Article

Randomized Clinical Trial of Primary Care Based Online Depression Prevention Intervention: Impact on Adolescent Modifiable Factors and Behaviors

Kushagra B. Gupta [1], Calvin Rusiewski [1], Camilla Koczara [2], Marian Fitzgibbon [1,3,4], Mark Reinecke [5], Joshua Fogel [1,6], Linda Schiffer [3], Miae Lee [1], Emily Sykes [1], Kathy Griffiths [7], Tracy R. G. Gladstone [8] and Benjamin W. Van Voorhees [1,*]

[1] Department of Pediatrics, College of Medicine, University of Illinois at Chicago, Chicago, IL 60612, USA; kgupta22@uic.edu (K.B.G.); crusiew2@uic.edu (C.R.); mlf@uic.edu (M.F.); jfogel@uic.edu (J.F.); mlee9@uic.edu (M.L.); eesykes2@uic.edu (E.S.)
[2] Carver College of Medicine, University of Iowa, Iowa City, IA 52242, USA; ckoczara@wellesley.edu
[3] Institute for Health Research and Policy, School of Public Health, University of Illinois at Chicago, Chicago, IL 60608, USA; lschiff@uic.edu
[4] University of Illinois Cancer Center, University of Illinois at Chicago, Chicago, IL 60612, USA
[5] Feinberg School of Medicine, Northwestern University, Chicago, IL 60611, USA; m-reinecke@northwestern.edu
[6] Department of Business Management, Brooklyn College, Brooklyn, NY 11210, USA
[7] Research School of Psychology, College of Health & Medicine, The Australian National University, Canberra 2601, Australia; kathy.griffiths@anu.edu.au
[8] The Robert S. and Grace W. Stone Primary Prevention Initiatives, Wellesley Centers for Women, Wellesley College, Wellesley, MA 02481, USA; tgladsto@wellesley.edu
[*] Correspondence: bvanvoor@uic.edu

Abstract: The developmental period of adolescence can pose a risk for the onset of depressive disorders, but is also a time when potentially modifiable factors and behaviors related to depressive episode onset can develop. An online health intervention can provide an opportunity to reach at-risk adolescents in between primary care visits and could impact these modifiable factors and behaviors to support healthy development. We explore the Competent Adulthood Transition with Cognitive-Behavioral, Humanistic, and Interpersonal Therapy (CATCH-IT), a self-directed online cognitive behavioral therapy prevention intervention, and its impact on modifiable factors and behaviors related to: (1) program completion, (2) normative adolescent development, (3) coping, (4) family relations, (5) general health behaviors, and (6) externalizing behaviors, in a primary care sample of adolescents at intermediate to high risk of developing depression. Adolescents were enrolled into either CATCH-IT or Health Education (HE) control group and followed for 24 months. CATCH-IT improved some factors related to program completion (e.g., motivation, recommendation to peers for depression prevention, and physician positive relationship), coping (e.g., perceived behavior change), and family relations (e.g., parental psychological control, sibling relative status) as compared to HE. HE improved normative adolescent development (e.g., health and loss life events) as compared to CATCH-IT. CATCH-IT utilized in primary care may benefit some at-risk adolescents in selective factors and behaviors.

Keywords: adolescents; prevention and control; primary health care; depression; clinical trial

1. Introduction

During adolescence, many long-term lifestyle habits develop, and risk factors and health behaviors related to many chronic diseases are established (Lynch and Smith 2005; Birmaher et al. 1996a). Altering potentially modifiable factors and encouraging behavioral change to prevent disease may prevent long-term morbidity and impairment. The vast majority of mental, emotional, and behavioral disorders (MEB) initially occur before age 24

with a 20% annual incidence (O'Connell et al. 2009). Regarding adolescent depression, 20% of individuals will experience major depression by early adulthood (Rushton et al. 2002; Lewinsohn et al. 1993, 1998) and 5–10% will experience adolescent subthreshold depression (Birmaher et al. 2007). While the impact of depressive episodes on the life course makes primary care based prevention a health policy priority, the complexity and challenge of fielding feasible and efficacious interventions (e.g., that change modifiable risk factors) in this environment has been daunting (Van Voorhees et al. 2011).

Adolescent depression affects the developmental trajectory (Lewinsohn et al. 1999; Weissman et al. 1999; Birmaher et al. 1996b) and creates substantial risk for reoccurring depressive episodes (Georgiades et al. 2006; Lewinsohn et al. 1999; Klein et al. 2005; Pine et al. 1998; Hankin 2006). Many depression prevention interventions focus on ameliorating factors related to "cognitive" or "interpersonal behaviors" that closely track with psychotherapy theories (Van Voorhees et al. 2015). Community based depression prevention interventions research by our group and others has identified and assessed instruments to measure a wide range of potentially modifiable factors and behaviors across six domains, including those impacting: (1) program completion (motivation, physician relationship, attitudes toward the intervention), (2) normative adolescent development (quality of life, social adjustment, life events), (3) coping (perceived benefits of behavioral principles, hopelessness), (4) family relations (family relationships, parental mood), (5) general health behaviors (internet use, physical and social activity, body mass index (BMI)), and (6) externalizing behaviors (substance use, oppositional defiant activities) (Lewinsohn et al. 1994, 1995, 1997; Liu 2002; Hollon et al. 1990; Booth et al. 2008; Van Voorhees et al. 2008a, 2008b, 2008c; Paunesku et al. 2008; Gladstone and Kaslow 1995; Gottlieb et al. 2016).

Health systems and government institutes are interested in reducing the costs of preventable MEB (Bardach et al. 2014; van Zoonen et al. 2014). They are also interested in switching from the current "wait until sick enough for treatment" model to a preventative model for major and minor depressive episodes (MmDE) (Weisz et al. 2005; van Zoonen et al. 2014). However, there are currently no health system models to prevent adolescent MmDE (Weisz et al. 2005). The screen, brief intervention, referral, and treatment intervention (SBIRT) model has been evaluated extensively in primary care as a method to address multiple health risk factors or health related behaviors in adults and children (Madras et al. 2009; Sterling et al. 2019). However, SBIRT and primary care based counseling is time consuming, expensive, and may not reach sufficient numbers of at-risk adolescents (Moreno-Peral et al. 2015; Rubio-Valera et al. 2014).

One method to reduce this implementation burden while still retaining the SBIRT model is to use self-directed information and communication technology interventions in primary care (Ritterband et al. 2009; Mohr et al. 2011; Durlak and DuPre 2008). We developed a "technology-based behavioral vaccine," the Competent Adulthood Transition with Cognitive-Behavioral, Humanistic, and Interpersonal Therapy (CATCH-IT), to address this need (Embry 2002; Van Voorhees et al. 2011, 2015; Gladstone et al. 2015). CATCH-IT is based on behavioral activation, cognitive behavioral psychotherapy, interpersonal psychotherapy, and motivational interviewing (Gladstone et al. 2015; Van Voorhees et al. 2015). It considers key barriers in primary care preventative mental health and is mostly delivered through the internet (Gladstone et al. 2015; Van Voorhees et al. 2015). Prior publications for this clinical trial of CATCH-IT demonstrated reduced depressed episodes in moderated results with hopelessness, family relationships, and depressed mood, (Van Voorhees et al. 2020), and reduced internalizing symptoms when moderated by positive relationships in primary care, parental depression, and adolescent externalizing symptoms (Gladstone et al. 2020).

To our knowledge, this study is the first to measure a full range of potentially modifiable factors and behaviors in a technology-based depression prevention intervention applied in a medical setting with a real-world SBIRT protocol consisting of large-scale primary care screening, identification of at-risk adolescents, and preventative intervention referral. This clinical trial compares the impact of the CATCH-IT intervention over

24 months to an attention control, health education (HE), on potentially modifiable factors and behaviors across six domains of (1) program completion (motivation, physician relationship, attitudes toward the intervention), (2) normative adolescent development (quality of life, social adjustment, life events), (3) coping (perceived benefits of behavioral principles, hopelessness), (4) family relations (family relationships, parental mood), (5) general health behaviors (internet use, physical and social activity, BMI), and (6) externalizing behaviors (substance use, oppositional defiant activities). We hypothesize that CATCH-IT in comparison to HE would improve modifiable factors related to program completion, coping, and family relations, which were a focus of the CATCH-IT intervention (Hypothesis 1). We hypothesize that HE in comparison to CATCH-IT would improve general health behaviors (Hypothesis 2). An exploratory hypothesis was whether either intervention would impact normative adolescent development and externalizing behaviors, which were not the focus of either CATCH-IT or HE (Hypothesis 3).

