

# Universal Mental Health Screening in Pediatric Primary Care: A Systematic Review

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**Objective:** Universal mental health screening in pediatric primary care is recommended, but studies report slow uptake and low rates of patient follow-through after referral to specialized services. This review examined possible explanations related to the process of screening, focusing on how parents and youth are engaged, and how providers evaluate and use screening results. **Method:** A narrative synthesis was developed after a systematic review of 3 databases (plus follow-up of citations, expert recommendations, and checks for multiple publications about the same study). Searching identified 1,188 titles, and of these, 186 full-text articles were reviewed. Two authors extracted data from 45 articles meeting inclusion criteria. **Results:** Published studies report few details about how mental health screens were administered, including how clinicians explain their purpose or confidentiality, or whether help was provided for language, literacy, or disability problems. Although they were not addressed directly in the studies reviewed, uptake and detection rates appeared to vary with means of administration. Screening framed as universal, confidential, and intended to optimize attention to patient concerns increased acceptability. Studies said little about how providers were taught to explore screen results. Screening increased referrals, but many still followed negative screens, in some cases because of parent concerns apparently not reflected by screen results but possibly stemming from screen-prompted discussions. **Conclusions:** Little research has addressed the process of engaging patients in mental health screening in pediatric primary care or how clinicians can best use screening results. The literature does offer suggestions for better clinical practice and research that may lead to improvements in uptake and outcome. *J. Am. Acad. Child Adolesc. Psychiatry*, 2013;52(11):1134–1147. **Key Words:** mental health, patient engagement, pediatrics, primary care, screening

Much evidence points to a gap between the prevalence of child and adolescent mental health problems and the amount and timeliness of treatment received.<sup>1,2</sup> Universal screening in pediatric primary care has been proposed as a way to detect and systematically address mental health care needs. Screening and initial treatment of mental health problems are recommended by the American Academy of Pediatrics' Task Force on Mental Health, and the

US Preventive Services Task Force recommends screening for adolescent depression.<sup>3,4</sup> The 2010 Patient Protection and Affordable Care Act mandates that commercial health plans offer depression screening,<sup>5</sup> and Medicaid's Early and Periodic, Screening, Diagnosis, and Testing (EPSDT) requires mental health assessment of all covered children.<sup>6</sup> However, to date, screening remains far from universal,<sup>7-9</sup> and mental health service follow-up rates after a positive result are reported to be low.<sup>10-12</sup> Although there are many potential explanations for these disappointing results, including difficulty coordinating with other screening initiatives,<sup>13</sup> the mechanics of and compensation for administration,<sup>14,15</sup> and limited availability of follow-up treatment,<sup>15-18</sup> other explanations may involve how screening has been implemented.



This article is discussed in an editorial by Dr. Michael S. Jellinek on page 1131.



Clinical guidance is available at the end of this article.



Supplemental material cited in this article is available online.

One set of potential difficulties with implementation centers on how screens are presented to youth and families. Universal mental health screening addresses conditions that are particularly stigmatized and subject to cultural variation in symptomatology, threshold for treatment, and even legitimacy as diagnostic entities.<sup>19</sup> The appropriateness of mental health screening in general medical settings may not be universally accepted by patients or even providers. In mental health screening, respondents must actively collaborate to disclose potentially sensitive information,<sup>20</sup> and must decide whether what they are experiencing matches the questions and response categories on the screener.<sup>21,22</sup> Ultimately, respondents can credibly assert the existence of a problem even if the screen does not detect it, or vice versa.

A second set of potential difficulties relates to the way in which initial screening results are used by front-line clinicians. Screening programs choose their initial tests and cut-points to balance the risk of missing cases with the burden (on both clinicians and patients) of subsequent assessments needed to confirm a diagnosis.<sup>23</sup> Programs normally include plans for these subsequent assessments and figure them into the effort needed for implementation.<sup>24,25</sup> Although many brief instruments have been validated for detecting child mental health conditions,<sup>26-30</sup> their psychometric properties make them unsuitable for use as universal screens without a deliberate follow-up step. For example, the Pediatric Symptom Checklist (PSC), the Strengths and Difficulties Questionnaire (SDQ), and the Patient Health Questionnaire (PHQ) have positive predictive values of 50% or less at the prevalence rates found in well-child visits.<sup>31-34</sup> The PSC and SDQ have negative predictive values of about 90% at well-child visit prevalence rates, so even negative results may need at least brief validation of a child's low-risk status. In addition, broad-band instruments such as the PSC and SDQ yield only a risk of having some disorder, requiring additional steps to refine a working diagnosis before a treatment plan can be developed. The PSC and SDQ have subscales that point toward a particular group of problems, but these distinctions may not be reliable across populations.<sup>30,35</sup>

The purpose of this article is to review the available information about how families and youth are currently engaged in mental health screening programs in primary care, and how providers evaluate and use the information

collected from screens. Improving the fit between screening practices and the nature of mental health screening could be one path toward improving mental health screening outcomes.

