supervision. In the study design, online chatters were compared to those who selected the traditional telephone-based chat service. In between-group comparisons, while the online chatters were had more severe levels of symptoms of mental disorders, outcome at follow-up did not differ. Users displayed moderate improvements between pre- and post-chat surveys in regard to perceived burden (ES= 0.46) and wellbeing (ES= 0.62). These effects appeared to continue through the one-month follow up (ES= 0.52 for both scales).⁵⁸

Free-standing websites, such as YooMagazine, are created to promote health literacy, foster early detection of mental health problems, and encourage help seeking among its users.⁶¹ The Internet site uses a magazine format with monthly focus articles, topical information sheets (based on existing public health materials), and a questions/response board. Adolescents pose questions that are answered by experts. The intervention was studied by enrolling 1775 students grades 7–12 who completed both baseline and follow-up surveys and who had access to the site over a 1-year period. Overall, 25.6% of respondents utilized the Internet site, recording a mean of 21.27 visits (SD=62.40), and posted a mean of 8.32 (SD=12.05) questions. Questions about relationships and sexuality comprised the majority (67%) while only a minority involved mental health (7%). Greater mental health symptoms predicted greater use of the Internet site. Students who visited the site were more likely to have visited a mental health specialist in the last year and to report a reduction in school-related worries than non-site users(61).

ReachOut! (www.reach-out.org) is a website with a multifaceted approach to improving adolescent mental health that aims to increase literacy, strengthen meaningful participation

and relationships, enhance skills that bolster resilience, and improve help seeking among youth⁶⁰. To accomplish this, ReachOut! uses 1) research related information prepared by youth volunteers, 2) an online community forum, 3) games based on CBT, 4) self-expression, 5) portable digital media (podcasts, short message service (SMS)), and 6) ReachOut Professional (information for health professionals about the program. ReachOut has had over seven million visitors.⁶⁰ A convenience sample of visitors to the site reported favorable ratings of knowledge and support for health seeking.

Ciao is a website that provides health and leisure information and the locations of medical and mental health providers. It allows users to ask questions of health professionals while remaining anonymous. During the year of publication, 4,382 questions were posted with 20% with regard to general health, 14% interpersonal relations, 10% substance abuse and 3% interpersonal violence. In a convenience survey of users, the great majority reported they would recommend it to a friend and 35% reported finding a useful address.⁵⁹

Ecological Context and Developmental Considerations

Child and Family Characteristics

Socio-demographics: Studies were conducted in many countries around the world. The greatest number of publications were from groups in Australia (9), followed by the United States (3). One article each came from the Netherlands, Switzerland, and Canada. Out of the 11 interventional trial studies, 8 out of 11 (72.7%) listed participants as primarily from middle- to upper-class families.^{44, 47–49, 51–53, 55–56} Health promotion survey articles did not provide information regarding user demographics. Many of the studies did not describe the ethnicity of participants, but the three that did indicated that 40% or more of their patient population was non-white.^{44, 49, 53} Three studies indicated high levels of children living with both parents (78.3%–85.0%).^{46, 51–52} Overall, information provided in these articles directs us to believe that the majority of interventions were tested in middle to upper class populations.

Ecological setting

Intervention and Internet sites were introduced in a variety of settings. Six interventions were introduced to young people at school. Four of the interventions, primarily the health promotion sites, were free-standing.^{58–61} Two studies combined home and primary care settings,^{44, 49} and two combined home and mental health specialist settings.^{51–52} One study was used only in a mental health care provider's office⁵⁷ as a supplement to regular treatment. For the most part, the school and primary care interventions were preventative while the mental health clinic models were for treatment. Free-standing programs tended to be public health amenities focused on mental health promotion.

A structured setting for introduction of the Internet intervention may increase participation and improve outcomes. For instance, in the randomized controlled trials testing the MoodGym program in schools, all participants at least logged on once (although only 30% to 40% of participants completed ≥ 3 out of 5 modules). Increased participation was associated with improved outcomes in one of the studies.^{46–48} Similarly, in a health care setting, the authors of Project CATCH-IT reported that between 77.5% and 90% of participants visited the site, and that those people spent between 98.40 and 143.70 minutes exploring it.^{44, 49} Additionally, MoodGym studies demonstrated different results for boys and girls depending on the peer setting. Outcomes for boys and girls varied by whether the program was introduced in a mixed or single gender school: boys had more favorable outcomes in mixed gender settings, while girls had more favorable outcomes in single gender settings.^{46–48} Another contextual influence might be pre-conditioning: specifically, whether or not there is also engagement with a medical professional. In the CATCH-IT

study, the combination of a primary care physician's motivational interview and an Internet program appeared to be superior to only receiving brief advice and an Internet program in increasing participation and preventing depressive episodes.⁴⁴

