Review Article

Evidence-based prevention programs targeting youth mental and behavioral health in primary care: A systematic review

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ARTICLE INFO

ABSTRACT

The objectives of this systematic review were to: 1) identify evidence-based youth (i.e., infancy, pre-school age, school age, and adolescence) mental and behavioral health disorder preventive interventions conducted in or offered by primary care settings, and 2) describe these interventions' characteristics, efficacy, and clinical involvement. Randomized controlled trials that targeted the prevention of mental or behavioral health outcomes for youth and had a connection to primary care were included. The PRISMA guidelines were utilized for two phases: 1) searching PubMed, EMBASE, PsycInfo, CINAHL, and Cochrane databases in January 2017; and 2) searching United States Preventive Services Task Force (USPSTF) Systematic Reviews in November 2017. The two phases revealed 504 and 58 potential articles, respectively. After removal of duplicates, screening of abstracts, and full-text reviews, 19 interventions (infancy: n = 2, pre-school age: n = 3, school age: n = 6, adolescence: n = 8) were included: 1) 10 interventions described in 17 articles from the databases, and 2) 9 interventions described in 11 articles from the USPSTF reviews. The included interventions capitalized on primary care settings as a natural entry point to engage youth and families into interventions without requiring a large amount of clinic involvement. Commonalities of efficacious interventions and recommendations for future research are discussed. The authors encourage primary care providers, mental and behavioral health providers, and/or public health researchers to continue developing and testing preventive interventions, or adapting existing interventions, to be implemented in primary care.

1. Introduction

1.1. Mental and behavioral health: the burden across youth development

Youth mental and behavior health disorders, ranging from infancy to adolescence, not only impact the youth's morbidity and mortality into adulthood, but also their family, community, and the economy (Boat, 2015). The Centers for Disease Control and Prevention define mental disorders among youth as "serious changes in the way children typically learn, behave, or handle their emotions, which cause distress and problems getting through the day". Behavioral disorders are grouped under the mental health disorder category, and include substance abuse and conduct problems. In the United States, the prevalence of mental health disorders among youth is approximately 20% (Perou et al., 2013). Some of the most common mental and behavioral health disorders include: attention-deficit/hyperactivity disorder, behavioral or conduct problems, anxiety, and depression; with prevalence rates of

6.8%, 3.5%, 3.0%, and 2.1%, respectively (Perou et al., 2013).

Multiple studies have demonstrated that these disorders in children are associated with substance use, sexual risk-taking behavior, criminal behavior, and poor social skills concurrently and throughout the individual's lifespan (O'Connell et al., 2009). As youth transition through different developmental stages they are exposed to various risks that may initiate the onset of a disorder or exacerbate underlying symptoms. The literature notes that the formation of mental and/or behavioral problems begins during the earliest stages of life. For example, the infant's attachment to his/her caretaker facilitates the expansion of the child's coping capacities with stressful stimuli, then this expression of resiliency may mediate mental health development over the later stages of the life cycle (Schore, 2001). A further example, what starts as noncompliance in early childhood, can lead to aggression and lying in middle childhood, which can lead to risky sexual behavior and conduct problems in adolescence (Dishion and Kavanagh, 2003). Effects of mental and behavioral problems that continue into adulthood include:

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poor psychosocial functioning (Lewinsohn et al., 2000); difficulties in work, family, and parenting (Weissman et al., 1999; Kessler et al., 2014); and decreased educational achievement or attainment (Kessler et al., 1995).

The cost of mental and behavioral health treatments is substantial. Six million youth receive annual treatment for mental and behavioral health problems, playing a substantive contribution to the estimated $247 billion per year spent on mental health treatments (Hawkins et al., 2015). Even more alarming is the number of children who do not receive any services. In one study that examined 3 national surveys, investigators found that among youth who needed mental health services, 80% were not receiving treatment (Kataoka et al., 2002). There are several potential explanations for the scarcity of mental and behavioral health treatment utilization. Firstly, there is stigma around mental health; unfortunately, certain subgroups (e.g., racial and ethnic groups and individuals with lower levels of education) stigmatize mental disorders more heavily than others, impacting problem identification to choice of treatment (Cauce et al., 2002). Additionally, many parents do not wish to label their children with a mental disorder because they do not want to medicate their children (Pescosolido et al., 2007). Other researchers have labeled poorly coordinated services, lack of health insurance, and shortages in mental health providers as other barriers to treatment (Murphey et al., 2013). Due to the burden of mental and behavioral disorders, costly treatment, and under-utilization of mental health services, it is imperative that we seek prevention efforts that are easily accessible and effective across all developmental stages, from infancy to adolescence.

1.2. Primary care: an opportunity for mental and behavioral disorder prevention

Pediatric primary care settings have been identified as local, friendly, and non-stigmatizing environments that may serve as an optimal setting to embed mental and behavioral health services for children and families (Kolko and Perrin, 2014; Leslie et al., 2016; Tolan and Dodge, 2005). The American Academy of Pediatrics recommends that parents take their child to the pediatric primary care office more than nine times before the age of 2 and once a year until the age of 21. This schedule presents many opportunities to offer prevention programs to children and families. Research indicates that the utilization of pediatric primary care settings by children and adolescents has increased over the past decades. According to the Child Trends Databank (2014), the proportion of youth under six years of age who received a well-child visit in the past year increased from 84% in 2000 to 91% in 2013. Additionally, there was a 10% increase in well-child or adolescent visit to a pediatric office, among children and adolescents ages 0–17, increasing from 73% in 1997 to 83% in 2013 (Federal Interagency Forum on Child and Family Statistics, 2015). As a result of recent policy initiatives, several preventive services for youth (such as developmental screenings, behavioral assessments, and substance use assessments) are covered by insurance, further highlighting primary care as a home for prevention (Kuo et al., 2012; Leslie et al., 2016).

1.3. Rationale

While the United States Preventive Services Task Force (USPSTF) conducted a comprehensive review of the literature for primary care-relevant behavioral counseling interventions, there are still gaps that must be addressed. First, the USPSTF's reviews only focused on tobacco use (Patnode et al., 2013), substance use (Patnode et al., 2014), and sexual risk behavior (O'Connor et al., 2014) counseling interventions. USPSTF's review did not expand on other behavioral health issues, such as externalizing behaviors. Furthermore, none of the USPSTF systematic reviews focused on preventive mental health counseling interventions for youth that expressed maladaptive behaviors yet did not meet DSM-5 diagnostic criteria. With evidence that early externalizing behaviors

and mental health symptoms can be precursors for serious mental and behavioral disorders later in life, it is eminent to review mental and behavioral health disorder preventive interventions. Moreover, some of the interventions cited in the USPSTF reviews are only "primary-care relevant," thus have not been tested in connection to or within primary care (e.g., a dental clinic, Lando et al., 2007; a school, Eggert et al., 2002). Other systematic reviews, unrelated to USPSTF, focus only on a specific age group in primary care (e.g., early childhood; Shah et al., 2016; Regalado and Halfon, 2001), instead of all youth developmental phases. Hence, there is a need to review programs that are appropriate for the different age groups or that may be offered across age groups seen in primary care: infancy, pre-school age, school age, and adolescence. Lastly, systematic reviews of primary care interventions often focus on treatment rather than prevention (e.g., depression treatment; Linde et al., 2015).