2. Materials and Methods

2.1. Study Design and Setting

We conducted a phase three randomized clinical trial (RCT) to test the effectiveness of CATCH-IT in targeting modifiable factors and behaviors to prevent the onset of adolescent depression in an intermediate to high-risk primary care sample. Adolescents aged 13–18 years old and their parent were recruited. Both interventions were in English, and understanding English was an inclusion criteria (not understanding English is an exclusion criteria). Adolescents with subthreshold depression symptoms or history of depression were included, and those with a current depression diagnosis or receiving treatment for depression were excluded. Adolescents provided informed assent, and parents provided informed consent for their teen and themselves (18-year-old adolescents provided informed consent for themselves). Adolescents were randomized into CATCH-IT or HE, and outcomes of mood and modifiable factors and behaviors were measured at 2, 6, 12, 18, and 24 months after enrollment. The sample included adolescents with either current elevated depressive symptoms (60%) or known history of a major depressive episode (MDE) (12%) or both (28%). The targeted enrollment goal was 400 adolescents: 200 from Chicago sites and 200 from Boston sites. Figure 1 describes the overall participant enrollment of 193 participants for CATCH-IT and 176 participants for HE. The study design and implementation approach have been previously published (Gladstone et al. 2015; Van Voorhees et al. 2009a, 2015; Marko et al. 2010; Iloabachie et al. 2011).

2.2. CATCH-IT Intervention

The CATCH-IT intervention included a self-directed component, delivered separately through the internet for both the adolescent and parent, and a motivational interviewing (MI) component delivered over the phone. The self-directed component consisted of 14 modules to be completed by the adolescent and 4 by the parent. The MI component was comprised of the interviews themselves, administered at baseline, 2, and 12 months post-enrollment, and between 1 and 3 coaching calls (Miller and Rollnick 1991). The coaching calls were attempted at 1 month into the study in Chicago, and 2 and 4 weeks, and 18 months into the study in Boston. Also, up to 3 "check-in" calls were attempted during weeks 1–3, lasting an estimated 5 minutes, and were meant to ensure that the participants were able to access the online components of the intervention. The therapeutic methodology of this third version of CATCH-IT has been published (Gladstone et al. 2015; Van Voorhees et al. 2015).
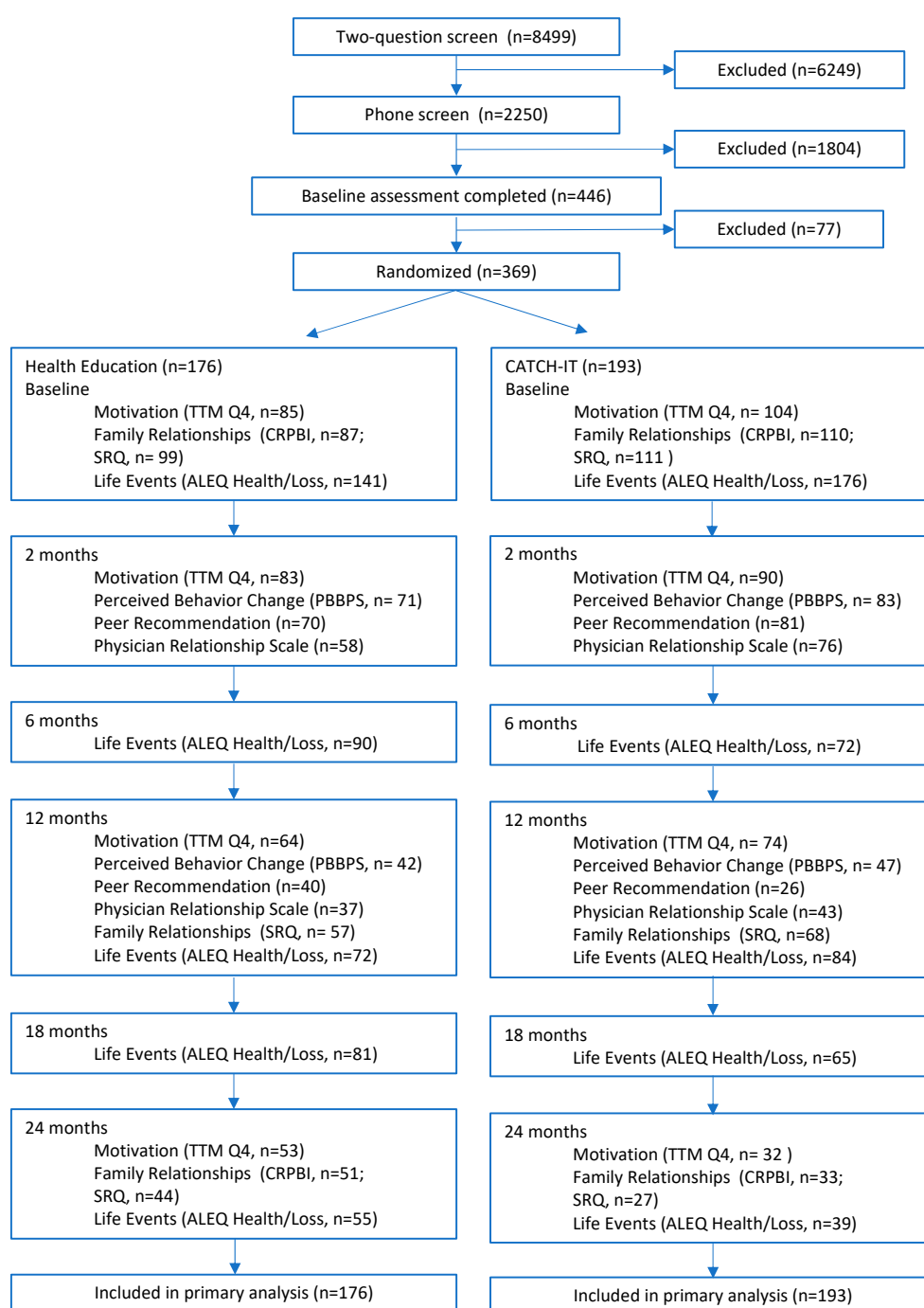
Figure 1. Consort Diagram. Note: TTM Q4 = Trans-Theoretical Model Question 4, CRPBI = Children's Report of Parent Behavior Inventory, SRQ = Sibling Relationships Questionnaire (SRQ), PBBPS = Perceived Benefits of Behavioral Principles, and ALEQ = Adolescent Life Events Questionnaire.

2.3. Health Education Intervention

The HE intervention was developed from the HealthWatch website, originally developed as an internet-based attention control for the ANU WellBeing study (Griffiths et al. 2010; Gladstone et al. 2015). The HE intervention was comprised of 14 modules based on the 12 modules of the HealthWatch website that were completed by the adolescent. Each module had a first component of probing questions and a second component that introduced well-being topics. Material was chosen so that little contained any information about interventions for mental health disorders. Additionally, the HE intervention also

included up to 3 check-in calls (weeks 1–3) and 4 modules to be completed by the parent, which included similar adolescent health information. It did not include an MI component.

2.4. Intervention Shared Elements

Both interventions utilized a SIBRT model and were consistent with 9 sequential areas of the Guidelines for Adolescent Depression in Primary Care (GLAD-PC), which are closely related to the Chronic Care Model (Zuckerbrot et al. 2018).

2.5. Measures

Demographic information was self-reported at baseline and follow-up assessment points to be utilized in the statistical analysis of outcomes. Information collected was baseline age (years), sex (male/female), race (white, non-white), ethnicity (Hispanic, non-Hispanic), and clinical site (Chicago, Boston).

2.6. Outcomes

(1) Modifiable factors related to program completion were the Trans-Theoretical Model (TTM) Scale, the Theory of Planned Behavior (TPB) Scale, the Physician Relationship Scale, depressed peer recommendation, satisfaction, and usefulness items. (2) Modifiable factors related to normative adolescent development were the Social Adjustment Scale (SAS-SR), Quality of Life (WHOQOL-BREF), and the Adolescent Life Events Questionnaire (ALEQ). (3) Modifiable factors related to coping were the Perceived Benefits of Behavioral Principles Scale (PBBPS) and the Beck Hopelessness Scale (BHS). (4) Modifiable factors related to family relations were the Conflict Behavior Questionnaire (CBQ), the Children's Report of Parent Behavior Inventory (CRPBI), the Sibling Relationships Questionnaire (SRQ), the Sibling Differential Experience (SIDE), and the Center for Epidemiological Studies-Depression Scale (CES-D$_{10}$). (5) Modifiable factors related to general health behaviors were the Teen Behavior Questionnaire (TBS) and body mass index. (6) Modifiable factors related to externalizing behaviors were the Disruptive Behaviors Disorder Scale (DBD) and the drugs and alcohol screening instrument, the CRAFT (Car, Relax, Alone, Forget, Friends, Trouble). Table 1 summarizes these outcome measures.