Internet Site and Development

Instructional models

Most of the programs included some form of CBT or other behavioral therapy and utilized a variety of learning strategies. The most commonly used approaches were interactive features such as homework, quizzes, or forums that were intended to engage participant interest. Fourteen interventions included some form of interactivity.^{44, 46–49, 51–54, 57–61} Eight interactive interventions included some form of quiz or homework.^{44, 46–49, 51–53} Seven programs required students to do problem solving exercises.^{44, 46–49, 51, 53} The Internet site developers incorporated learning experiences intended to appeal to children and adolescents including animation, peer forums and question and answer boards, and games. These learning experiences have not been extensively discussed in recent conceptual models (with the exception of gaming) for site development or motivation to use the same in adults as well as greater levels of supervision.^{21, 24, 62–63}

Support

Site navigation was addressed in a variety of ways. Some of the interventions directed users through the modules. This was achieved by either using a hard-coded program, or through the direct instruction of a mediating health care specialist. Three of the interventions provided direct chat contact with a health care provider,^{51–52, 54} while N= 6 were supervised via school class^{46–48, 50, 53, 55–56} and N=10 were supervised by an Internet or phone based therapist or social worker.^{44, 49–54, 58–60} Most intervention allowed for self-directive navigation (N= 8)^{44, 46–49, 60–61} while one has machine directed navigation.⁵¹

Safety

Given the sensitivity of child and adolescent psychiatry, it is not surprising that the majority of interventions included some form of support for users. While not all of the papers directly included information regarding safety and support, those that did not were school-based, and all of the school-based interventions were thought to be supervised by a school teacher. Some of the programs also included information on where to reach health professionals if necessary, and in some cases provided health surveys that were monitored for student distress.

Peer-to-Peer Interaction

Four programs provided a peer to peer forum for participants to ask questions, tell stories, and share positive ideas.^{53, 59–61} One of the studies included gaming aspects.⁶⁰ These forums allowed participants to ask questions and share stories and coping strategies with one another. The involvement of parents, family and even peers in building resiliency in children and youth is supported in both empirical and observational studies.^{64–67} However, there are many concerns related to exposure to self-harm, negative affective states, or pessimistic cognitions of other peers.^{68–69} One program developed volunteer monitors (REACHOUT) and is consistent with successful approaches employed adults.⁷⁰

Parent involvement

Five interventions included a parent component,^{44, 49, 51–53} with two of these including some form of parent-to-parent forum or Internet-based psychotherapy.^{53–54} Parent content focused primarily on mental health education. In addition, some of the programs provided

parents with coping strategies that could be used to assist children dealing with specific symptoms (i.e. relaxation exercises to reduce anxiety⁷¹ (Spence et al.)). Brunning (The Student Bodies Program) reported in her eating disorder intervention that parent score improvements did not impact their daughters' scores on clinical ratings.

Comparison with Adult Studies and Child Face-to-Face Psychotherapy

The fact that child and adolescent Internet interventions demonstrate small-to-moderate effect sizes is a new finding. The effect sizes for depression (0.20), anxiety (0.24), eating disorders (0.29), substance abuse (0.25), and all studies (0.23) health promotion (ES=0.42) tended to be modestly smaller than those observed in adult Internet studies (depression, ES=0.41), anxiety, (ES=0.93), substance abuse (ES=0.40), eating disorders (ES=0.10), and health promotion/psycho-education (ES=0.20).^{26, 29, 72-73} However, most of studies included an active control condition such as a health class or even another version of the Internet intervention. This is suggested by the somewhat larger effect size for pre/post (0.40) than for between groups for all clinical measures (ES=0.23). These differences in effect size could be explained by lack of appropriate educational and behavior change approaches for children and adolescents. For example, more engaging learning approaches suited to children may have larger effect sizes, as was demonstrated in a meta-analysis of media (video based) interventions for child behavior problems (ES=0.67).²⁵ Conversely, perhaps children and adolescents incorporate coping strategies more slowly into their emerging repertoires of response to external stressors than adults. The finding that effect sizes in this review are similar to face-to-face prevention intervention for depression (ES=0.26) and eating disorders (ES=0.26) suggests that the small effect sizes are characteristics of the current psychotherapy approaches, regardless of delivery, rather than of the Internet delivery mechanism.⁷⁴⁻⁷⁵ The NNT sizes for depression (9.88) and anxiety (26.36) were larger than their corresponding NNT values in face to face treatment (NNT= 7.1 and 3.0).⁷⁶