1.4. Objectives

To address the existing gaps in the literature, the objectives of this systematic review are to: 1) identify evidence-based youth (i.e., infancy, pre-school age, school age, and adolescence) mental and behavioral health disorder preventive interventions conducted in or offered by primary care settings, and 2) describe the resulting interventions' characteristics, efficacy, and clinic involvement. A review of which preventive interventions are available in primary care settings could encourage primary care practitioners and public health researchers to develop, implement, and/or adapt preventive interventions for use in connection to primary care.

2. Methods

2.1. Eligibility criteria

To be included in this systematic review, studies had to first report child and adolescent (i.e., ages birth to 18) mental or behavioral health outcomes. Mental and behavioral health outcomes and the developmental phases of infancy (ages birth-two), preschool age (ages three-five), school age (ages 6–12), and adolescence (ages 13–18) were chosen in accordance with Centers for Disease Control and Prevention's definitions. Second, studies had to be randomized controlled trials, with at least a pre- and post-intervention assessment, to be considered evidence-based. Evidence-based was defined in accordance with most of the standards of evidence in prevention science (Gottfredson et al., 2015), including valid causal inference and efficacy claims. Fourth, studies had to be focused on prevention, instead of treatment, defined as any universal, selective, or indicated interventions prior to the onset of mental or behavioral disorder (IOM, 1994). The Institute of Medicine (1994) defines preventive interventions as follows: "universal" refers to targeting the general population, "selective" refers to targeting a higher risk group, and "indicated" refers to targeting those already showing early symptoms or signs of the disorder. If the authors specified the intervention as treatment, if medication was used, or if the child was already diagnosed with a disorder, the article was excluded.

Additionally, the studies had to be connected to a primary care setting. Hence, the intervention could either be offered to participants who were screened or referred through the primary care setting, be delivered partially during the routine visit (e.g., clinic personnel conduct motivational interviewing, but then the intervention takes place outside the primary care visit), be delivered fully during the routine visit, or be delivered fully in the clinic outside the routine visit. The rationale for this flexibility is that in real-world settings it is unrealistic to believe that all preventive interventions occur fully in the primary care office. Instead, it has been recommended that primary care act as an entry point or a point of referral for interventions (WHO, 2008). Lastly, studies had to be in English, and no specific publication years were considered in the search of the databases.
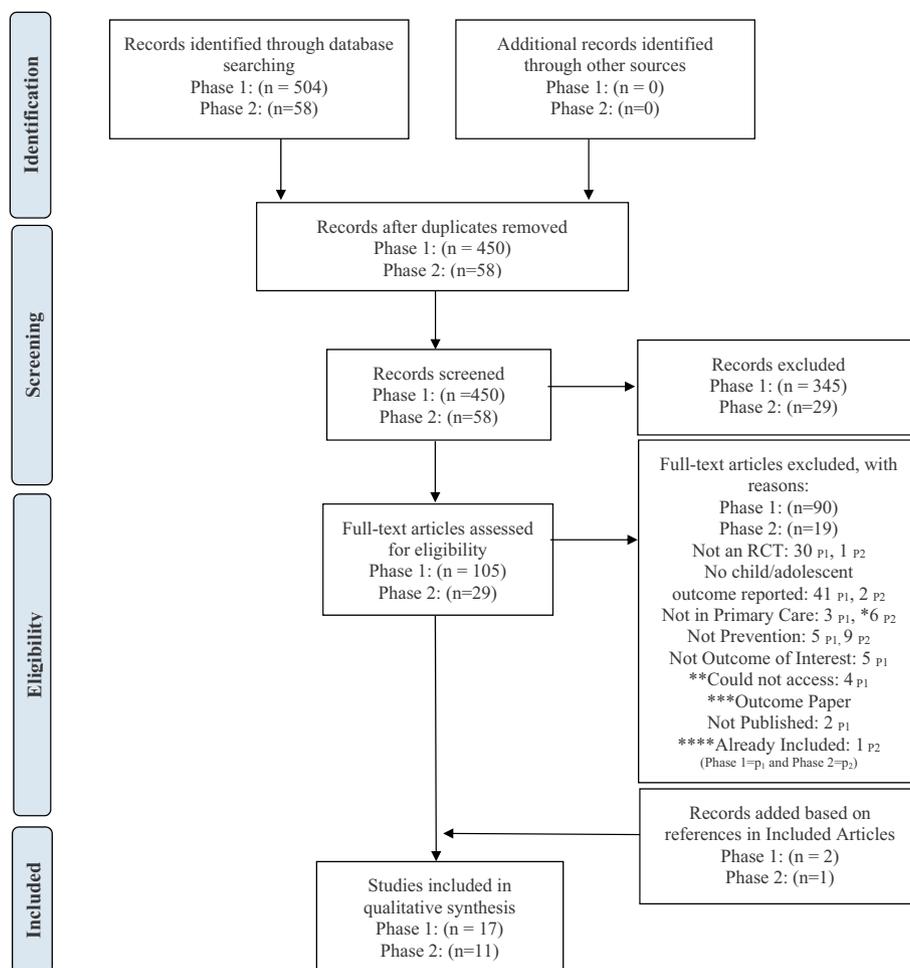
Fig. 1. The study selection process for Phases 1 and 2, based on the PRISMA Flow Diagram.
*Phase 2: One article, Colby et al., 2012, recruited from schools, medical offices, and community, however wasn't primarily through medical offices.
** Could Not Access: (Hudziak, 2016; Kowalenko et al., 2011; Melnyk, 2007; Scazufca et al., 2013).
***Phase 1: Study Protocol Available, but Outcome Paper Unavailable: (Longhi et al., 2016; Saulsberry et al., 2013a).
****Phase 2: Already included in phase 1: Pbert et al., 2008.

If the articles could not be accessed after consulting with the University's library, they were excluded (these articles are noted on the PRISMA diagram, Fig. 1). If the articles were study protocols, the authors searched for the outcome paper. If no outcome paper was found, the article was excluded (noted on Fig. 1). Articles related to the randomized controlled trials that did not report between group differences in the youth (e.g., cost effectiveness analyses, feasibility interviews) were excluded.