Table 1. Description of Outcome Measures.

Domain	Measure	Description	Sample Item
1. Modifiable Factors Related to Program Completion	Trans-Theoretical Model	A 3-item (plus a fourth separate item) self-report of motivation that measures self-efficacy and intention to change risk-factor behaviors before, during, and after the intervention. The standard motivation measure approach described by Miller and Rollnick (Miller and Rollnick 1991) was adapted for our study. A higher score indicates a higher ranking on three items assessing importance, ability, or readiness to reduce depression risk on a 10-point Likert scale ranging from 1 = not important to 10 = very important, which are reported together as the scale. The fourth item assessing stage of change asked adolescents about their current position on reducing depression risk (ranging from precontemplation to decision, with plan) and is analyzed separately. Measures were taken at baseline and 2, 12, and 24 months.	Rate the importance of preventing/stopping an episode of clinical depression over the next two weeks. Question 4: Please click the bubble next to the one statement that best fits your current position with regard to changing the way you think about and solve everyday problems to reduce /lower your risk of developing clinical depression (severe enough to need a treatment).
	Theory of Planned Behavior	A 19-item self-report on motivation utilizing a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree, with higher scores indicating stronger agreement with positive attitudes toward subthreshold depression intervention participation. Measures were taken at baseline and 12 and 24 months (Armitage and Conner 2001).	I believe going through an online program like this one would help me be healthy.
	Physician Relationship Scale	A 9 question self-report, which rates the adolescent's relationship with their primary care provider in the following areas: understanding, engagement, helpfulness, comfort, and trust, reported on a 5 point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree (Van Voorhees et al. 2009b).	I am more likely to change behaviors or thought patterns because of the interview with the primary care provider.
	Satisfaction, Usefulness, and Peer Recommendation	Adolescents responded to six items about satisfaction, usefulness, and recommendation for peers who may become depressed regarding the intervention on a 10 point Likert scale ranging from 1 = very unsatisfied to 10 = very satisfied, with higher scores being more positive.	I would recommend this program to a friend who could develop depression.
2. Modifiable Factors Related to Adolescent Development	Social Adjustment Scale	A 36-item self-report with higher scores indicating worse social functioning on a Likert scale ranging from 1 = never or none to 5 = always or all or vice versa depending on the question. Measures were taken at baseline and at 12 and 24 months (Weissman et al. 1978).	How many days of classes did you miss in the last 2 weeks?
	Quality of Life	A self-report of 26 total items regarding overall health (2 items, scored 0–100, on a Likert scale of 1 = very poor or dissatisfied to 5 = very good or satisfied) and four domains scored 0–100 generally on a Likert scale ranging from 1 = not at all or very dissatisfied or very poor or never to 5 = completely or very satisfied or very good or always: physical health (7 items), psychological (6 items scored), social relationships (3 items), and environment (8 items). Measures were taken at baseline and 6, 12, and 24 months (Group 1998).	How satisfied are you with your health?
	Adolescent Life Events Questionnaire	A six-month retrospective self-report scored in a range of 0–51 and includes seven subscales of specific groups of life events scored on a range from 0–9 using yes/no questions, with higher scores indicating more life events. Measures were taken at baseline and 2, 6, 12, 18, and 24 months (Hankin and Abramson 2002).	You were seriously ill or injured, hospitalized, or had surgery.
3. Modifiable Factors Related to Coping	Perceived Benefits of Behavioral Principles	Adolescents were asked to respond to 10 items about perceived behavior-related cognitive skill acquisition or perceived behavior modification due to a lesson relating to the core content of CATCH-IT based on either cognitive behavioral therapy (CBT), behavioral activation (BA), or interpersonal therapy (IPT). Higher scores on the 10 point Likert scale (1 = very unhelpful to 10 = extremely helpful) represented a stronger perceived benefit of a given type of therapy. The scale was created by Zubinski et al. assessing an eating disorder technology intervention (Zabinski et al. 2001) and the items were rephrased by Van Voorhees et al. to apply to CATCH-IT (referred to as sociocultural relevance scale in protocol paper) (Gladstone et al. 2015; Van Voorhees et al. 2015). Measures were taken at 2 and 12 months (Gladstone et al. 2015; Van Voorhees et al. 2015).	The program has helped me challenge negative thought patterns about everyday situation and problems.
	Beck Hopelessness Scale	A self-report on a scale of 0–20 utilizing 20 true or false items, with higher scores indicating increased hopelessness. Administered at baseline and at 2, 6, 18, and 24 months (Beck et al. 1974).	I look forward to the future with hope and enthusiasm.

Table 1. *Cont.*

Domain	Measure	Description	Sample Item
4. Modifiable Factors Related to Family Relations	Conflict Behavior Questionnaire	A self-report of conflict with mother or father, with a higher score indicating increased conflict on a scale of 0–20. Adolescents responded to 40 true or false questions. Measures were taken at baseline and 6 and 18 months (Prinz et al. 1979).	At least three times a week, my father and I get angry at each other.
	Children's Report of Parent Behavior Inventory	A self-report by adolescents and parents where higher scores indicate increased acceptance, psychological control, and monitoring by the mother or father. Participants responded to 15 items on a 3 point Likert scale with options being 1 = not like him/her, 2 = somewhat like him/her, or 3 = a lot like him/her at baseline and 24 months (Schaefer 1965).	Makes me feel better after talking over my worries with him.
	Sibling Relationships Questionnaire	A self-report of relationship with sibling in four domains, with higher scores indicating increased warmth/closeness (scored 1–5), relative status/power (scored −4 to 4), conflict (scored 1–5), and rivalry (scored 0–2) (Buhrmester and Furman 1990). Measures were taken at baseline, 12 and 24 months.	Who usually gets treated better by your mother, you or this sibling?
	The Sibling Differential Experience	A self-report of relative relationship with parent in comparison to sibling in affection and control by mother or father, with higher scores indicating a greater difference between participant and sibling. Participants responded to 18 items on a Likert scale of 1 = In general, this parent has been much more this way toward my sibling than me to 5 = in general, this parent has been much more this way toward me than my sibling. Measures were taken at baseline and at 24 months (Daniels and Plomin 1985).	Mother has been strict with us.
	Center for Epidemiological Studies-Depression Scale (CES-D$_{10}$).	The CES-D$_{10}$ is a seven-day self-report (or administered over the phone) of depressive symptoms with 20 items on a 4-point Likert scale ranging from 0 = rarely or none of the time to 3 = most or all of the time. Higher scores indicate increased symptoms on a score range of 0–30 (Radloff 1991). Measures from adolescents and parents were taken at baseline and at 2, 6, 12, 18, and 24 months.	During the past week I was bothered by things that usually don't bother me.
5. Modifiable Factors Related to General Health Behaviors	Teen Behavior Questionnaire	A self-report questionnaire, with questions about diet, exercise, religion, and internet use. The questionnaire uses a variety of formats, some open ended, some no/yes, and some Likert scales (Gladstone et al. 2015; Van Voorhees et al. 2015). We identified the items used in the questionnaire by conducting a series of analyses using the National Longitudinal Study of Adolescent Health data set to examine the relationship between various reported behaviors at baseline and likelihood of experiencing a depressive episode at one-year follow-up (Booth et al. 2008; Van Voorhees et al. 2008b). These items have been previously reported by our group in relationship to depression risk (Booth et al. 2008; Van Voorhees et al. 2008b). Measures were taken at baseline and 2 and 12 months. Physical activity was assessed by asking adolescents how frequently they engaged in certain exercises (team sport, weightlifting, yoga, or others) over the previous week, in terms of both number of sessions and total minutes spent exercising. Adolescents selected activities and provided text answers. Religious activity was assessed via an open-ended question, while frequency of prayer or attendance at religious services was assessed via a Likert scale (5-point scale for prayer, from 1 = never to 5 = at least once a day, and a 4 point scale for religious service attendance and attendance at special activities at place of worship, from 1 = never to 4 = at least once a week. Diet was assessed by asking adolescents to responded to 9 items of dietary preferences: on a 6 point Likert scale ranging from 1 = less than once a month to 6 = more than 2 times a week for eating fish and yes/no items on willing to eat applesauce, pudding, yogurt, milk, apple juice, mango juice, orange juice, takes omega-3 fatty acids fish oil supplements. Internet use and media use was assessed via a self-report of number of internet activities adolescents engaged in the past week (six options provided, scored on a scale 0–6) and mental health website use was assessed via a self-report of number of websites adolescents visited (six options provided, scored on a scale 0–6).	Did you engage in any of the following activities during the past week? If yes please check the box and indicate the number of times and how many total minutes spent on each activity.
	Body Mass Index	BMI was calculated from self-reported height and weight at baseline, 2, 6, 12, and at 24 months.	Self-reported height and weight.
6. Modifiable factors related to externalizing disorders	Disruptive Behaviors Disorder Scale	A self-report by the adolescent and parent regarding the adolescent measuring the level of adolescent's behavioral problems. Adolescents answered 41 questions on a Likert scale ranging from 1 = not at all to 5 = very much. Measures were taken at baseline and at 6, 12, and 24 months (Pelham et al. 1992).	Often loses temper.
	The CRAFT	The CRAFT measures drug use using 6 yes or no items regarding context and family/friend concern to detect substance use disorders in adolescents. Measures were taken at baseline and at 2, 6, 12, and 24 months (Knight et al. 1999, 2002).	Have you used alcohol or drugs to relax, feel better about yourself, or to fit in?