Summary

We conducted a review of the literature with regard to child and adolescent mental health intervention, from which we identified twenty unique publications (sixteen highlighted in table 1) and twelve separate interventions. These interventions encompassed depression, anxiety, substance abuse, eating disorders, and mental health promotion. Studies were very heterogeneous with a wide range of study designs and comparison groups creating some challenges in interpretation. However, modest evidence was found that Internet interventions demonstrated benefits compared to controls and pre-intervention symptom levels. Interventions had been developed for a range of settings, but tended to recruit middle-class participants of European ethnicity. Internet interventions demonstrated a range of approaches towards engaging children and incorporating parents and peers into the learning process.

Conclusions

Our systematic review can best be characterized as an exploration of an entirely new field that has largely been developed in the last decade. An important strength of this review is range of setting, disorders and types of interventions identified in this review and the use of semi-quantitative methods to compare studies with one another and our results with those of prior studies. However, the studies identified focused primarily on internalizing disorders and only one involved in externalizing disorders. The reader should consider the following limitations: 1) lack of attention to broader aspects of the ecological context of the child, 2) narrow scope developmentally in terms of modalities, age range and disorders, and 3) variable attention to elements like supervision that will be critical in integrating Internet programs into systems of care. Despite the unanswered questions regarding internet mental

health interventions for children and adolescents, a small body of literature is beginning to develop that supports its efficacy. While effect sizes in this study are small to moderate, that may be sufficient given their potential low cost and ease of distribution.

Future Directions

Increased attention to ecological context child development and intervention:

1. Increased use of primary settings to conduct Internet-based prevention research for mental disorders and mental health clinics to evaluate blended treatment approaches
2. Study designs that incorporate and evaluate contribution of family and peer participation, to outcomes.
3. Increasing diversity of study populations to encompass broader range of family and community contexts.

Expand the developmental range – modalities, age, and disorders

1. Study new delivery modalities such as gaming, virtual reality, and social media.
2. Develop and evaluate interventions across age range from infants to adolescents.
3. Develop and evaluate interventions for externalizing as well as internalizing disorders

Research to address integration of interventions into wider systems of care

1. Evaluation of the degree of professional supervision, including safety monitoring plans.
2. Improved study design that determine contribution to healthcare system including: a) control conditions such as treatment as usual, b) larger sample sizes to detect smaller effect sizes, and c) economic and cost effectiveness analyses
3. Exploration of economic costs and benefits in children and adolescents

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Figure 1.
Ecological and Developmental Model of Child Internet Mental Health Interventions

Table 1

Child and Adolescent Internet Interventions Content and Outcomes

Citation	Age/Gender	N	Study Type	Control	Setting/Goal	Content	Outcomes: Effect Size (95% CI)
Depression Studies							
O'Keamey et al. (2009); all female study; MoodGYM	15–16 years female: 100%	157	RCT	MoodGym vs. normal school health class	School/Prevention	CBT Education	CESD: ES=.18 (–0. to 0.50) ‡0.23 (–0.11 to 0.57) CESD: ES=0.11 (–.46 to 0.68) NNT (risk of depression)= 9.10
O'Keamey et al. (2006); all male study; MoodGYM	15–16 years male: 100%	78	RCT	MoodGym vs. normal school health class	Prevention, psychoeducation, treatment	CBT Education	CESD: total participants; ES=0.15 (0.03 to 0.26) ‡0.05 (–0.07 to 0.18) CESD: male participants; ES=0.40 (0.23 to 0.56) ‡0.21 (–0.07 to 0.18) RCMAS: total participants; ES=0.15 (0.03 to 0.26) ‡0.31 (0.18 to 0.43)
Calcar et al. (2009) MoodGYM	14.34 (0.75) female:55.9%	1477	RCT	MoodGym vs. normal school health class	Prevention, psychoeducation, treatment	CBT Education motivation for change	NNT (incidence of anxiety)=71.43 NNT (incidence of depression)= 14.93 CESD-10: ES=0.18 (–0.25 to 0.61) ‡0.54 (0.11 to 0.97) NNT (depressive episode)= 5.60
Van Voorhees et al. (2009); Project CATCH- IT	17.39 (2.04) female:56.6%	84	RCT	Motivational Interview vs. Brief Advice	Primary Care/Prevention	CBT IPT and BA motivational interview	