2.2. Information sources and search terms

This systematic review was conducted in two phases: 1) a search in five electronic databases; and 2) a search in publicly available USPSTF systematic reviews. In the first phase, conducted in January of 2017, PubMed, EMBASE, PsycInfo, CINHAL, and Cochrane were searched. These databases are commonly used in public health research. Across all databases, the same search terms were used: ("mental health" or "behavioral medicine" or "behavioral health") AND ("primary health care" or "primary care") AND "prevention". The National Library of Medicine's thesaurus, "MeSH", was utilized to identify the most appropriate and widely used terms. The filters of "clinical trial" or "randomized controlled trial", "child: birth to 18 years", and "language: English" were also applied to all databases. In the second phase, conducted in November of 2017, the USPSTF website was searched for articles related to mental or behavioral health in youth. This search

resulted in six USPSTF systematic reviews (i.e., suicide risk, O'Connor et al., 2013; alcohol misuse, Jonas et al., 2012; depression, Williams et al., 2009; drug use, Patnode et al., 2014; tobacco use, Patnode et al., 2013; sexually risk behaviors, O'Connor et al., 2014). Each of these six systematic reviews was hand searched to find articles that met the inclusion criteria from phase one. The authors decided to search through the USPSTF systematic reviews to provide a more comprehensive summary of the literature.

2.3. Study selection and data collection process

For the first phase, all articles were placed in an Endnote Database, and all duplicates were removed. For the abstract review, full-text review, and data extraction, articles were randomly assigned and evenly distributed among the authors on an Excel file. After each step, authors met to discuss any uncertainty regarding an article's eligibility criteria in order to reach a consensus on the article's inclusion. The second phase followed the same review process. In the data extraction phase, the second author cross-checked which articles were already included in our first phase of data extraction, then combined the final included studies into one Excel sheet.

The Excel sheet for data extraction included rows annotated by articles' citations and columns that pertained to population, intervention, comparison condition, outcome, and setting (i.e., PICOS; Moher et al., 2009). Data that were gathered for setting characteristics

Table 1
Summary of interventions' characteristics and clinic involvement, organized by developmental phase and alphabetically by first author.

First author(s), year(s)	Baseline sample size and family characteristics	Age (range or M, SD)	Intervention name	Prevention type (universal, selected, or indicated)	Intervention strategies and duration	Clinic involvement
Infancy						
Bayer et al., 2010; Hiscock et al., 2008b	733 mothers; 76.7% Anglo-Australian; 58.9% income > $60,000; 45.7% completed post-graduate degree; 96.7% married	8 months	Toddlers without tears	Universal-parents of an 8 month old child	- Delivered to parents-only by nurses and child psychologists - 3 manualized, 2-h parent-group sessions at different points of child development (8, 12, and 15 months) targeting parenting skills, such as encouraging desirable behavior and dealing with tantrums. - Total duration: 7 months	*Screening and referral, fully delivered by health professionals outside of routine visit* - Nurses invited mothers attending routine visit - At 8-month routine visit, educational hand outs were given - At 12 and 15 months, parents invited to attend parent group sessions - Over 7 h of training for all nurses
Hiscock et al., 2008a	328 mothers; 79.9% Australian; income NR; 52.9% completed post graduate degree; 98.9% living with partner	7.4 ± 0.6 months	Infant sleep study	Indicated-mothers had to report an infant sleep problem to participate	- Delivered to parents-only by nurses - Mothers offered choice of two behavioral interventions, "controlled crying" or "camping out", and given handouts accordingly - Individualized sleep plan developed by nurses - Total duration:12 months	*Screening and referral, fully delivered by clinic personnel during routine visit* - Nurses invited mothers - Counseling and materials given at routine visits - 5 h of training for all nurses
Preschool age						
Huttunen et al., 2011; McGrath et al., 2013; Sourander et al., 2016	464 parents; ethnicity NR; income NR; 57.4% completed college; 83.5% two-parent household	4 years	Strongest families-Finland-Canada (SFFC)	Indicated - parent had to report youth conduct problems for the previous 6 months to participate	- Delivered to parents-only online and by trained coach - Parents log on to a website where they have access to 11 online sessions, which focus on skills for strengthening parent-child relationships. Sessions include exercises, instructional videos, and skill demonstration videos. - The parents are asked to complete one session per week. After each session, a trained coach calls the parent to provide support and respond to questions. - Total duration: 10–12 weeks, with 2 booster sessions 2–3 months and 4–5 months after intervention	*Screening* - Research team mailed study information package and questionnaire, which were returned to nurses at child's annual check-up - Nurses mailed questionnaires to research team
Patterson et al., 2002	116 parents; 91.4% White; income NR; educational level NR; 14.7% single	2–8 years	Webster-Stratton's parents and children series	Indicated-youth had to score in upper 50% of a behavior inventory to participate	- Delivered to parents-only by a trained health visitor with either a second health visitor of a nursery nurse - 10, 2-h parent group sessions including video vignettes of parent-child interactions, group discussion, role play and home practice once a week - Total duration: 10 weeks	*Screening and referral, fully delivered in clinic outside of routine visit* - Postal survey was sent to all parents - Three-days of training for participating nurses and health visitors, and weekly supervision meetings. Note: not clear what constitutes a health visitor.
Turner and Sanders, 2006	30 families; ethnicity NR; income NR; 25% did not complete high school; 80% two-parent household	37.38 ± 10.77 months	Primary Care Triple P (preschool)	Selected - parents had to request behavioral problem advice to be invited to participate	- Delivered to families by nurses - 3–4,30 min individual family consultations once a week with a break of 3 to 4 weeks before the fourth session if it was needed - Advice on managing problem behaviors was provided to the parents, assisted by	*Screening and referral, fully delivered by clinic personnel during normal working hours* - Parents screened at clinic - Five nurses were trained and accredited for delivery of Primary Care Triple P

Table 1 (*continued*)