3. Analysis

Descriptive statistics of mean and standard deviation were used for the continuous variables. Frequency and percentage were used for the categorical variables. Inferential statistics of the chi-square test for trend were used for categorical variables. The *t*-test for independent samples was used for continuous variables. All linear effects mixed growth models were adjusted for baseline age, sex, race (white or non-white), ethnicity (Hispanic or non-Hispanic), and clinical site. To examine group differences in change over time in CES-D$_{10}$ scores, a random intercept and slope linear mixed effect growth model was utilized and, to improve linearity, was conducted with and without a square root transformation of the time scale. Simple slopes were used to estimate within-group changes (the estimated slope was multiplied by 24, or square root of 24 in the time-transformed model, to calculate 24 months adjusted mean change). To test for significant differences between CATCH-IT and HE slopes, the group*time interaction *p*-value was used. All p-values were two tailed with alpha for significance at $p < 0.05$. The Software used was SAS v 9.4.

4. Results

Sample. A diverse primary care sample of N = 369 adolescents (68% female, 43% non-Hispanic white) aged 13–18 years old (mean = 15.4 years SD = 1.5 years) was recruited and randomized into CATCH-IT (N = 193) and HE (N = 176). There was no difference between groups in depressive episodes at 24 months, and the sample had a low incidence of depressive episodes at two years of follow-up (4.6% per year for CATCH-IT (Van Voorhees et al. 2020), and 5.8% per year for HE (Van Voorhees et al. 2020), versus 9.2% for the general population (Rushton et al. 2002). Submitting baseline data was not required for participants to receive either intervention, and a number of participants did not complete baseline assessments (Figure 1).

Modifiable factors related to program completion. For the Trans-Theoretical Model (TTM), analyzing the separate TTM Question Four (stage of change, Table 2), there was a statistically significant ($p = 0.02$) difference in responses between the CATCH-IT and HE groups at 12 months. The largest percentage of participants in CATCH-IT fell into the contemplation stage (27%), followed by the decision, no plan (21.6%), and the decision with plan (21.6%) stage. HE showed the largest percentage of participants in the precontemplation (28.1%), contemplation (26.6%), and decision no plan (17.2%) stages. A trend was difficult to establish in both groups. The TTM Scale, measuring self-efficacy and intention to assess motivation, did not significantly differ between the CATCH-IT and HE groups (data not shown).

The TPB Scale, measuring attitudes towards participation to assess motivation, showed no statistically significant difference between the CATCH-IT and HE groups (data not shown). For the Physician Relationship Scale, the positive relationships in primary care metric (Table 2) showed a statistically significant ($p = 0.02$) mean difference between CATCH-IT and HE at 12 months with a higher score for CATCH-IT. No differences occurred at 2 months. Regarding peer recommendation (Table 2), there was a statistically significant mean difference between CATCH-IT and HE in recommendation for peers who may become depressed at 12 months ($p = 0.02$) with a higher score for CATCH-IT. No differences occurred at 2 months. Usefulness and satisfaction did not significantly differ between the groups (data not shown).

Table 2. Program Completion Comparisons: Trans-Theoretical Model Question 4 (Intention, Current Position on Reducing Risk), Physician Relationship Scale, and Peer Recommendation.

	CATCH-IT (N = 193)			HE (N = 176)			
	Total N	**N**	**%**	**Total N**	**N**	**%**	***p*-Value [a]**
Trans-Theoretical Model Question 4							
Baseline	104			85			0.19
Precontemplation		25	(24.0%)		17	(20.0%)	
Contemplation		33	(31.7%)		23	(27.1%)	
Preparation		27	(26.0%)		21	(24.7%)	
Decision, no plan		13	(12.5%)		19	(22.4%)	
Decision with plan		6	(5.8%)		5	(5.9%)	
2 months	90			83			0.47
Precontemplation		7	(7.8%)		12	(14.5%)	
Contemplation		24	(26.7%)		25	(30.1%)	
Preparation		23	(25.6%)		16	(19.3%)	
Decision, no plan		26	(28.9%)		15	(18.1%)	
Decision with plan		10	(11.1%)		15	(18.1%)	
12 months	74			64			0.02
Precontemplation		8	(10.8%)		18	(28.1%)	
Contemplation		20	(27.0%)		17	(26.6%)	
Preparation		14	(18.9%)		10	(15.6%)	
Decision, no plan		16	(21.6%)		11	(17.2%)	
Decision with plan		16	(21.6%)		8	(12.5%)	
24 months	32			53			0.61
Precontemplation		7	(21.9%)		12	(22.6%)	
Contemplation		8	(25.0%)		17	(32.1%)	
Preparation		9	(28.1%)		10	(18.9%)	
Decision, no plan		4	(12.5%)		11	(20.8%)	
Decision with plan		4	(12.5%)		3	(5.7%)	
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	***p*-Value [b]**
Physician Relationship Scale (1–5) [c]							
2 months	76	4.0	(0.7)	58	3.9	(0.9)	0.28
12 months	43	4.2	(0.6)	37	3.8	(0.7)	0.02
Would recommend to friend who could develop depression (1–10) [d]							
2 months	81	7.8	(2.4)	70	7.7	(2.4)	0.85
12 months	26	8.3	(2.3)	40	7.0	(2.1)	0.02

[a] From Cochran-Mantel-Haenszel test for differences in row mean scores. [b] From *t*-tests with pooled variance for difference between groups at each visit. [c] Higher scores are more positive. [d] Seven-item scale; higher scores are more positive.

Modifiable Factors Related to Normative Adolescent Development. The SAS-SR and QHOQOL-BREF each did not significantly differ between the groups (data not shown). The ALEQ health and loss subscale (Table 3) showed a statistically significant difference between the slopes of CATCH-IT and HE through 24 months ($p = 0.03$), with fewer health and loss events in the HE group, and a statistically significant decrease in the slopes of both CATCH-IT ($p < 0.001$) and HE ($p < 0.001$). The ALEQ total score and other ALEQ subscales did not significantly differ between the groups. There was a pattern of a statistically significant decrease in the slopes of both CATCH-IT and HE for total score and all subscales except for moves and changes for CATCH-IT and other for both CATCH-IT and HE.

Table 3. Normative Adolescent Development Comparisons: Adolescent Life Events Questionnaire.