## METHOD

### Search Strategy

PubMed, PsycInfo, and EMBASE were searched for studies of universal mental health screening in pediatric primary care in developed countries. A research librarian and an expert in systematic reviews were consulted on database selection and search term development. Terms were identified using each database's controlled vocabulary and other key words within 4 domains: mental health, children, primary care, and screening. Three authors (K.F., L.W., and R.Z.) came to consensus on the final terms for each database. Searches combined these terms using "AND" logic. In addition to the database searches, studies were identified through reviewing citations of key articles. No restrictions were placed on start date; the end date for inclusion was through May 2012. Once a final set of articles had been selected, an additional hand search was made for articles related to the same studies that might contain additional information on the screens or their use.<sup>36</sup>

### Study Selection and Data Abstraction

Three authors (K.F., L.W., and R.Z.) developed selection criteria with a broad view of primary care that also included studies of school-based services and low-acuity services within pediatric emergency departments. A key criterion was that screening was administered systematically to patients attending primary care visits. Psychometric validation studies and epidemiological studies were excluded. Studies of attitudes toward screening were included as long as the participants had actually experienced screening and were not responding to hypothetical scenarios. Studies were excluded if they did not involve children or youth or examined only screening for substance abuse or developmental delay. No exclusions were made based on research design or language. One author (R.Z.) reviewed all titles and abstracts generated through the formal database searches according to these criteria. She then retrieved the full text for the selected articles and formally coded each article for inclusion in the review. In unclear cases, 2 or more authors reviewed the article and reached consensus on whether to include it.

Data abstraction followed PRISMA guidelines.<sup>37</sup> The extraction tool addressed the 2 main potential problems with screening implementation discussed above. To gather information about approaches to engaging patients in the screening process, including addressing concerns about stigma, descriptions were noted of by whom and how screens were presented to

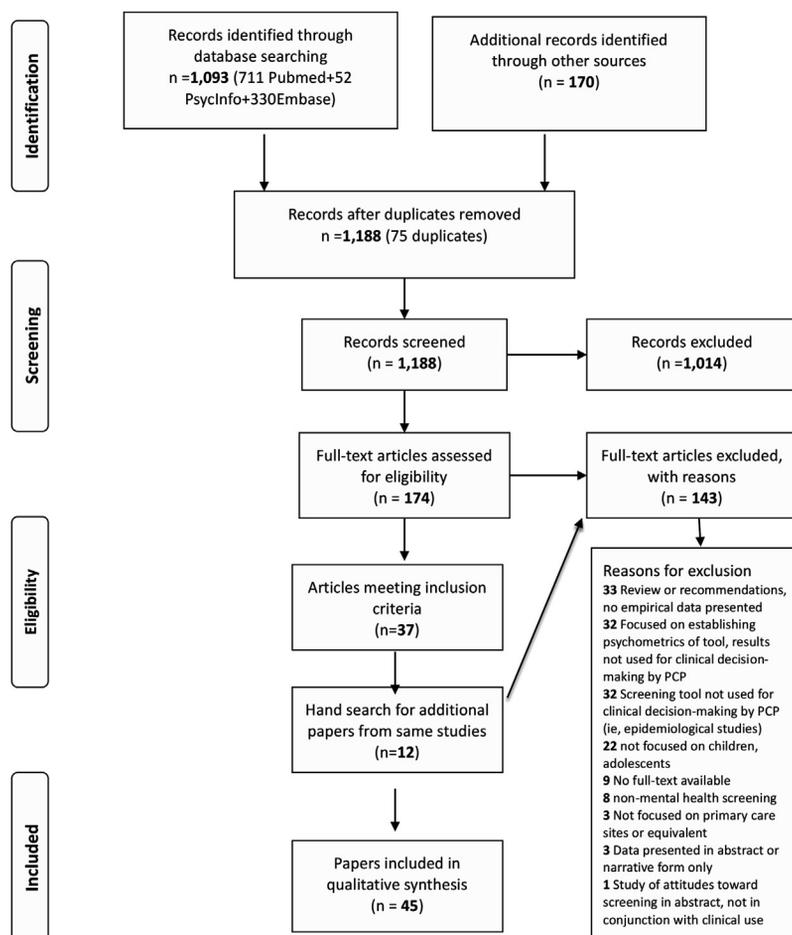
families, if and how issues of confidentiality were discussed, and the type of assistance offered while completing the screener. To gather information about plans for second-stage evaluation of screening results, descriptions were noted of how clinicians were taught or supported in scoring instruments, interpreting results, and using results in clinical decision making. Within these 2 major areas, sub-areas emerged during analysis. When present, data on how the factors studied related to rates of participation in screening or to visit process or outcome were also extracted. Each article was initially abstracted by a single author and then checked by a second author. When a single study was represented by multiple articles, we merged information from the different articles unless it was explicitly stated that methods differed across the elements of interest. No attempt was made to rate the strength of study methods. The heterogeneity of study designs and measures precluded a formal meta-analysis. The results presented here represent a narrative synthesis of the extracted data. The online supplement to this article includes a sample search strategy from 1 of the databases (PubMed)

(Supplement 1, available online), detailed tables (Tables S1 and S2, available online) summarizing abstracted data, and the PRISMA checklist of the search process (Table S3, available online).