First author(s), year(s)	Baseline sample size and family characteristics	Age (range or M, SD)	Intervention name	Prevention type (universal, selected, or indicated)	Intervention strategies and duration	Clinic involvement
					selective use of parenting tip sheets and video resources - A consultation flip chart, tip sheets, and other parenting resource materials were given. - Total duration: 4–8 weeks	- Nurses completed supervision sessions
School age						
Borowsky et al., 2004	224 families; 78.3% White; income NR; education level NR; 64.1% two-parent household	11.2 ± 2.3 years	Positive parenting	Indicated-youth had to screen positive on 1 of the psychological subscales to participate	- Delivered to youth by physicians: Counseling in clinic (not manualized) - Delivered to parents by trained parent educator: Telephone-based parenting education program: 13, 15–30 min weekly telephone sessions. Parents received 2 videotapes and a manual, both which centered on monitoring, discipline, decision-making, and other parenting practices - Total duration: 13 weeks	*Screening and referral, partially delivered during routine visit* - Clinicians counseled adolescents about screening results and referred parents to telephone-based parenting education program
Curry et al., 2003	4026 families; 85% white; 68% income > $45,000; 77% completed post-high school; 10% single parent household	10–12 years	The steering clear project	Universal - families with children 10–12 years old	- Delivered to families by trained counselors - Parent and child received written materials with information and activities that focus on tobacco use prevention - Two telephone counseling calls were made to educate and counsel parents on written materials - A newsletter and access to a steering clear website - Total duration: 20 months	*Screening and referral, partially delivered during routine visit* - Researchers identified parents through health plan files, and sent a letter signed by medical staff and project investigators that described the intervention - Clinicians would be prompted through medical records to give participating families motivational messages and encouragement to use the intervention materials
Fidler and Lambert, 2001	2942 adolescents; ethnicity NR; income NR; educational level NR; marital status NR	10–15 years	N/A	Universal - had to be non-smoking, adolescents to participate	- Delivered to youth-only by research team - Information about smoking, certificates, and posters intended to reinforce non-smoking behavior at 3-month intervals - Youth encouraged to contact project team if they wished - Total duration: 12 months	*Screening* - Intervention materials were sent under the signature of the participant's provider - No direct clinician involvement
Guilamo-Ramos et al., 2011	264 mother-adolescent dyads; 84.5% Latino; income NR; 28% completed high school; 44.6% single parent household	11–14 years (mean 12.9)	Families talking together	Selective - African American or Latino 11–14 year olds	- Delivered to families by social workers - 30 min, manualized counseling session that taught parents effective communication and parenting strategies for reducing sexual risk behavior, and encouraged two homework sessions with adolescent - Two booster calls (1 month and 5 months after the intervention) - Total duration: 5 months	*Screening and referral, partially delivered during routine visit* - Project staff screened and recruited mothers and adolescents from the waiting room - Social worker delivered first part of intervention to mothers during adolescent's well child visit - While adolescent did their assessment, mother met with child's physician to discuss the results of their child's examination and

Table 1 (continued)

First author(s), year(s)	Baseline sample size and family characteristics	Age (range or M, SD)	Intervention name	Prevention type (universal, selected, or indicated)	Intervention strategies and duration	Clinic involvement
						physicians provided endorsement of the program
Spijkers et al., 2013	81 families; 96% Dutch; income NR; 63.3% medium to high education; 16.2% single parent	10.57 ± 0.73 years	Primary Care Triple P (school age)	Indicated-youth had to have mild to moderate psychosocial problems	- Delivered to families by nurses - Four, 30-min sessions. Note: Same format as Primary Care Triple P (preschool) - Total duration: 4–6 weeks	*Screening and referral, delivered by clinic personnel during normal working hours* - Parents completed screening prior to routine visit - Eight nurses were trained and accredited for delivery of Primary Care Triple P - Nurses completed supervision sessions
Stevens et al., 2002	3145 parent/child pairs; ethnicity NR; 58.5% income > $50,000; 14.5 mean years of parent education; 83.8% married	11 ± 0.09 years	The Darmouth prevention project	Universal - families with fifth and sixth grade children	- Delivered to families by clinicians - Physician engaged the child and parent in a joint discussion about alcohol and tobacco use or about bicycle helmet, and seatbelt use, and safe gun storage - The family and clinician signed a contract that the family would talk about the risks at home and develop a family policy about alcohol and tobacco or about safety issues - Educational newsletters and bi-annual calls were performed - At subsequent clinic visits, families were reminded about the importance of communication - Total duration: 36 months	*Screening and referral, fully delivered during routine visit* - Clinicians recruited and facilitated the intervention - 3 h of training for physicians and nurse practitioners
Adolescence						
Boekeloo et al., 1999	215 adolescents; 68% African American; income NR; educational level NR; marital status NR	12–15 years	ASSESS (awareness, skills, self-efficacy/self-esteem, and social support)	Universal – Adolescents 12–15 years old	- Delivered to youth-only by research team and physician - Research assistant provided adolescent with audiotaped STD risk assessment, and provided results to physician - Physician reviewed answers, communicated about safe sex practices, and provided a brochure - Total duration: Length of doctor's appointment	*Screening and referral, fully delivered in clinic during routine visit* - Physicians delivered the intervention - Physicians attended a 45 min training
Danielson et al., 1990	522 adolescent males; ethnicity NR; income NR; educational level NR; marital status NR	15–18 years	N/A	Universal - male patients 15–18 years old	- Delivered to youth-only by health care practitioner - Adolescent viewed a video promoting abstinence and contraception for first half, and consulted with health care practitioner for second half - Total duration: 1h	*Screening and referral, fully delivered during routine visit* - Nurse practitioners, physician assistants, and registered nurses were trained on how to introduce the program and to consult with the patient
DiClemente et al., 2004	522 adolescent girls; 100% African American; income NR; educational level NR; 74.1% single-parent household	15.99 ± 1.25 years	N/A	Indicated - sexually experienced African American girls	- Delivered to youth-only by health educator and peer educators - Four, 4-h group sessions (on consecutive Saturdays) including discussion and role-play about ethnic pride, awareness of HIV	*Screening fully delivered in clinic outside of routine visit* - Research team screened participants at clinic

Table 1 (*continued*)