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Citation	Age/Gender	N	Study Type	Control	Setting/Goal	Content	Outcomes: Effect Size (95% CI)
Van Voorhees et al. (2008); Project CATCH- IT <i>Anxiety Studies</i>	17.44 (2.04) female:56.6%	84	RCT	Motivational interview vs. Brief Advice	Prevention	CBT IPT and BA motivational interview	Perceived social support: ES=0.20 (-0.39 to 0.77) #ES=0.76 (0.18 to 1.32)
March et al. (2009); BRAVE-online	9.45 (1.37) female:54.8%	73	RCT	BRAVE Program vs. wait-list	Treatment psychoeducation	CBT	CESD: ES=0.08 (-.43 to 0.59) #0.24 (-0.27 to 0.75) SCAS-C: ES=0.18 (-.34 to 0.69) #ES=0.91 (0.37 to 1.43) SCAS-P: ES=0.31 (-.20 to 0.82) #0.94 (0.40 to 1.46) NNT (remission of anxiety)= -5.08 RCMAS: ES=0.42 (-0.15 to 0.98) #0.78 (0.21 to 1.32) NNT (remission of anxiety)= -2.57 Knowledge: ES=0.36 Support seeking coping ES=0.02 Avoidant coping ES=.22 Total difficulties ES=0.16
Spence et al. (2006)	9.93 (1.74) female:41.7%	72	RCT	online intervention vs. wait list	Treatment psychoeducation	CBT Education	
Van Vliet and Andrews (2009); Climate Schools <i>Eating Disorder Studies</i>	13 years unknown	653	Clinical trial	Climate Schools vs. control schools	Treatment psychoeducation	Education	

Citation	Age/Gender	N	Study Type	Control	Setting/Goal	Content	Outcomes: Effect Size (95% CI)
Heinicke et al. (2007); My body, My life	14.4 (1.53) female:100%	83	RCT	Intervention vs wait list	Prevention	CBT motivation for change	EDI-Bulimia: ES=0.45 (0.02 to 0.91) $\neq$ 0.48 (0.01 to 0.95)
Brown et al. (2009) Student Bodies	15.1 (0.4) female:100%	153 Children	RCT	Intervention vs. normal health education	Prevention	Adult Ed, Child Ed CBT, Social-Support	EDI-Bulimia: ES=0.13 (-0.20 to 0.91) $\neq$ 0.10 (-.18 to 0.37)
		69 parents					Knowledge (Child) ES=0.64 (0.29-0.98) $\neq$ 0.93 (.63 to 1.21)
							PACS(Healthy Outlook); ES=0.29 (0.22 to 0.79) $\neq$ 0.74 .11 to 1.33)
Substance Abuse Studies							
Newton et al. (2009) Climate Schools	13.08 (0.58) female:40%	764	RCT	Online intervention vs. normal health class	Prevention Treatment Psychoeducation	Cannibus Alcohol education	Alcohol knowledge ES=0.78 (0.64 to 0.93) $\neq$ 0.79 (0.65 to 0.94)
							Weekly Alcohol Consumption 0.25 (0.11 to 0.39) $\neq$ 0.05 (-0.09 to 0.19)
Health Promotion							
Fukkink and Hermanns (2009); Kinder-telefoon	13.8 (2.0) female:80%	339	non-randomized trial	telephone chat- users	wellness promotion	problem-solving, Social-support	Well Being (chat vs. phone); ES= 0.15 (0.01 to 0.28) $\neq$ 0.63 (. 47 to .78)
							Perceived Burden; ES= 0.04 (-0.10 to

Citation	Age/Gender	N	Study Type	Control	Setting/Goal	Content	Outcomes: Effect Size (95% CI)
Santor et al. (2009) YouMagazine	grades 7–12 unknown	558	non-randomized trial	non-users of Internet program	Health Information	psychoeducation	0.17) [‡] 0.46 (0.30 to 0.60) Relative risk of visiting mental health specialist =2.19 (1.22 to 3.92) >1,000 logins in 1 year >7,000,000 logins since 1998 After visiting Reach Out, 38% of people contact a mental health professional
Nicholas (2010); Reach Out website	ages 16–25 unknown	1,016	convenience sample, Survey/Description	none	Prevention Treatment Education	Education, CBT, Gaming, social support	83% of users felt satisfied with the content
Michaud and Colombe (2009); "Ciao" website	13–18 63% female	257	convenience sample, Survey/Description	none	Treatment Education	Education, Professional, interaction forum	

[‡] indicates pre/post effect size (as compared to between group effect sizes). ES = effect size. NNT = number needed to treat. CESD = Center for Epidemiological Studies Depression Scale. RCMAS = Revised Children's Manifest Anxiety Scale. EDI = Eating Disorder Inventory. CBT = Cognitive Behavioral Therapy.