	Unadjusted Means						Within-Group Slopes [a]				Between-Group Slope Difference *p*-Value [a]
	CATCH-IT (N = 193)			Health Ed (N = 176)			CATCH-IT		Health Ed		
	N	Mean	SD	N	Mean	SD	b	*p*-Value [a]	b	*p*-Value [a]	*p*-Value [a]
Adolescents Life Events Questionnaire (ALEQ) [b]											
LEQ total score (0–51)							−0.122	<0.001	−0.158	<0.001	0.25
Baseline	168	8.1	(5.8)	134	8.2	(5.7)					
6 months	69	4.5	(3.8)	90	5.5	(6.1)					
12 months	82	4.7	(4.5)	70	3.7	(4.6)					
18 months	65	4.9	(4.6)	81	4.6	(4.7)					
24 months	39	4.9	(5.4)	54	3.9	(4.6)					
Health and loss (0–9)							−0.038	<0.001	−0.067	<0.001	0.03
Baseline	176	2.6	(2.1)	141	2.9	(2.1)					
6 months	72	1.8	(1.9)	90	1.9	(2.1)					
12 months	84	1.7	(1.9)	72	1.3	(1.5)					
18 months	65	1.7	(1.8)	81	1.4	(1.7)					
24 months	39	1.7	(2.2)	55	1.1	(1.7)					
Arguments or conflicts (0–9)							−0.041	<0.001	−0.033	<0.001	0.51
Baseline	174	2.3	(1.8)	140	2.3	(1.9)					
6 months	70	1.3	(1.5)	88	1.5	(1.9)					
12 months	83	1.3	(1.8)	72	0.8	(1.3)					
18 months	65	1.4	(1.7)	81	1.5	(1.8)					
24 months	39	1.2	(1.7)	55	1.2	(1.6)					
Moves and changes (0–6)							−0.010	0.06	−0.020	<0.001	0.16
Baseline	173	0.6	(1.0)	140	0.7	(1.1)					
6 months	70	0.3	(0.6)	89	0.4	(0.9)					
12 months	83	0.4	(0.7)	70	0.3	(0.7)					
18 months	65	0.3	(0.7)	81	0.3	(0.6)					
24 months	39	0.4	(0.8)	54	0.2	(0.6)					
School and job (0–9)							−0.013	0.02	−0.017	0.002	0.62
Baseline	169	0.9	(1.1)	136	1.0	(1.1)					
6 months	69	0.5	(0.9)	89	0.6	(0.9)					
12 months	82	0.5	(0.8)	70	0.6	(1.0)					
18 months	65	0.6	(1.0)	80	0.6	(1.0)					
24 months	39	0.6	(0.9)	54	0.6	(0.9)					
Finances/money (0–4)							−0.010	0.02	−0.009	0.03	0.89
Baseline	168	0.8	(1.1)	134	0.7	(1.0)					
6 months	69	0.3	(0.7)	90	0.4	(0.8)					
12 months	82	0.5	(0.9)	70	0.3	(0.8)					
18 months	65	0.4	(0.8)	81	0.4	(0.9)					
24 months	39	0.5	(0.9)	54	0.3	(0.8)					
Crime and legal issues (0–8)							−0.015	<0.001	−0.018	<0.001	0.69
Baseline	168	0.7	(1.3)	133	0.6	(1.2)					
6 months	70	0.2	(0.6)	90	0.5	(1.1)					
12 months	82	0.2	(0.6)	72	0.2	(0.5)					
18 months	65	0.3	(0.7)	81	0.2	(0.7)					
24 months	39	0.4	(0.7)	54	0.2	(0.7)					
Other (0–6)							0.001	0.68	−0.001	0.56	0.48
Baseline	169	0.2	(0.5)	135	0.2	(0.4)					
6 months	71	0.1	(0.3)	90	0.2	(0.5)					
12 months	81	0.1	(0.4)	72	0.2	(0.5)					
18 months	64	0.2	(0.4)	81	0.2	(0.5)					
24 months	39	0.2	(0.4)	54	0.1	(0.4)					

[a] From linear mixed effect growth models with random intercept and slope, adjusted for sex, ethnicity (Hispanic, non-Hispanic), race (white, non-white), baseline age, site, and baseline teen CES-D$_{10}$. Within-group estimated slopes and p-values are from estimates of simple slopes. The *p*-value for the visit*time interaction is used to test for a significant difference between slopes. Unadjusted means represent raw arithmetic means without any statistical adjustments. Within-group slopes represent estimated slopes (change over time) for CATCH-IT and HE from the growth curve models. [b] Higher scores indicate more events.

Modifiable Factors Related to Coping. The PBBPS (Table 4) showed a statistically significant mean difference between CATCH-IT and HE at 2 months (*p* = 0.008) and 12 months (*p* = 0.003) with higher scores for CATCH-IT. There was a statistically significant between-group mean difference in the BA subscale (2 months, *p* = 0.005; 12 months, p = 0.01), the CBT subscale (2 months, *p* = 0.01; 12 months, *p* = 0.02), and the IPT subscale (12 months, *p* < 0.001) in all of which CATCH-IT had greater scores than HE. The BHS did not significantly differ between groups (data not shown).

Table 4. Coping and Family Relations Comparisons: Perceived Benefits of Behavioral Principles Scale (BA/CBT/IPT Subscales), Children's Report of Parent Behavior Inventory, and Sibling Relationships Questionnaire.

	CATCH-IT (N = 193)			Health Ed (N = 176)			
	N	Mean	SD	N	Mean	SD	*p*-Value [a]
Perceived Benefits of Behavioral Principles Scale (1–10) [b]							
2 months	83	6.5	(2.1)	71	5.5	(2.2)	0.008
12 months	47	6.9	(2.1)	42	5.5	(2.1)	0.003
Subscales (1–10) [b]							
Behavioral Activation (BA)							
2 months	80	6.8	(2.1)	71	5.8	(2.4)	0.005
12 months	47	7.0	(2.2)	42	5.8	(2.2)	0.01
Cognitive Behavioral Therapy (CBT)							
2 months	80	6.5	(2.1)	70	5.6	(2.4)	0.01
12 months	45	6.8	(2.3)	42	5.6	(2.2)	0.02
Interpersonal Psychotherapy (IPT)							
2 months	80	5.9	(2.4)	70	5.3	(2.4)	0.14
12 months	46	6.8	(2.2)	41	5.0	(2.2)	<0.001

	Unadjusted Means						Within-Group Slopes [c]				Between-Group Slope Differences *p*-Value [c]
	CATCH-IT			HE			CATCH-IT		HE		
	N	Mean	SD	N	Mean	SD	b	*p*-Value [a]	b	*p*-Value [a]	*p*-Value [a]
Children's Report of Parent Behavior Inventory (CRPBI) [d]											
CRPBI, Mother											
Acceptance (10–30)							0.024	0.45	0.003	0.92	0.60
Baseline	109	25.0	(4.8)	87	24.7	(4.6)					
24 months	33	26.3	(4.6)	52	24.8	(5.1)					
Psychological control (8–24)							−0.052	0.03	0.013	0.50	0.04
Baseline	110	12.3	(3.5)	87	11.6	(3.3)					
24 months	33	10.9	(3.0)	51	12.0	(3.7)					
Monitoring (5–15)							−0.009	0.55	−0.014	0.29	0.84
Baseline	103	13.5	(2.0)	84	12.8	(2.4)					
24 months	32	13.5	(1.9)	49	12.7	(2.7)					
CRPBI, Father											
Acceptance (10–30)							0.035	0.36	−0.012	0.72	0.36
Baseline	102	22.6	(5.4)	74	21.9	(5.6)					
24 months	33	23.4	(6.3)	46	21.5	(6.3)					
Psychological control (8–24)							−0.031	0.16	0.027	0.17	0.053
Baseline	102	11.8	(3.6)	74	11.8	(3.6)					
24 months	33	11.2	(3.2)	46	12.6	(4.4)					
Monitoring (5–15)							0.023	0.24	−0.005	0.77	0.28
Baseline	97	11.1	(2.9)	73	11.0	(3.3)					
24 months	32	11.4	(3.2)	44	11.0	(3.2)					
Sibling Relationships Questionnaire (SRQ)											
Warmth/closeness (1–5) [e]							0.012	0.01	0.009	0.04	0.62
Baseline	107	3.1	(0.8)	89	3.2	(0.8)					
12 months	69	3.1	(0.8)	56	3.2	(0.8)					
24 months	27	3.3	(0.9)	44	3.3	(0.8)					
Relative status/power (−4 to 4) [f]							0.003	0.57	−0.011	0.01	0.03
Baseline	111	0.1	(0.9)	99	0.2	(1.0)					
12 months	68	0.2	(0.8)	57	0.3	(0.9)					
24 months	27	0.1	(0.8)	44	0.1	(0.8)					
Conflict (1–5) [g]							−0.017	0.002	−0.008	0.11	0.19
Baseline	107	2.7	(0.9)	92	2.6	(0.8)					
12 months	69	2.5	(0.8)	57	2.4	(0.8)					
24 months	27	2.4	(0.8)	44	2.5	(0.9)					
Rivalry (0–2) [h]							−0.007	0.03	−0.005	0.11	0.57
Baseline	105	0.5	(0.5)	90	0.5	(0.5)					
12 months	64	0.5	(0.5)	53	0.4	(0.5)					
24 months	26	0.2	(0.4)	42	0.4	(0.5)					

[a] From *t*-tests with pooled variance for difference between groups at each visit. [b] Higher scores indicate that the intervention was rated as more helpful. [c] From linear mixed effect growth models with random intercept and random slope (random intercept only for CRPBI and SIDE), adjusted for sex, ethnicity (Hispanic, non-Hispanic), race (white, non-white), baseline age, site, and baseline adolescent CES-D10. Within-group estimated slopes and *p*-values are from estimates of simple slopes. The *p*-value for the visit*time interaction is used to test for a significant difference between slopes. [d] A higher score indicates higher acceptance, control, or monitoring. [e] A higher score indicates greater warmth/closeness. [f] Relative status: −4 (sibling higher status) to 4 (participant higher status). [g] A higher score indicates greater conflict. [h] A higher score indicates greater rivalry, defined as parental partiality.