First author(s), year(s)	Baseline sample size and family characteristics	Age (range or M, SD)	Intervention name	Prevention type (universal, selected, or indicated)	Intervention strategies and duration	Clinic involvement
Hollis et al., 2005, 2003	2526 adolescents; 79.6% White; income NR; educational level NR; marital status NR	14–17 years	Teen reach	Universal - adolescent between 14 and 17 years old	risk reduction strategies, and importance of healthy relationships - Total duration: 4 weeks - Delivered to youth-only by trained health counselor - After routine visit, adolescent interacted for 10–12 min with pathways to change computer program, which assessed readiness to change smoking habits - Brief motivational interviewing with health counselor after computer program - Two additional booster sessions with the computer program and health counselor in next 11 months - Total duration: 12 months	- Sessions took place at the clinic on Saturdays - No direct clinician involvement *Screening and referral, partially delivered during routine visit* - Primary care clinicians were provided a written prompt to encourage teens to quit smoking or to not start, then encouraged teen to speak with a health counselor
Jemmott et al., 2005	682 adolescent girls; 67.6% African American; income NR; educational level NR; marital status NR	12–19 years (M = 15.5)	Women's health project	Indicated - sexually experienced African American or Latino adolescent girls	- Delivered to youth-only by trained community member - One 250-min group session including group discussions, videotapes, games, and experiential exercises - There were two arms, relative to health promotion control: 1) information-based HIV/STD intervention provided information necessary to practice safer sex, and 2) skill-based HIV/STD intervention provided information and taught skills necessary to practice safer sex - Total duration: 250 min	*Screening and referral* - Clinicians referred eligible adolescents to the research team
Landback et al., 2009; Van Voorhees et al., 2008, 2009; Saulsberry et al., 2013b	84 adolescents; 61% White; $40,249 mean income; educational level NR; married	17.44 ± 2.04 years	Competent adulthood transition with cognitive-behavioral, humanistic, and interpersonal training (CATCH-IT)	Indicated - youth had to report subthreshold depression to participate	- Delivered to youth-only by physicians and online - 14 Internet based modules teaching adolescents how to reduce behaviors that increase vulnerability for depressive disorders and increase protective behaviors - If adolescent in motivational interview condition, they received three motivational phone calls from a social worker - Total duration: 4–6 weeks	*Screening and referral, partially delivered during routine visit* - Trained 12 primary care physicians on how to conduct a 1–2 min interview or a 5–15 min motivational interview to then refer adolescent to website
Pbert et al., 2008	2709 adolescents; 91.2% white; income NR; educational level NR; marital status NR	16.84 ± 1.44 years	Air it out	Universal-adolescents 13–17 years old	- Delivered to youth-only by providers: Cessation advice and referred to peer counselor - Delivered by trained college counselor: Short follow up telephone calls tailored to adolescent's behavior change needs at 2, 6, 12, and 21 weeks - Total duration: 21 weeks	*Screening and referral, partially delivered during routine visit* - Participants recruited through letters on physician's letterhead, telephone calls, and postings in clinics - Providers (pediatricians, nurse practitioners, physician's assistants and pediatric residents) completed a 1-h training for brief counseling - Intervention algorithm was attached to patient's medical chart

Table 1 (*continued*)

First author(s), year(s)	Baseline sample size and family characteristics	Age (range or M, SD)	Intervention name	Prevention type (universal, selected, or indicated)	Intervention strategies and duration	Clinic involvement
Walton et al., 2013	328 adolescents; 60.7% African American; income NR; educational level NR; marital status NR	16.3 ± 1.4 years	Project chill	Selective - adolescents reporting past year *Cannabis* use	- Delivered to youth-only by trained therapist or online - CBI was a stand-alone interactive animated program on a tablet that included audio feedback, exercises, and role play - TBI included summaries, open-ended questions, and role play - Total duration: Time in waiting room	*Screening* - Research staff obtained appointment logs and recruited from waiting rooms - No direct clinician involvement

Note. Some interventions served a range of ages that crossed developmental phases, but were listed in the developmental stage in which the mean age available, the intervention was listed in accordance with the minimum of the age range. Six of the interventions spanned different developmental periods: preschool to school age (n = 1), school age to adolescence (n = 5). We listed the majority of each baseline family characteristic; however, if the article didn't list the majority percentage, we listed what they had reported for the categories of interest (i.e., ethnicity, family income, parent's educational level, and parent's marital stuatus). NR signifies "not reported".

included: the recruitment strategy and whether the intervention was referred by, delivered partly, or delivered fully in the clinic. If the article was excluded, authors marked the reason for exclusion, according to whichever criterion was not met (i.e., not a randomized controlled trial "RCT", no child/adolescent outcomes, not in primary care, not prevention, not outcome of interest, could not access, or other). Note that an article may have met several exclusion criteria, yet the authors were instructed to select "not an RCT" because it was the first exclusion criterion on the list.

3. Results

3.1. Study selection

The systematic search across five databases (PubMed, EMBASE, PsycInfo, CINHAL, and Cochrane) produced 504 articles for review. Of these articles, only 17 met inclusion criteria, and were included in the final data synthesis. These 17 articles describe ten interventions. In addition, the search across six USPSTF systematic reviews produced 58 articles for review. Of these articles, only 11 articles met the inclusion criteria and were included in the final data synthesis. These 11 articles describe an additional nine interventions. Fig. 1 outlines the study selection process with the PRISMA diagram for the first (five databases) and second (six USPSTF systematic reviews) phases, respectively.

3.2. Synthesis of results

Interventions' characteristics are summarized in Table 1. Seven of the trials provided another intervention (e.g., nutrition intervention), and one utilized a wait-list control. Of the 19 interventions evaluated: two targeted infants, three targeted preschool age children, six targeted school-age children, and eight targeted adolescents. Overall, samples recruited into the interventions were mostly indicated (n = 8) or universal (n = 8), with three interventions including a selective sample. The sample sizes of the trials ranged from 30 to 4026 participants. The duration of the interventions ranged from the time in a waiting room (approximately five minutes) or routine visit (approximately one hour) to sessions dispersed throughout 36 months; with most intervention sessions being dispersed throughout four to 13 weeks. Ten of the interventions included a parenting component, while nine interventions were targeted directly at youth. Intervention strategies included interactive group sessions, telephone-based counseling, in-clinic one-on-one counseling, delivering educational materials, and online or technology assisted counseling sessions. The most common modality was interactive group sessions. Most interventions utilized several strategies, for example, one-on-one counseling followed by telephone-based counseling or online sessions.

Interventions' clinic involvement are summarized in Table 1. The majority of the interventions was not fully delivered during a routine medical visit (n = 15). Six of these were partially delivered by a clinician or research assistant during the routine visit (i.e., they utilized some sort of provider interaction, such as referral, interviewing, and/or counseling, yet the rest of the intervention was off-site). Five of these utilized clinician's time or space outside of the routine visit, e.g., participants were invited back to complete remaining sessions. Two of the interventions only utilized clinician's time for screening or referral. Two of the interventions did not have any direct clinician involvement, and only utilized the clinic setting for screening or obtaining potential participant names. Only four of the interventions were fully delivered in the clinic during routine medical visits. Ten of the interventions trained clinicians on how to deliver the interventions; mostly nurses (n = 6) and physicians (n = 4). Eight of the interventions were delivered by personnel outside the clinic (e.g., social workers or peer counselors), while eleven of the interventions were either partially delivered (e.g., portion was delivered by physician and another portion delivered by trained counselor, n = 7) or fully delivered by the clinicians (n = 4).

Table 2
Summary of interventions' results, organized by developmental phase and alphabetically by first author.