## RESULTS

Initial searches produced 1,263 titles of possible relevance (Figure 1). Of these, we screened the 1,188 unique titles and abstracts. Review of these titles and abstracts, plus searches for articles possibly related to those found to be in range, resulted in a preliminary review of 186 full-text articles. The final narrative synthesis included 45 articles describing 38 studies. The most common reasons for exclusion after full-text review were that the article was a review article without original data (n = 33) or an epidemiologic (n = 32) or psychometric (n = 29) study without information about clinical use. The 38 studies synthesized spanned nearly 4 decades from 1976 to 2012, although 31 studies (35 articles)

**FIGURE 1** Literature search flow diagram.



were published between 2002 and 2012. A total of 25 took place in primary care settings, 6 in emergency departments, and 1 entirely and another partly in school-based sites. One study was conducted among children in foster care, and 2 others among children receiving a variety of ambulatory services. One study was a survey of parents who had used primary care services for children with mental health problems, and another compiled state data on primary care mental health screening.<sup>9,38</sup> Of the 36 studies that described a single screening program, 11 involved only screens completed by parents, whereas 22 included screening completed by youth themselves and 3 by either parents or youth, depending on age.

Most ( $n = 21$ ) of the studies were observational, examining either systematic or convenience samples of patients who underwent screening. Nine conducted pre-post comparisons of screening trials or programs.<sup>39-47</sup> Two studies compared different timing of feedback of screening results to providers,<sup>10,48</sup> and 1 study compared screening to providers asking the same questions as part of the visit.<sup>49</sup> One study was part of a randomized trial of depression treatment, but all study participants were similarly screened.<sup>50</sup> Only 1 study randomized parents to complete a screen versus usual care.<sup>51</sup> Table 1 presents a summary of the settings and instruments used.<sup>52-75</sup> Additional details about the populations and data elements extracted are presented in Tables S1 and S2, available online.

### Engaging Parents and Youth in the Screening Process

*Who Presents Screening to Parents and Youth?* Different types of staff were used to introduce and administer mental health screening, but no consensus emerged on who is best suited for this role. There was no evidence that parents or youth were given a choice about who would administer the screening tool. Among studies that did not employ temporary research assistants for the task ( $n = 21$ ), 13 reported screens being introduced by administrative staff (e.g., "front desk personnel") before visits.<sup>8,10-12,32,40,44,48,57,61,63-65</sup> Seven reported that screens were given to families by nurses or specially trained aides.<sup>41,47,56,59,60,69,72</sup> One study incorporated screening questions into the prompts given to primary care providers by an electronic medical record system.<sup>46</sup> Only 1 study, in an emergency department, asked families who they thought should best introduce mental health screening to eligible patients. In

that study, respondents believed that screens should be introduced by clinicians, and only after there had been time to build a level of rapport suited to a sensitive topic.<sup>45</sup> In another emergency department study, most youth said they were comfortable with being asked by a nurse about suicidality.<sup>54</sup>

*Explaining the Purpose and Processes of Screening.* Little is described about how the purpose or processes of mental health screening are explained to parents or youth. Examples from the studies include having an appointment clerk tell parents that "optional mental health screening" is available at no cost,<sup>65</sup> having a staff member say that clinicians are interested in how youth are feeling,<sup>50</sup> and saying that a "mood questionnaire" is being given to all new patients.<sup>74</sup> One study told parents the clinic was "including questions about children's emotion and behavior as part of their pediatric visit."<sup>34</sup> In another, a nurse asked parents to complete the socioemotional scales of the Ages and Stages Questionnaire for their child and presented them with a letter (in English or Spanish) explaining its purpose (the contents of the letter are not described in the published report).<sup>56</sup> The most elaborate framing was described in a study conducted in an emergency department.<sup>60</sup> A slide show introduced screening using "adolescents' own words about how a depressed teenager might feel." The slides also described what would happen if a screen were scored positive.