Modifiable Factors Related to Family Relations. For the CPRBI (Table 4), when relating to the mother, the psychological control subscale showed a statistically significant difference between the slopes of the groups through 24 months ($p = 0.04$) with a lower score indicating less maternal psychological control for CATCH-IT. There was a statistically significant decrease from baseline to 24 months ($p = 0.03$) for CATCH-IT but no significant change for HE. The other CRPBI subscales did not significantly differ between groups.

For the SRQ (Table 4), the relative status/power subscale showed a statistically significant difference between the slopes of the groups through 24 months ($p = 0.03$), with a higher score indicating increased status/power over siblings for CATCH-IT. There was a statistically significant decrease for HE ($p = 0.01$) but no significant change for CATCH-IT. The other SRQ subscales did not significantly differ between groups. The CBQ, SIDE, and parent CES-D$_{10}$ each did not significantly differ between the groups (data not shown).

Modifiable Factors related to General Health Behaviors. The TBQ omega 3 fatty acids item showed a statistically significant ($p = 0.02$) difference by slope between CATCH-IT and HE at 12 months (data not shown). Outcomes of the TBQ showed no significant difference between groups in the remaining food items, physical activity, team sports, aerobic activity, religious, and media and internet activity (data not shown). BMI did not significantly differ between the groups (data not shown).

Modifiable Factors Related to Externalizing Behaviors. The DBD and CRAFT each did not significantly differ between the groups (data not shown).

Missing Analysis. There was attrition in follow-up observed for both groups. A logistic regression model was used to identify if participants that received the PBBPS and ALEQ instruments and were later missing were different from those that continued to participate in the study. Figure 1 shows the number of participants at different times receiving the PBBPS and ALEQ. A predictor of missingness in the PBBPS at 12 months was maternal education (some college vs. college graduate: odds ratio (OR), 2.29; 95% CI, 1.12–4.67; $p = 0.02$). A predictor of missingness in the ALEQ at 12 months was living in Boston (Boston vs. Chicago: OR, 0.30; 95% CI 0.18–0.50; $p < 0.001$). A predictor of missingness in the ALEQ at 24 months was living in Boston (Boston vs. Chicago: OR, 0.12; 95% CI 0.07–0.23; $p < 0.001$), randomization to HE (CATCH-IT vs. HE: OR, 1.89; 95% CI 1.08–3.31; $p = 0.03$), and maternal education (high school graduate or less vs. college graduate: OR, 3.23; 95% CI 1.23–8.48; $p = 0.02$).

5. Discussion

This exploratory study assessed the impact of a randomized controlled trial of a primary care online intervention, CATCH-IT, on modifiable factors and behaviors related to the onset of depressive episodes. We found partial support for the CATCH-IT intervention improving modifiable factors related to program completion, coping, and family relations. We found partial support for HE improving normative adolescent development. We did not find any support for either intervention improving modifiable factors related to general health behaviors and externalizing behaviors.

Hypothesis 1 (H1). *We found partial support for Hypothesis 1, as CATCH-IT improved some modifiable factors related to program completion (motivation, recommendations to peers, and positive relationship with physician), coping (perceived benefits of behavioral principles), and family relations (mother and sibling relationships). Regarding motivation, it is surprising that participants reported an increased stage of change (TTM Question 4), but not participation self-efficacy and intention (TTM) or positive attitudes (TPB) toward intervention participation. A prior study of CATCH-IT showed no pre/post changes in TPB for treatment. Our current findings are consistent with this pattern (Marko et al. 2010) with regard to improved motivation. There was greater endorsement of perceived benefits of behavioral principles and recommendations to peers who may become depressed, but not overall satisfaction or usefulness. We were surprised by the lack of significance for overall satisfaction or usefulness for CATCH-IT in comparison to HE. Usefulness was reported as high for*

both interventions. We suggest that adolescents found a sense of usefulness to the entire project of SBIRT plus either intervention arm.

We found benefits for CATCH-IT regarding a positive relationship with the primary care physician. This is similar to findings previously reported, that exposure to a MI increases scores on the positive physician relationship scale (Van Voorhees et al. 2009a). Regarding family relationships, CATCH-IT decreased maternal psychological control and increased relative power/status of participant over sibling. However, parent conflict behavior and mood did not improve. Overall, these findings are consistent with prior findings that adolescents use self-directed programs to problem solve a range of issues, including attempting to improve relationships (here with mother and siblings), across individual, family, school and community domains, which reduces their sense of perceived "stress" (Iloabachie et al. 2011). It is also possible that the SBIRT model has some general improvements for both intervention groups.

Hypothesis 2 (H2). *We did not find any support for Hypothesis 2, as HE did not impact adolescent modifiable general health behaviors (internet use, physical and social activity, BMI). Given that HE encourages physical activity, social interactions, and visiting health websites while CATCH-IT is neutral to physical activity and health websites but encourages social interactions, it is somewhat surprising that the groups were comparable in internet habits and physical and social activities. HE does not contain psychotherapy components, such as behavioral activation, without which it is possible some adolescents may not make changes to habits or behaviors based on the physical health and website information provided in the intervention.*

Hypothesis 3 (H3). *We found limited support for Hypothesis 3, that CATCH-IT or HE would improve factors not targeted by the interventions (externalizing factors, normative adolescent development). CATCH-IT did not improve either factor. HE showed fewer health and loss life events compared to CATCH-IT. For those in grief (a substantial number of adolescents who noted deaths of peers or family members on entry into the study), HE may be better by not engendering additional focus on the trauma (Eisma et al. 2013; Nolen-Hoeksema 2001; Nolen-Hoeksema et al. 2008).*

6. Conclusions

The CATCH-IT primary care, internet-based preventive model improved some modifiable factors related to program completion (motivation, recommendation to peer for depression prevention, and positive relationship with physician), coping (perceived benefits of behavioral principles), and family relations (mother and sibling relationships). We found no subsets where CATCH-IT appears contraindicated. This exploratory report suggests that at-risk adolescents may see some benefit from CATCH-IT as a primary care intervention referral within a scalable SBIRT model utilizing GLAD-PC components.

Our results, however, must be considered in light of the potential limitations of our study. We expected a number of participants to show MDE onset during the study because adolescents in this sample were at an intermediate to high risk of developing depression. However, MDE onset was surprisingly low, suggesting the possible benefits of other study-related factors (e.g., assessments, individual expectations) that we did not measure and that did not differ by intervention group. Future studies should identify and control for these potential non-specific intervention effects.

Primary care physicians may seek to utilize the CATCH-IT intervention between visits for at-risk adolescents as it may have mood benefits or improvements in factors and behaviors related to MDE onset. Providing a preventative option for at-risk adolescents that may not have alternatives in a "wait until sick enough for treatment" model is one element that may reduce adolescent depression prevalence and deliver an important public health benefit.

References

Armitage, Christopher J., and Mark Conner. 2001. Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology* 40: 471–99. [CrossRef]

Bardach, Naomi S., Tumaini R. Coker, Bonnie T. Zima, J. Michael Murphy, Penelope Knapp, Laura P. Richardson, Glenace Edwall, and Rita Mangione-Smith. 2014. Common and costly hospitalizations for pediatric mental health disorders. *Pediatrics* 133: 602–9. [CrossRef]

Beck, Aaron T., Arlene Weissman, David Lester, and Larry Trexler. 1974. The measurement of pessimism: The hopelessness scale. *Journal of Consulting and Clinical Psychology* 42: 861. [CrossRef]

Birmaher, Boris, David Brent, and ACAP Work Group on Quality Issues. 2007. Practice parameter for the assessment and treatment of children and adolescents with depressive disorders. *Journal of the American Academy of Child & Adolescent Psychiatry* 46: 1503–26.

Birmaher, Boris, Neal D. Ryan, Douglas E. Williamson, David A. Brent, and Joan Kaufman. 1996a. Childhood and adolescent depression: A review of the past 10 years. Part II. *Journal of the American Academy of Child & Adolescent Psychiatry* 35: 1575–83.

Birmaher, Boris, Neal D. Ryan, Douglas E. Williamson, David A. Brent, Joan Kaufman, Ronald E. Dahl, James Perel, and Beverly Nelson. 1996b. Childhood and adolescent depression: A review of the past 10 years. Part I. *Journal of the American Academy of Child & Adolescent Psychiatry* 35: 1427–39.