First author(s), year(s)	Outcomes		% reach	Length of follow up	Comparison condition	Between group (intervention vs. control) differences in youth outcomes
	Primary	Secondary				
Infancy						
Bayer et al., 2010; Hiscock et al., 2008b	Child's externalizing and internalizing behavior	Parenting practices, maternal mental health	68.5	18 months, 2 years, 3 years	Usual care	- Child behavior scores were similar at 18 months, 2 years, and 3 years
Hiscock et al., 2008a	Maternal report of infant sleep, child mental health	Maternal wellbeing, maternal rating of infant temperament	47.2	10 months, 12 months, 24 months	Usual care	- Prevalence of infant sleep problems was lower in the intervention group at 10, 12 and 24 months - Child mental health did not differ between groups
Preschool age						
Huttunen et al., 2011; McGrath et al., 2013; Sourander et al., 2016	Child's disruptive behavior symptoms and impairment scores	Parenting skills, parent conflict, parent's sense of coherence, parental distress, child's callous and unemotional traits	63.6	6 months, 12 months	Access to a website with parenting tips and a single 45-min telephone call with a coach reviewing the parenting tips	- Significant improvement in child externalizing symptoms at 6 and 12 months
Patterson et al., 2002	Child's externalizing behaviors	Child's prosocial and antisocial behaviors, Parent's mental health, parenting stress, Parent's self esteem	29.7	10 weeks, 6 months	No intervention services	- No significant difference at 10 weeks - Intervention group significantly improved conduct problems at 6 months
Turner and Sanders, 2006	Child behavior	Parenting, parent stress	N/A	8 weeks, 6 months	Wait-list control group	- Parents in intervention reporting significantly fewer targeted problem behaviors at post intervention - Note: Control condition data was not collected at 6 months, so no comparison can be made at follow up. Improved problem behavior for children in intervention was maintained from post intervention to 6 months
School age						
Borowsky et al., 2004	Child's externalizing and internalizing behavior	Frequency of bullying, youth attitudes on violence, positive parenting	49.2	9 months	No intervention Services	- Intervention group exhibited significant decreases in aggressive behavior, delinquent behavior, and attention problems at 9 months - Differences in anxiety/depression were not statistically significant at 9 months - Intervention significantly reduced parent-reported bullying, fighting, and fight-related injuries requiring medical care among youths in the intervention group at 9 months
Curry et al., 2003	Susceptibility to smoking	Experimentation with smoking and monthly smoking, parent-child discussions	55.0	20 months	Usual care	- No significant differences between intervention and control on primary outcome - Intervention associated with modest but statistically significant increases in parent-child discussions of smoking related topics
Fidler and Lambert, 2001	Smoking uptake	Changes in smoking behavior and attitudes	100.0	6 months, 12 months	No information sent	- Intervention group significantly lower overall smoking uptake at 12 months - Intervention effects greater for boys - More effective among young people whose initial attitudes identified them as definite non-smokers than those who were potential smokers

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Table 2 (*continued*)

First author(s), year(s)	Outcomes — Primary	Outcomes — Secondary	% reach	Length of follow up	Comparison condition	Between group (intervention vs. control) differences in youth outcomes
Guilamo-Ramos et al., 2011	Adolescent sexual activity	N/A	81.0	9 months	Usual care	- Note: Control condition was not measured at 6 months. - Significant reduced rates of transitioning to sexual activity and frequency of sexual intercourse observed in the intervention group relative to standard care
Spijkers et al., 2013	Child behavior	Parent behavior, parent stress	18.4	Post-program, 6 months, 12 months	Usual care	- The difference between groups for child behavior was not significant at post intervention, 6 months, and 12 months.
Stevens et al., 2002	Alcohol and tobacco use, bicycle helmet and seatbelt use, and gun access and use	Parental alcohol and tobacco use, parent report of child outcomes and child problem behaviors	90.0	12 months, 24 months, 36 months	Safety intervention arm: physician encouraged discussion of safety issues and followed up as in the alcohol and tobacco arm	- Moderate increasing in drinking among children who received alcohol intervention - Increased bicycle helmet usage among children who received safety intervention
Adolescence						
Boekeloo et al., 1999	Adolescent sexual behaviors	Adolescent sexual outcomes	41.8	3 months, 9 months	Usual care	- No significant differences between intervention and control regarding sexual intercourse, number of partners, frequency of intercourse, condom use - More control participants reported signs of possible STD at follow up
Hollis et al., 2005, 2003	Abstinence from smoking	Abstinence from all other forms of tobacco	48.9	12 months, 24 months	Diet intervention control group: Health counselors provided 3–5 min of motivational counseling to increase consumption of fruits and vegetables, 2 informational brochures, and a small healthy snacks	- Significant increase in the proportion of all participants (i.e., both smokers and nonsmokers at baseline) who were smoke-free for 30 days at the 1-year and 2-year assessment for intervention condition, relative to control
Danielson et al., 1990	Sexual activity status, contraceptive practice	Impact on testicular self-examination	85.7	12 months	No intervention Services	- No significant differences on sexual activity status between intervention and control. - The positive effects of the consultation were only statistically significant among those who had not been sexually active at baseline
DiClemente et al., 2004	Consistent condom use	Other self-reported sexual behaviors, STD status, psychosocial mediators of sexual behavior	70.4	6 months, 12 months	General health promotion condition: four 4-h interactive sessions about nutrition and exercise	- Intervention participants reported using condoms more consistently, compared to control conditions, throughout both follow-up periods
Jemmott et al., 2005	Self-reported frequency of unprotected sexual intercourse	Frequency of sexual intercourse while intoxicated, number of sexual partners, biologically confirmed STDs, intention to use condoms, beliefs about using condoms, and condom-use knowledge	59.3	3 months, 6 months, 12 months	Health-promotion control intervention: 250 min group discussion on nutrition, physical activity, breast self-examination, cigarette smoking and alcohol use	- At 3 and 6 months, no significant differences between groups - At 12 months, skills-based intervention participants reported less unprotected sexual intercourse than the information-intervention participants or health control-intervention participants - At 12 months, skills-intervention participants reported fewer sexual partners and were less likely to test positive for STDs than the health control-intervention participants - Skills-based participants significantly greater increases in condom use knowledge than information-based participants.
			80.8			

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Table 2 (*continued*)