No studies compared the success of different means of explanation; however, parent and youth willingness to be screened varied among studies that presented screening as optional or universal. A study that invited families to complete screening materials online before visits reported that only 9% did so.<sup>64</sup> In a study in which registration staff asked parents if they would be interested in screening, only about 45% accepted.<sup>65</sup> In an emergency department study, nurses or technicians, "at any time during the adolescent patient's assessment," used a laminated pamphlet to describe the purpose of screening and ask for the adolescent's participation; 65% agreed to be screened.<sup>59</sup> In contrast, systematically presenting screening to patients or families as a routine part of health maintenance visits resulted in a higher rate of completion (85%–95%).<sup>11,41,61,62,74</sup> Youth in 1 emergency department study said they preferred universal screening to avoid the feeling of being "targeted" as having a mental health problem.<sup>45</sup>

TABLE 1 Summary of Included Articles and Studies

Study	First Author, Year, Reference	Setting	Instrument	Respondent	Framing to Patient	Youth Confidentiality	Accommodation	Scoring	Second-Stage Evaluation
1	Applegate 2003 <sup>39</sup>	PC	PSC	Parent only	Not stated	Parent only	Not stated	PCP with training	PCP decides
2	Asarnow 2005 <sup>50</sup> ; Asarnow 2009 <sup>52</sup> ; Wells 2012 <sup>53</sup>	PC	Items from CIDI and CES-D	Youth	"Interested in how youth feeling"	Self-administered; no further detail	English only	Study staff	PCP supported by care manager
3	Ballard 2012 <sup>54</sup> ; Horowitz 2010 <sup>55</sup>	ED	SIQ	Youth	Not stated	Self-administered; answers shared if concern for safety	English only	Not stated	On-site MH staff evaluate positives
4	Berger-Jenkins 2012 <sup>40</sup>	PC	Initial question for "concerns" then PSC	Parent	Not stated	Parent only	English and Spanish	Nurse	PCP decides; brief training
5	Briggs 2012 <sup>56</sup>	PC	ASQ-SE	Parent	Letter given to parent	Parent only	English and Spanish, can ask for help	Psychologist	On-site psychologist evaluates positives
6	Chisolm 2008 <sup>57</sup>	PC	Health eTouch	Youth	Not stated	Tablet with safeguards; told clinician will see results	Not stated; literacy a problem	Automatic	Referral information for + items; automatic email to suicide team
7	Chisolm 2009 <sup>10</sup>	PC	Health eTouch	Youth	Not stated	Same as study 6	Not stated	Automatic	Same as Study 6
8	Stevens 2008 <sup>48</sup>	PC	Health eTouch	Youth	Not stated	Same as study 6	Not stated	Automatic	Same as Study 6
9	Gardner 2010 <sup>32</sup>	PC	Health eTouch	Youth	Not stated	Same as study 6	Not stated	Automatic	PCP option to discuss with on-site SW
10	Diamond 2010 <sup>32</sup>	PC	BHS	Youth	Not stated	Not stated	Not stated	Automatic	PCP decides
11	Fein 2010 <sup>59</sup>	ED	BHS	Youth	Pamphlet and slide show explain purpose	Introduction explains limits of confidentiality	English only but could be audio assisted	Automatic	"Routine care" with consult available
12	Pailler 2009 <sup>45,60</sup>	ED	BHS	Youth	Same as study 11	Same as study 11	Same as study 11	Automatic	Same as study 11

TABLE 1 Continued

Study	First Author, Year, Reference	Setting	Instrument	Respondent	Framing to Patient	Youth Confidentiality	Accommodation	Scoring	Second-Stage Evaluation
13	Gall 2000 <sup>61</sup>	School HC	PSC with additional questions	Youth	Not stated	Not stated	Not stated	Not stated	Refer positive screens
14	Garrison 1992 <sup>62</sup>	PC	Custom survey	Parent only	Not stated; asked if willing to share with PCP	Parent only	English and Spanish	PCP	PCP decides
15	Gruttadaro 2011 <sup>38</sup>	PC	N/A	N/A	Parents feel giving screen positive frame	N/A	N/A	N/A	N/A
16	Hacker 2006 <sup>11</sup>	PC	PSC	Parent or youth	Not stated	Youth do in waiting area	Multiple languages	PCP scores	PCPs told to refer + or parent concern
17	Hacker 2009 <sup>12</sup>	PC	PSC	Parent or youth	Not stated	Same as study 16	Multiple languages	PCP scores	Same as Study 16
18	Hartung 2010 <sup>63</sup>	PC	Primary Care MH Screener	Parent	Not stated	Parent only	Parent only	Not scored; item by item review	Training on symptom clusters, follow-up probes
19	Hayutin 2009 <sup>51</sup>	PC and GI clinic	PSC	Parent	Parents given handout about interpretation	Parent only	Not stated	Some parents self-scored	PCP got 5-minute training on interpreting results
20	Horwitz 2008 <sup>64</sup>	PC	CHADIS system	Parent	Not stated	Parent only	Not stated	Automatic	Guidance for + items; PCP's had 30-min training
21	Husky 2011 <sup>65</sup>	PC	DPS-8	Youth	Not stated	Disclosure if danger	Not stated	Automatic	PCP decides
22	Jee 2011 <sup>41</sup>	PC for foster care	SDQ	Youth and foster parents	Not stated	Not stated	English only	Not scored till after visit	Provider reviews items, on-site SW can help
23	Jellinek 1999 <sup>66</sup> ; Wasserman 1999 <sup>67</sup> ; Kelleher 1997 <sup>68</sup>	PC	PSC	Parents	Not stated	Parent only	Not stated	Not stated	PCPs not given results