Booth, Karin Vander Ploeg, David Paunesku, Michael Msall, Joshua Fogel, and Benjamin W. Van Voorhees. 2008. Using population attributable risk to help target preventive interventions for adolescent depression. *International Journal of Adolescent Medicine and Health* 20: 307–20. [CrossRef] [PubMed]

Buhrmester, Duane, and Wyndol Furman. 1990. Perceptions of sibling relationships during middle childhood and adolescence. *Child Development* 61: 1387–98. [CrossRef]

Daniels, Denise, and Robert Plomin. 1985. Differential experience of siblings in the same family. *Developmental Psychology* 21: 747–60. [CrossRef]

Durlak, Joseph A., and Emily P. DuPre. 2008. Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American Journal of Community Psychology* 41: 327. [CrossRef]

Eisma, Marteen C., Margaret S. Stroebe, Hank A. Schut, Wolfgang Stroebe, Paul A. Boelen, and Jan van den Bout. 2013. Avoidance processes mediate the relationship between rumination and symptoms of complicated grief and depression following loss. *Journal of Abnormal Psychology* 122: 961. [CrossRef] [PubMed]

Embry, Dennis D. 2002. The Good Behavior Game: A best practice candidate as a universal behavioral vaccine. *Clinical Child and Family Psychology Review* 5: 273–97. [CrossRef] [PubMed]

Georgiades, Katholiki, Peter M. Lewinsohn, Scott M. Monroe, and John R. Seeley. 2006. Major depressive disorder in adolescence: The role of subthreshold symptoms. *Journal of the American Academy of Child & Adolescent Psychiatry* 25: 936–44.

Gladstone, Tracy, Katherine R. Buchholz, Marian Fitzgibbon, Linda Schiffer, Miae Lee, and Benjamin W. Van Voorhees. 2020. Randomized clinical trial of an internet-based adolescent depression prevention intervention in primary care: Internalizing symptom outcomes. *International Journal of Environmental Research and Public Health* 17: 7736. [CrossRef] [PubMed]

Gladstone, Tracy G., Monika Marko-Holguin, Phyllis Rothberg, Jennifer Nidetz, Anne Diehl, Daniela T. DeFrino, Mary Harris, Eumene Ching, Milton Eder, Jason Canel, and et al. 2015. An internet-based adolescent depression preventive intervention: Study protocol for a randomized control trial. *Trials* 16: 1–17. [CrossRef]

Gladstone, Tracy R., and Nadine J. Kaslow. 1995. Depression and attributions in children and adolescents: A meta-analytic review. *Journal of Abnormal Child Psychology* 23: 597–606. [CrossRef]

Gottlieb, Lev, Zoran Martinovich, Kathryn M. Meyers, and Mark A. Reinecke. 2016. Treatment for Depression Enhances Protection: Findings From the Treatment for Adolescents With Depression Study (TADS). *International Journal of Cognitive Therapy* 9: 38–56. [CrossRef]

Griffiths, Kathleen M., Dimitry Crisp, Helen Christensen, Andrew J. Mackinnon, and Kylie Bennett. 2010. The ANU WellBeing study: A protocol for a quasi-factorial randomised controlled trial of the effectiveness of an Internet support group and an automated Internet intervention for depression. *BMC Psychiatry* 10: 20. [CrossRef]

Group, Whoqol. 1998. Development of the World Health Organization WHOQOL-BREF quality of life assessment. *Psychological Medicine* 28: 551–58. [CrossRef]

Hankin, Benjamin L. 2006. Adolescent depression: Description, causes, and interventions. *Epilepsy & Behavior* 8: 102–14.

Hankin, Benjamin L., and Lyn Y. Abramson. 2002. Measuring cognitive vulnerability to depression in adolescence: Reliability, validity, and gender differences. *Journal of Clinical Child and Adolescent Psychology* 31: 491–504. [CrossRef] [PubMed]

Hollon, Steven D., Mark D. Evans, and Robert J. DeRubeis. 1990. *Cognitive Mediation of Relapse Prevention Following Treatment for Depression: Implications of Differential Risk*. Boston: Springer.

Iloabachie, Corrie Wells, Brady Goodwin, Melinda Baldwin, Karen Vanderplough-Booth, Tracy Gladstone, Michael Murray, Joshua Fogel, and Benjamin W. Van Voorhees. 2011. Adolescent and parent experiences with a primary care/Internet-based depression prevention intervention (CATCH-IT). *General Hospital Psychiatry* 33: 543–55. [CrossRef] [PubMed]

Klein, Daniel N., Peter M. Lewinsohn, Paul Rohde, John R. Seeley, and Thomas M. Olino. 2005. Psychopathology in the adolescent and young adult offspring of a community sample of mothers and fathers with major depression. *Psychological Medicine* 35: 353–65. [CrossRef] [PubMed]

Knight, John R., Lon Sherritt, Lydia A. Shrier, Sion Kim Harris, and Grace Chang. 2002. Validity of the CRAFFT substance abuse screening test among adolescent clinic patients. *Archives of Pediatrics & Adolescent Medicine* 156: 607–14.

Knight, John R., Lydia A. Shrier, Terrill D. Bravender, Michelle Farrell, Vander Joni Bilt, and Howard J. Shaffer. 1999. A new brief screen for adolescent substance abuse. *Archives of Pediatrics & Adolescent Medicine* 153: 591–96.

Lewinsohn, Peter M., Hyman Hops, Robert E. Roberts, John R. Seeley, and Judy A. Andrews. 1993. Adolescent psychopathology: I. Prevalence and incidence of depression and other DSM-III—R disorders in high school students. *Journal of Abnormal Psychology* 102: 133. [CrossRef]

Lewinsohn, Peter M., Ian H. Gotlib, and John R. Seeley. 1995. Adolescent psychopathology: IV. Specificity of psychosocial risk factors for depression and substance abuse in older adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry* 34: 1221–29.

Lewinsohn, Peter M., Ian H. Gotlib, and John R. Seeley. 1997. Depression-related psychosocial variables: Are they specific to depression in adolescents? *Journal of Abnormal Psychology* 106: 365. [CrossRef]

Lewinsohn, Peter M., Paul Rohde, Daniel N. Klein, and John R. Seeley. 1999. Natural course of adolescent major depressive disorder: I. Continuity into young adulthood. *Journal of the American Academy of Child & Adolescent Psychiatry* 38: 56–63.

Lewinsohn, Peter M., Paul Rohde, and John R. Seeley. 1998. Major depressive disorder in older adolescents: Prevalence, risk factors, and clinical implications. *Clinical Psychology Review* 18: 765–94. [CrossRef]

Lewinsohn, Peter M., Robert E. Roberts, John R. Seeley, Paul Rohde, Ian H. Gotlib, and Hyman Hops. 1994. Adolescent psychopathology: II. Psychosocial risk factors for depression. *Journal of Abnormal Psychology* 103: 302. [CrossRef]

Liu, Yih-Lan. 2002. The role of perceived social support and dysfunctional attitudes in predicting Taiwanese adolescents' depressive tendency. *Adolescence* 148: 823–35.

Lynch, John, and George D. Smith. 2005. A life course approach to chronic disease epidemiology. *Annual Review Public Health*, 1–35. [CrossRef]

Madras, Bertha K., Wilson M. Compton, Deepa Avula, Tom Stegbauer, Jack B. Stein, and H. Westley Clark. 2009. Screening, brief interventions, referral to treatment (SBIRT) for illicit drug and alcohol use at multiple healthcare sites: Comparison at intake and 6 months later. *Drug and Alcohol Dependence* 99: 280–95. [CrossRef] [PubMed]

Marko, Monika, Joshua Fogel, Elton Mykerezi, and Benjamin W. Van Voorhees. 2010. Adolescent internet depression prevention: Preferences for intervention and predictors of intentions and adherence. *Journal of Cyber Therapy and Rehabilitation* 3: 9. [PubMed]

Miller, William R., and Stephen Rollnick. 1991. *Motivational Interviewing: Preparing People to Change Addictive Behavior*. New York: Guilford Press.

Mohr, David, Pim Cuijpers, and Kenneth Lehman. 2011. Supportive accountability: A model for providing human support to enhance adherence to eHealth interventions. *Journal of Medical Internet Research* 13: e30. [CrossRef] [PubMed]

Moreno-Peral, Patricia, Sonia Conejo-Cerón, Ana Fernández, Anna Berenguera, María Martínez-Andrés, Mariona Pons-Vigués, Emma Motrico, Beatriz Rodríguez-Martín, Juan A. Bellón, and Maria Rubio-Valera. 2015. Primary care patients' perspectives of barriers and enablers of primary prevention and health promotion—A meta-ethnographic synthesis. *PLoS ONE* 10: e0125004. [CrossRef]

Nolen-Hoeksema, Susan. 2001. Ruminative coping and adjustment to bereavement. In *Handbook of Bereavement Research: Consequences, Coping, and Care*. Edited by Margaret S. Stroebe, Robert O. Hansson, Wolfgang Stroebe and Henk Schut. Washington, DC: American Psychological Association.