First author(s), year(s)	Outcomes		% reach	Length of follow up	Comparison condition	Between group (intervention vs. control) differences in youth outcomes
	Primary	Secondary				
Landback et al., 2009; Van Voorhees et al., 2008; Saulsberry et al., 2013b	Mood, depressive disorder, self-harm risk, hopelessness and loneliness, adverse events	Level of perceived family social support, perceived peer social support, level of school impairment related to depressed mood		4 weeks, 6 weeks, 12 weeks, 24 weeks, 52 weeks	Primary care physician (PCP) motivational interview + CATCH-IT internet program (MI), PCP brief advice + CATCH-IT Internet program (BA) Note: the difference is in the amount of time with physician interview (MI vs. BA) and follow up by social worker (MI only)	- Significant increase in motivation to prevent depressive disorder in entire cohort and MI group at post intervention - Depressed mood and frequency of moodiness declined significantly in both groups at post intervention - The percentage of those with clinically significant depression symptoms declined in both groups at 12 weeks - MI group was significantly less likely than BA group to experience a depressive episode or to report hopelessness at 12 weeks - Both groups demonstrated significant within-group decreases in depressed mood, loneliness, and self-harm ideation at 1 year
Pbert et al., 2008	Smoking cessation or abstinence, smoking behavior	Depressive symptoms	77.1	6 months, 12 months	Usual care	- Those who were non-smokers at baseline had a twofold increase in the odds of remaining abstinent at 6 months, and 1.5 fold increase at 12 month follow up - Those who were smokers at baseline had a 1.5 fold increase in the odds of being abstinent at 6 months, but did not differ at 12 months
Walton et al., 2013	*Cannabis* use, *Cannabis* related consequences (CC)	Other substance use	89.6	3 months, 6 months, 12 months	Given a brochure about *Cannabis*	- No significant differences between brief interventions and control group in reduction of *Cannabis* use - CBI had significant short term effects at 3 months on CC, relative to control - TBI significantly reduced frequency of *Cannabis* DUI, relative to control

Note. Some interventions served a range of ages that crossed developmental phases, but were listed in the developmental stage in which the mean age matched. If there was no mean age available, the intervention was listed in accordance with the minimum of the age range. Six of the interventions spanned different developmental periods: preschool to school age (n = 1), school age to adolescence (n = 5). "Reach" was calculated as the proportion of participants who enrolled in the study that met eligibility criteria.

Interventions' efficacy are summarized in Table 2. Overall, eleven of the interventions produced desired results, seven did not produce significant differences between experimental and control conditions, and one had an iatrogenic effect. Hence, approximately 95% of the interventions identified did not have an iatrogenic effect. The infancy phase was the only phase in which there were no significant effects on child externalizing or internalizing outcomes (n = 2). The pre-school developmental phase was the only phase in which all interventions demonstrated positive effects on child externalizing behavior (n = 3). In the school-age category (n = 6), three of the interventions found significant differences between intervention and control, such that children exhibited significant decreases in externalizing behaviors, smoking uptake, and sexual activity, respectively. Two of the school-age interventions found no significant between-group differences in children's behavior. One intervention moderately increased alcohol consumption, despite efforts to prevent it. In the adolescence category (n = 8), five interventions demonstrated significant improvements in depression (n = 1), smoking abstinence (n = 2), and sexual risk behavior (n = 2), in their respective trials, compared to their comparison conditions. Three interventions did not find any significant differences in their primary outcomes of adolescent sexual behavior (n = 2) or substance use (n = 1). Length of follow-up ranged from four weeks to three years, with most trials (n = 14) having at least a 12-month follow up. On average, 64.2% of participants who screened eligible in the clinic enrolled in the study. The most common comparison condition was care as usual or no intervention services provided (n = 11).

4. Discussion

To further explore the utility of the identified interventions in primary care, we focus the discussion on the commonalities between the efficacious interventions (n = 11) versus the commonalities of the interventions that did not produce desired results (n = 8). The common elements illuminate trends for what seemed to work and what did not. Although we cannot conclude that these common elements directly impacted the efficacious results observed, we suggest how these findings align with the current literature and recommend areas for future research.

4.1. Intervention characteristics

There is a need to identify efficacious interventions for families of infants in primary care, as it was the only developmental phase that did not produce desired results. The majority of the efficacious interventions (n = 8 out of 11) was classified as indicated or selective. On the other hand, the majority of the non-efficacious interventions (n = 5 out of 8) was classified as universal. This suggests that interventions are most efficacious in a clinic setting if they target outside of infancy and a higher-risk group (i.e., selective or indicated), instead of everyone in the clinic (i.e., universal). Research has suggested that preventive interventions may be most beneficial for selective or indicated samples, compared to universal (Sandler et al., 2014). Another consideration is that a universal sample may not have high enough baseline levels of a behavioral health problem to show a preventive effect over time: Researchers have called for longer term follow-up of prevention programs aimed at psychological disorders (Gillham et al., 2001).

Out of all the interventions, only three interventions were developed specifically for ethnic minorities. These three interventions had efficacious results, which may highlight the potential of primary care settings to reach ethnic subgroups for whom stigma is a barrier and have low utilization of mental health services (Cauce et al., 2002). The remaining trials consisted predominantly of non-Hispanic whites, with the exception of one trial which had a majority sample of African Americans although the intervention wasn't culturally specific for African Americans (interestingly, this trial was not efficacious). Since most of the interventions were delivered to samples that were from non-

ethnically/racially diverse, well-educated, two-parent households (see Table 1), it is unknown whether these interventions would be efficacious among diverse ethnic groups, lower income communities, or other marginalized communities. Furthermore, only three interventions reported investigating moderators of intervention effects. Pinpointing for whom and under which conditions an intervention works best is integral to prevention; especially when considering the prime opportunity for tailoring services based on the routine screening of patients in primary care clinics.

The intervention modalities aligned with the developmental trajectory of the youth. To illustrate, during infancy and pre-school age, the interventions were geared typically toward the parent solely whereas during school-age, the interventions were typically more family-centered. During adolescence, the interventions were geared toward the youth solely. As promoting positive parenting is effective in preventing adolescent mental and behavioral health problems (e.g., substance use; Hummel et al., 2013), researchers may want to consider evaluating and, if efficacious, implementing family-centered or parenting interventions for the adolescents in primary care. Of the 11 efficacious interventions, five had a parenting component, whereas six targeted youth only. Similarly, of the remaining eight interventions, five had a parenting component, whereas three targeted youth only. The main format of the efficacious interventions included: four which were group or family sessions, three which were online programs with a counseling component (either in the clinic or via follow up telephone calls with health educators), three which had brief clinician counseling followed by booster calls, and one which solely sent written materials over time. For the other interventions: four had counseling or interaction with study staff (e.g., online program in waiting room) during routine visit, two were group or family sessions, and two had brief clinician counseling followed by booster sessions. Hence, there wasn't a large difference in intervention modalities between efficacious and non-efficacious interventions.

One slight difference was that the efficacious interventions consistently had booster sessions or follow up calls, whereas the other interventions were mostly limited to the routine visit. Therefore, primary care is a critical entry point, but is rarely the sole intervention setting for prevention efforts. The clinic may be a good place to screen, refer, and provide brief consultation; however, for real behavior change to occur, the intervention should continue outside the routine visit. Two research questions that should be considered for future work include: 1) What intervention strategies are best suited for primary care samples? and 2) What intervention dosage, outside of the routine visit, is necessary for behavior change to occur? These research questions need to be addressed in conjunction with what clinic involvement is necessary, as discussed below.