TABLE 1 Continued

Study	First Author, Year, Reference	Setting	Instrument	Respondent	Framing to Patient	Youth Confidentiality	Accommodation	Scoring	Second-Stage Evaluation
24	John 2007 <sup>69</sup>	Outpatient pediatric clinics	Short Mood and Feeling Questionnaire	Youth	Not stated	Not stated	Not stated	Automatic	Prompts for counseling
25	King 2009 <sup>70</sup>	ED	Multiple	Youth	Not stated	Notify parent if "high risk"	English only	Research staff	Not stated
26	King 2012 <sup>71</sup>	ED	Multiple	Youth	Not stated	Some youth told staff member will review results	English only, reading level <6.1	Research staff	Not stated
27	Kuhlthau 2011 <sup>9</sup>	Multiple (claims data)	Multiple	Parent or youth	Not known	Not known	Not known	Not known	Not known
28	Metz 1976 <sup>72</sup>	PC	Multiphasic visit	Parent	Not known	Parent only	Not known; administered by staff	Clinical staff	PCP given detailed summary after visit
29	Murphy 1996 <sup>42</sup> ; Pagano 1996 <sup>73</sup>	School clinics and PC	PSC with function questions	Parent	Voluntary, reason explained	Parent only	Initially none, then given orally in English or Spanish	Not stated	PCP could refer regardless of score
30	Navon 2001 <sup>34</sup>	PC	PSC	Parent	Desire to include emotions and behavior, voluntary	Parent only	Bilingual research assistant	Research staff	PCP decides, could bring to MDT
31	Olson 2005 <sup>43</sup>	PC	Health Teen Screener	Youth	Not stated	Tablet with safeguards	Not stated	Automatic	2-hr training in interviewing and motivation
32	Olson 2009 <sup>44</sup>	PC	Health Teen Screener	Youth	Not stated	Tablet with safeguards	Not stated	Automatic	Areas of teen readiness to change highlighted
33	Schubiner 1994 <sup>49</sup>	PC	Safe Times Questionnaire	Youth	Learning how adolescents are interviewed	Not stated	Not stated	PCP scores	Training in interviewing, risk categories, psychometrics of screen

TABLE 1 Continued

Study	First Author, Year, Reference	Setting	Instrument	Respondent	Framing to Patient	Youth Confidentiality	Accommodation	Scoring	Second-Stage Evaluation
34	Smith 1990 <sup>74</sup>	PC	STAI, CDI	Youth	Mood questionnaire for all new patients	Not stated	Not stated	Not stated	Received results after initial assessment
35	Williams 2011 <sup>75</sup>	ED	DPS	Youth	Short orientation to computer	Headphones and audio assisted	Audio assisted, English only	Automatic	Managed by on-site SW
36	Wintersteen 2010 <sup>46</sup>	PC	Custom survey, 2 stage, in EMR template	Youth	Part of psychosocial part of visit	Not stated	Not stated	Not applicable	90-min training on response to suicidality; on-site SW for help
37	Zuckerbrot 2006 <sup>8</sup>	PC	Columbia Depression Screen and option to use DISC module	Youth	Not stated	Confidential place to complete	Not stated (front desk staff assisted sometimes)	Part automatic, part PCP	Some PCP training and list of referral resources
38	Rausch 2012 <sup>47</sup>	PC	Columbia Depression Scale	Youth	Not stated	Not stated	English and Spanish instruments	PCP scored	"Brief introduction to adolescent depression" and scoring guide; refer positives

Note: CDI = Children's Depression Inventory; CES-D = Center for Epidemiologic Studies Depression Scale; DPS = Diagnostic Predictive Scales; ED = Emergency Department; EMR = electronic medical record; MH = Mental Health; PC = Primary Care; PCP = Primary Care Provider; PSC = Pediatric Symptom Checklist; SDQ = Strengths and Difficulties Questionnaire; STAI = State-Trait Anxiety Inventory.

*Statements About Confidentiality.* Most studies ( $n = 18$  of 27) in which youth were given screens did not state how confidentiality was explained. Those that did used varying language. Two studies of suicide screening in an emergency department told teens that clinicians and parents would be informed of results that indicated a concern for safety.<sup>55,70</sup> Two studies of more comprehensive screening, 1 in an outpatient setting and 1 in an emergency department, told teens that their results would remain confidential unless there was evidence of danger to self or others, abuse, or significant functional impairment.<sup>60,65</sup> In 4 studies, youth were told explicitly that their health care provider would see the results.<sup>10,32,48,57</sup> One study said only that clinical staff had explained the “standard limits of confidentiality.”<sup>59</sup>

There was evidence that youth valued knowing whether their responses would be confidential. One study of a computerized, broad-band primary care mental health screener for youth 11 to 20 years of age found that a belief that data would remain private and would be used only for health care was positively correlated with satisfaction with use of the screen.<sup>57</sup> In Paillet *et al.*'s emergency department study, youth also said they wanted to know about the extent of confidentiality around their results.<sup>45</sup> Another study found that youth completing a screen on a hand-held device preferred it to paper because they believed it was more likely to preserve the confidentiality of their responses.<sup>44</sup> One study suggested that some youth might change their answers to screens based on who would talk with them about results.<sup>71</sup> Youth from low-income families, when told a research staff member would meet with them to review results, reported, on average, lower scores on a suicide risk instrument than did those who were told they would not have the review. Higher-income youth did not demonstrate this difference, and it is not clear whether the same effect would be seen if the review had involved a nurse, doctor, or social worker.