Nolen-Hoeksema, Susan, Blair E. Wisco, and Sonja Lyubomirsky. 2008. Rethinking rumination. *Perspectives on Psychological Science* 3: 400–24. [CrossRef]

O'Connell, Mary Ellen, Thomas Boat, and Kenneth E. Warner. 2009. *Preventing Mental, Emotional, and Behavioral Disorders among Young People: Progress and Possibilities*. Washington, DC: National Academies Press.

Paunesku, David, Justin Ellis, Joshua Fogel, Sachiko A. Kuwabara, Jackie Gollan, Tracy Gladstone, Mark Reinecke, and Benjamin W. Van Voorheesa. 2008. Clusters of behaviors and beliefs predicting adolescent depression: Implications for prevention. *Journal of Cognitive and Behavioral Psychotherapies* 8: 147–68.

Pelham, William E., Jr., Elizabeth M. Gnagy, Karen E. Greenslade, and Richard Milich. 1992. Teacher ratings of DSM-III-R symptoms for the disruptive behavior disorders. *Journal of the American Academy of Child & Adolescent Psychiatry* 31: 210–18.

Pine, Daniel S., Patricia Cohen, Diana Gurley, Judith Brook, and Yuju Ma. 1998. The risk for early-adulthood anxiety and depressive disorders in adolescents with anxiety and depressive disorders. *Archives of General Psychiatry* 55: 56–64. [CrossRef]

Prinz, Ronald J., Sharon Foster, Ronald N. Kent, and K. Daniel O'Leary. 1979. Multivariate assessment of conflict in distressed and nondistressed mother-adolescent dyads. *Journal of Applied Behavior Analysis* 12: 691–700. [CrossRef]

Radloff, Lenore Sawyer. 1991. The use of the Center for Epidemiologic Studies Depression Scale in adolescents and young adults. *Journal of Youth and Adolescence* 20: 149–66. [CrossRef] [PubMed]

Ritterband, Lee M., Frances P. Thorndike, Daniel J. Cox, Boris P. Kovatchev, and Linda A. Gonder-Frederick. 2009. A behavior change model for internet interventions. *Annals of Behavioral Medicine* 38: 18–27. [CrossRef] [PubMed]

Rubio-Valera, Maria, Mariona Pons-Vigués, Maria Martínez-Andrés, Patricia Moreno-Peral, Anna Berenguera, and Ana Fernández. 2014. Barriers and facilitators for the implementation of primary prevention and health promotion activities in primary care: A synthesis through meta-ethnography. *PLoS ONE* 9: e89554. [CrossRef]

Rushton, Jerry L., Michelle Forcier, and Robin M. Schectman. 2002. Epidemiology of depressive symptoms in the National Longitudinal Study of Adolescent Health. *Journal of the American Academy of Child & Adolescent Psychiatry* 41: 199–205.

Schaefer, Earl S. 1965. A configurational analysis of children's reports of parent behavior. *Journal of Consulting Psychology* 29: 552. [CrossRef] [PubMed]

Sterling, Stacy, Andrea H. Kline-Simon, Ashley Jones, Lauren Hartman, Katrina Saba, Constance Weisner, and Sujaya Parthasarathy. 2019. Health care use over 3 years after adolescent SBIRT. *Pediatrics* 143: e20182803. [CrossRef]

Van Voorhees, Benjamin, Tracy R. G. Gladstone, Kunmi Sobowale, C. Hendricks Brown, David A. Aaby, Daniela A. Terrizzi, Jason Canel, Eumene Ching, Anita D. Berry, James Cantorna, and et al. 2020. 24-Month Outcomes of Primary Care Web-Based Depression Prevention Intervention in Adolescents: Randomized Clinical Trial. *Journal of Medical Internet Research* 22: e16802. [CrossRef]

Van Voorhees, Benajmin W., David Paunesku, Jackie Gollan, Sachiko Kuwabara, Mark Reinecke, and Anirban Basu. 2008a. Predicting future risk of depressive episode in adolescents: The Chicago Adolescent Depression Risk Assessment (CADRA). *The Annals of Family Medicine* 6: 503–11. [CrossRef]

Van Voorhees, Benjamin W., David Paunesku, Sachiko A. Kuwabara, Anirban Basu, Jackie Gollan, Benjamin L. Hankin, Stephanie Melkonian, and Mark Reinecke. 2008b. Protective and vulnerability factors predicting new-onset depressive episode in a representative of US adolescents. *Journal of Adolescent Health* 42: 605–16. [CrossRef]

Van Voorhees, Benjamin W., Joshua Fogel, Benjamin E. Pomper, Monika Marko, Nicholas Reid, Natalie Watson, John Larson, Nathan Bradford, Blake Fagan, Steve Zuckerman, and et al. 2009a. Adolescent dose and ratings of an Internet-based depression prevention program: A randomized trial of primary care physician brief advice versus a motivational interview. *Journal of Cognitive and Behavioral Psychotherapies* 9: 1–19.

Van Voorhees, Benjamin W., Joshua Fogel, Mark A. Reinecke, Tracy Gladstone, Scott Stuart, Jackie Gollan, Nathan Bradford, Rocco Domanico, Blake Fagan, Ruth Ross, and et al. 2009b. Randomized clinical trial of an Internet-based depression prevention program for adolescents (Project CATCH-IT) in primary care: Twelve-week outcomes. *Journal of Developmental and Behavioral Pediatrics* 30: 23–37. [CrossRef] [PubMed]

Van Voorhees, Benjamin W., Karen Vanderplough-Booth, Joshua Fogel, Tracy Gladstone, Carl Bell, Scott Stuart, Jackie Gollan, Nathan Bradford, Rocco Domanico, Blake Fagan, and et al. 2008c. Integrative internet-based depression prevention for adolescents: A randomized clinical trial in primary care for vulnerability and protective factors. *Journal of the Canadian Academy of Child and Adolescent Psychiatry* 17: 184.

Van Voorhees, Benjamin W., Nicholas Mahoney, Rina Mazo, Alinne Z. Barrera, Christopher P. Siemer, Tracy Gladstone, and Ricardo F. Muñoz. 2011. Internet-based depression prevention over the life course: A call for behavioral vaccines. *The Psychiatric Clinics of North America* 34: 167–83. [CrossRef] [PubMed]

Van Voorhees, Benjamin W., Tracy Gladstone, Stephanie Cordel, Monika Marko-Holguin, William Beardslee, Sachiko Kuwabara, Mark Allan Kaplan, Joshua Fogel, Anne Diehle, Chris Hansen, and et al. 2015. Development of a technology-based behavioral vaccine to prevent adolescent depression: A health system integration model. *Internet Interventions* 2: 303–13. [CrossRef] [PubMed]

van Zoonen, Kim, Claudia Buntrock, David Daniel Ebert, Filip Smit, Charles F. Reynolds III, Aartjan T. F. Beekman, and Pim Cuijpers. 2014. Preventing the onset of major depressive disorder: A meta-analytic review of psychological interventions. *International Journal of Epidemiology* 43: 318–29. [CrossRef] [PubMed]

Weissman, Myrna M., Brigitte A. Prusoff, W. Douglas Thompson, Pamela S. Harding, and Jerome K. Myers. 1978. Social adjustment by self-report in a community sample and in psychiatric outpatients. *Journal of Nervous and Mental Disease* 166: 317–26. [CrossRef]

Weissman, Myrna M., Susan Wolk, Risë B. Goldstein, Donna Moreau, Philip Adams, Steven Greenwald, Claudia M. Klier, Neal D. Ryan, Ronald E. Dahl, and Priya Wickramaratne. 1999. Depressed adolescents grown up. *JAMA* 281: 1707–13. [CrossRef] [PubMed]

Weisz, John R., Irwin N. Sandler, Joseph A. Durlak, and Barry S. Anton. 2005. Promoting and protecting youth mental health through evidence-based prevention and treatment. *American Psychologist* 60: 628. [CrossRef]

Zabinski, Marion F., Denise E. Wilfley, Meredith A. Pung, Andrew J. Winzelberg, Kathleen Eldredge, and C. Barr Taylor. 2001. An interactive internet-based intervention for women at risk of eating disorders: A pilot study. *International Journal of Eating Disorders* 30: 129–37. [CrossRef]

Zuckerbrot, Rachel A., Amy Cheung, Peter S. Jensen, Ruth E. Stein, Danielle Laraque, and GLAD-PC Steering Group. 2018. Guidelines for adolescent depression in primary care (GLAD-PC): Part I. Practice preparation, identification, assessment, and initial management. *Pediatrics* 141: e20174081. [CrossRef] [PubMed]