4.2. Clinic involvement

Among the efficacious interventions, six were delivered by non-clinic personnel (e.g., social worker, community person), three were partially delivered by clinic personnel during routine visit then followed up by non-clinic personnel or online program over time, and two were delivered only by clinic personnel (outside of routine visit). On the other hand, among the non-efficacious interventions, six were delivered fully by clinic personnel (four during routine visit, two outside of routine visit) and two were delivered by non-clinic personnel. Notably, the only four that delivered the intervention completely during a routine medical visit, which included counseling from clinician (e.g., nurses, physicians, nurse practitioners, and physician assistants) after a brief screening of the target behavioral outcome (e.g., sexually transmitted disease risk), were not efficacious. This is consistent with reports that providers may not have the time or resources to deliver mental and behavioral health services in the context of a short well-child visit (Bitar et al., 2009). One study calculated it would take 7.4 hours a day for a clinician to deliver the prevention services recommended by the

USPSTF, which is impossible to meet and balance with existing demands (Yarnall et al., 2003). Studies have also reported that the way most clinics are organized may not facilitate the full integration of prevention programs, so having accessible off-site programs may best facilitate the clinicians' and families' needs (Huttunen et al., 2011; Prado et al., 2015).

In addition to aforementioned time constraints, this finding suggests clinic personnel may not be adequately trained in mental health counseling (Kuo et al., 2012), despite training efforts by intervention staff. Someone with more intensive mental or behavioral health training, such as a social worker or therapist, may be better suited, compared to a physician or nurse, to deliver the programs to patients with behavioral challenges. Additionally, coordination of care, i.e., clinic personnel introducing the program and then a behavioral health specialist following up, may be best suited for the primary care setting (Croghan and Brown, 2010). The literature has supported the need to integrate behavioral health specialists in primary care clinics (Green and Cifuentes, 2015). Future intervention researchers may want to consider working with clinics which already have a behavioral health specialist co-located in or collaborating with the clinic (Leslie et al., 2016).

A key missing piece in the identified articles is whether the clinic involvement facilitates or hinders program delivery and outcomes: None of the interventions included in this review assessed systematically the clinic's response to program implementation. Qualitative or quantitative research with clinicians could answer: a) How do clinicians respond to the added responsibilities? b) What are the challenges and/or advantages of integrating preventive programs in clinics? c) Does clinic involvement have a direct or indirect effect on desired youth outcomes? and d) How much clinic involvement is needed for intervention efficacy? For example, the Evidence-Based Practice Attitude Scale (Aarons, 2004) could measure whether a clinic with positive attitudes toward evidence-based practice facilitates improved youth outcomes, compared to a clinic with negative attitudes. Further, a trial could test whether outcomes differed for participants who had brief counseling session with a clinician versus participants who had brief counseling session with a clinician plus contact with a trained facilitator outside the routine visit. While our findings for the efficacious interventions were mainly delivered by non-clinic personnel, it is inconclusive as to who is best suited, e.g., a nurse or a community health worker or a collaboration, to deliver the preventive program.

Perhaps the most important research question to consider is: How do interventions with clinic involvement compare, in terms of recruitment, enrollment, engagement, and efficacy, to interventions in settings traditionally used for mental and behavioral health preventive interventions (e.g., schools)? While the average percentage of eligible participants that enrolled in the included trials aligns with the recruitment rates of prevention programs (Heinrichs et al., 2005), a trial which implements the same program in a primary care versus community setting would be a more accurate comparison of enrollment success. Further, of the 19 interventions, one study of an efficacious intervention mentioned, yet did not directly compare in a trial, that the same intervention implemented in a classroom setting demonstrated no prevention effects (Hollis et al., 2005). If interventions in the clinic setting have superior benefits than interventions in other settings, it would capitalize primary care as an opportune setting for mental and behavioral health disorder prevention.

4.3. Limitations

This systematic review was susceptible to certain limitations. First, since we focused on published, peer-reviewed articles, there may be positive outcome bias present in the included articles (Dwan et al., 2008). Secondly, the criterion requiring randomized controlled trials may have excluded feasibility and acceptability studies in primary care settings. Future reviews should gather feasibility and acceptability

outcomes as they may provide valuable insights into the barriers and facilitators of implementing mental or behavioral health interventions in the primary care setting (Cordova et al., 2016). We recognize that randomized controlled trials may not be the only, or most useful, trial methodology in primary care. Several interesting articles were excluded that had community level measures of change (Margolis et al., 2001; Oppenheim et al., 2016), quasi-experimental designs (Harris et al., 2012), and case management as a prevention intervention (Wansink et al., 2015). Others were excluded that utilized a community-centered approach, tailored to the specific needs of the families in the clinic (Malcolm, 2002; Keawkingkeo, 2016). In other words, what works in every day practice or in a specific community may be different from what works in a controlled trial over a limited period of time.

Thirdly, while only including randomized controlled trials diminishes certain threats to internal validity (e.g., random selection of participants into the study), we did not consider post-randomization threats to internal validity (e.g., contamination of subjects or differential attrition in follow up assessments). Fourth, the criterion of children of ages birth to 18 years may have excluded interventions that spanned from adolescence to young adulthood. For example, more substance use preventive interventions could have been captured if this strict criterion were released (e.g., Barroso et al., 2012). Additionally, while we did closely follow PRISMA guidelines for reporting of systematic review (see Supplement 1), we did not report on risk of bias. Lastly, the systematic search resulted in multiple articles for the same intervention. While the authors tried to find all the articles associated with the particular intervention, there may incomplete reporting of the listed interventions.

5. Conclusion

With the individual and societal burden of mental and behavioral health disorders, it is imperative that evidence-based prevention programs reach youth across all developmental stages. Our unique focus on prevention not only aligns with primary care as a de-stigmatized, natural entry point for mental and behavioral health disorder prevention, but also with the wide age-range served in pediatric primary care settings. In this systematic review, we identified and described nineteen interventions across infancy, preschool age, school age, and adolescence. Of the 19 interventions, over half produced health benefits beyond usual primary care. However, there still is a gap in the availability of efficacious prevention programs in primary care, which may be due to important research questions not being addressed (e.g., the effect of clinic involvement on desired intervention outcomes or the benefit of preventive programs in a clinic setting above other settings). The authors encourage primary care providers, mental and behavioral health providers, as well as public health researchers, to fill the gap by developing or adapting, testing, and implementing youth mental and behavioral prevention programs in primary care.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2018.12.009.

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