*Privacy for Youth During Administration.* Providing privacy during the completion of a screen is another aspect of assuring confidentiality and increasing disclosure. Most studies involving youth did not discuss privacy, and 1 study suggested that it could be difficult to assure, at least in an emergency department. In that study, parents gave consent for only 60% of eligible youth to be screened. The second most common reason for parents declining

consent was unwillingness to leave the room while the youth completed the screen.<sup>55</sup> Another emergency department study used computer-assisted administration with headphones, offering the possibility of private responses even though others might be present.<sup>60,75</sup> Three primary care studies offered youth a “confidential space” to complete the screen.<sup>8,65,74</sup> Some studies using computerized screens noted the advantage that responses could no longer be seen once they were entered.<sup>43,76</sup>

*Assistance With Completion.* Little is known about the best strategies for conducting screening in primary care when families come from varying cultural, language, or literacy backgrounds. Eight of the studies reviewed excluded families that did not speak English;<sup>41,50,54,59,70,71,74,75</sup> many others ( $n = 20$ ) did not state the language in which screening was administered. Only 3 studies reported that parents or youth were able to ask for assistance when completing screens,<sup>34,42,56</sup> and 1 computer-administered screen had an option that allowed the respondent to listen to the questions as they were presented.<sup>59,60</sup>

Two studies provided insight into the impact of helping families who have problems with language or literacy. One, which used the PSC with Latino families, found a high rate of incomplete forms when the instrument was self-administered.<sup>42,73</sup> After a switch to oral administration, completion rates improved, and the proportion “positive” increased among parents of children more than 5 years of age (it stayed the same for younger children). The study was not able to determine what about oral administration had been helpful; the authors speculated that overcoming inability to read the written form, greater confidence in disclosing the information verbally, or the ability of the person administering the screen to explain unfamiliar terms, may have contributed. In another study with a high (70%) completion rate and a culturally heterogeneous population (screening forms in 6 languages), language and literacy issues were thought to be among the reasons why some forms were not completed.<sup>12</sup>

*Attitudes Toward Screening and Screening Uptake.* In addition to valuing statements about universal and confidential processes, as noted above, studies found that youth and parents value screening as a means to improve treatment. In 1 study, youth rated screening more highly if they believed that it would help them communicate with their provider and receive better care.<sup>57</sup>

Other reasons for endorsing screening included the hope for better linkage to services<sup>54</sup> and increasing the likelihood of having one's concerns addressed during the visit.<sup>44</sup> In a survey of parents of children with mental health problems, screening was seen by the parents as an opportunity for doctors to signal that mental health problems beyond common concerns such as attention-deficit/hyperactivity disorder (ADHD) were appropriate for discussion in primary care.<sup>38</sup>

### Evaluation and Use of Screening Results

*Scoring Screening Instruments.* Only 6 studies stated or implied that providers were taught how to score the screens used,<sup>8,11,12,39,47,49</sup> and only 1 stated explicitly that providers were taught that a screen could have variable and low predictive values depending on the cut-point used.<sup>8</sup> In 20 studies, screens were scored by a computer, research assistant, or co-located mental health provider.<sup>10,34,40,43-45,48,50,51,56-59,64,65,70-72,75</sup> One study had providers review the screen during the visit but not score it formally until afterward.<sup>41</sup> Another suggested that providers not score the screen at any time, but rather follow up on individual positive items and assess for functional impairment before considering a referral.<sup>63</sup> Several studies did not describe how screens were scored.

*Exploring Initial Screening Results With Families.* The studies reviewed provide little guidance on how providers should explain and confirm screening results with families. Only 2 studies said explicitly that providers were trained either to ask follow-up questions about specific positive answers<sup>63</sup> or to validate the results through further questioning.<sup>8</sup> Some appeared to assume that clinicians would be recommending further care for those with positive screen results.<sup>34,42,47,53,54</sup> One explicitly said that children who scored positive (on the PSC) should be referred to a co-located social worker unless they were already receiving mental health care.<sup>11</sup> Although some providers received a degree of training on diagnosis and management of the conditions targeted in the screens<sup>8,46,49,64</sup> or had some degree of access to a mental health consultant,<sup>11,32,41,56,59</sup> others received only brief instruction,<sup>47</sup> in 1 case as little as a few minutes.<sup>51</sup> Other providers were simply instructed to follow "routine practice" or use results in whatever way they believed was clinically indicated<sup>39,40,59,60,72</sup> or as an "adjunct to their clinical judgment."<sup>34</sup> One study provided more general training in motivational interviewing, patient-centered

counseling, and developing action plans regarding issues that might come up as a result of screening.<sup>43</sup> Three computerized screening systems provided prompts or referral resources keyed to particular positive answers, but except in 1 case<sup>64</sup> there did not appear to be training provided on use of the prompts.<sup>10,32,48,57,69</sup>

*Screening Follow-Up.* Reported referral rates provide some clues to how providers use screening results to make clinical decisions. Whether parents were also asked more generally about mental health concerns influenced the relationship of screening results to follow-up plans. In 1 study, the overall referral rate for children who were PSC positive was 75% versus 5% for children who were negative. However, among children whose parents said they had mental health concerns about their child, referral rates for PSC-positive and -negative children were very similar (94% and 72%, respectively).<sup>11</sup> In a study of adolescents that used a different outcome measure,<sup>10</sup> 16% of those with positive screens had at least 1 mental health visit in the follow-up observation period, compared to 5% of those who screened negative. However, the relationship of receiving follow-up services to a positive screen was seen for depression and suicidal thoughts, but not for substance problems. This study also involved a comparison of youth whose providers received screening results at the time of the visit or after a delay. Receipt of results at the time of the visit led to increased provider rates of recognition of youth mental health problems<sup>48</sup> but not to subsequent differences in service use. Thus, it was not clear whether the difference in use related to increased provider referrals or to screened youth being motivated to seek mental health services. Even youth who screened negative had more use than youth who had not been screened (although the comparison group was not randomized).

Four studies, when viewed together, could suggest that more elaborate screens offering diagnostic support may allow providers to be more discerning about follow-up processes compared to brief screens that yield only an overall risk status. Three studies using the brief PSC reported that about 70% or more of those with a positive result received a referral.<sup>11,42,61</sup> In contrast, in a study using the Depressive Psychopathology Scale (DPS-8; an 84-item computerized instrument covering suicide, social phobia, panic attacks, generalized anxiety, obsessive-compulsive disorder, depression, and substance

abuse),<sup>65</sup> 45% of those positive received a referral. Three of these studies (2 PSC and the DPS-8 study) were carried out in settings with integrated or co-located behavioral health services, although they differed in the age range of the children/youth involved and in whether parents were asked if they had concerns.

Two studies found that although positive screens greatly increased the likelihood of referral, a large proportion of the mental health referrals made from primary care ultimately were for children who had screened negative. In Hacker *et al.*'s study using the PSC,<sup>11</sup> 61% of mental health referrals were for children with negative screens. In the study with youth using the DPS-8,<sup>65</sup> 11 (46%) of the total 24 with mental health follow-up plans were screen negative. Screening may thus prompt parents or youth to provide information during the visit even if they did not reveal it in their responses to the screen itself. In 2 studies using computerized screens with summary reports, screened youth reported that the process had reduced the chance that 1 of their concerns would not be discussed.<sup>43,44</sup> Screening may also prompt providers to ask additional questions (beyond those on the screen) even when they are not explicitly trained to do so. Some providers reported that screening had helped them better plan visits and focus on topics that were most relevant to patients.<sup>32,43,44</sup> In a study that made audio recordings of visits before and after screening was introduced, screening increased the number of discussions of behavioral issues, and this was not related to the screening score.<sup>39</sup> One study randomized providers to use the PSC scored either by parents or by a staff assistant.<sup>51</sup> After the visit, parents reported on the extent to which PSC items had been discussed with their child's doctor. Screening (compared to a nonscreened control group) increased discussions regardless of who scored the PSC, but staff scoring increased the extent to which providers raised topics rather than parents. Parent scoring did not impact the extent to which parents initiated discussions, but it was positively correlated with their satisfaction that PSC-related issues had been sufficiently discussed.

## DISCUSSION

For mental health screening to succeed, respondents must be willing to divulge potentially sensitive information and agree to its meaning and validity. This review found that current use

in primary care, at least as reflected in the contents of published reports, places little emphasis on steps that would make this possible. Published reports give little explanation of how the purpose of screening is explained or what youth are told about who will have access to the information. Assistance with completion or accommodation for language differences, hearing or vision impairment, or limited literacy is not usually described, and there are only inconsistent reports of attention to privacy during the screening process. However, although systematic comparison among studies is not possible, there is some evidence that attention to these factors influences attitudes toward screening and rates of uptake.

The literature also provides little insight into how clinicians evaluate initial screening results and use them to make clinical decisions. Although some programs paired screening with training or facilitated access to consultation and evaluation, the plans described for many assumed either that clinicians already knew what to do with the information or that all patients who screened positive should be referred for evaluation or treatment from a specialist. Only 2 articles said explicitly that the psychometrics of the screens that they used had been explained to providers, and that providers were trained either to ask follow-up questions or in some way validate the screen results.<sup>8,63</sup> In the absence of skills to interpret results, and especially when using instruments that do not explicitly help differentiate among possible mental health problems, busy clinicians may opt to refer all positive screens (or cases with parental concerns). Such a policy could overwhelm limited mental health resources with large numbers of appointments, many of which might not be kept. In fact, 1 study noted that the cut-point on its depression screen had to be adjusted upward because primary care and behavioral health providers could not handle the volume of cases being identified.<sup>48</sup> One of the reviewed articles—perhaps because it was evaluating a new instrument—provides a possible model for what providers should know if they are to use existing screening tools. Hartung *et al.*<sup>63</sup> trained providers how to decide when follow-up questions were warranted, suggested general probes to get further information, and underscored that assessing impairment was a necessary step before considering a referral.

Other guidance can be drawn from the studies about possible ways to address problems with

engagement. The few studies that asked found that both patients and providers found screening useful as a way to more efficiently and acceptably initiate discussions of mental health problems and be responsive to patient concerns.<sup>32,38,43,44</sup> The studies reviewed suggest that families and youth are likely to feel positive about screening that is framed as universal, intended to optimize attention to their concerns, and designed to address common but sensitive issues in a thoughtful and confidential manner. As has been found in other settings, computerized screening was well accepted and may prove to be an effective way of efficiently administering screens that offer more decision support, overcome literacy barriers, and create a greater sense of confidentiality.<sup>77,78</sup> Studies of general medical care have also found that youth asked to disclose sensitive concerns are responsive to assurances about confidentiality.<sup>79</sup> These considerations apply not just to screening but also to engaging parents, children, and youth in any service to which they are subsequently referred.<sup>38,45</sup> Mental health problems can be chronic or recur across the lifespan, and negative experiences may make an individual reluctant to seek services when they are needed at a time in the future.

All of our observations regarding the relationship of engagement and evaluation to screening uptake or follow-up are best taken as jumping-off points for further study; we did not conduct a formal meta-analysis, and none of the studies reviewed were designed to explore these issues. The scanty information provided in most studies about engagement and evaluation steps does not necessarily mean that they were neglected by investigators, but could reflect a form of publication bias. Investigators or editors may see these details as unrelated to outcomes and thus less important to report than other study details. In addition, the inclusion of studies from school and low-acuity emergency settings goes beyond the usual definition of primary care, although it reflects the ways in which many children and youth receive general medical services. The strongest conclusion that can be drawn from this review is that the existing literature on pediatric mental health screening processes for patient engagement and provider use is very limited. Key issues such as how to present screeners in ways that are not potentially damaging to therapeutic relationships (e.g., intrusive, culturally inappropriate,

not confidential), or how to help providers make valid use of screening results, have not received systematic study.

The large number of screen-negative children referred in some studies poses an important question for planning follow-up services. We do not know whether these referrals represent false-negative results (which could be caused by failure to disclose information on the screen itself, a misadjustment of the cut-off point, or the overall process prompting disclosure of concerns not covered on the screen), or, less optimistically, an oversensitization to mental health concerns prompted by using the screen. New research on mental health screening in primary care should at the very least provide details about how screening is framed to patients and how providers are taught to use results; ideally it should study variations in these aspects of the process within the context of a clear vision of the clinical goals desired. ☺



### Clinical Guidance

- The literature suggests that screening can have a positive effect on parent, youth, and primary care provider willingness to discuss mental health issues.
- There is a suggestion in published studies that parents and youth favor screening that is framed as universal, confidential, and designed to improve communication with their primary care provider, but there remain many questions about how screening can best be presented in primary care settings.
- Screening may have unpredictable and potentially undesired impacts for patients and systems in the absence of support for clinical decision making, first-line treatment, and linkage to specialty care. Factors that promote effective screening—attention to informing patients about clinical goals, using accessible terms, and discussing confidentiality—are also important aspects of any care that is subsequently offered.
- Mental health professionals working with primary care providers may want to inquire about the extent to which their colleagues have been trained to interpret screening results. If asked for informal or formal consultation based on screening findings (positive or negative), it could be important to ask how the screen was administered, what other information has been gathered, and how the combined information has led to a desire for consultation or referral.

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## SUPPLEMENT 1

### Sample Search Strategy (PubMed)

*Mental Health.* "Mental Health"[majr] OR "mental health"[tiab] OR "mental illness"[tiab] OR "Anxiety Disorders"[Mesh] OR "Anxiety, Separation"[Mesh] OR "Attention Deficit and Disruptive Behavior Disorders"[Mesh] OR "Depressive Disorder/classification"[Mesh] OR "Depressive Disorder/diagnosis"[Mesh] OR "Substance-Related Disorders/classification"[Mesh] OR "Substance-Related Disorders/diagnosis"[Mesh] OR "Self-Injurious Behavior/classification"[Mesh] OR "Self-Injurious Behavior/diagnosis"[Mesh] OR "anxiety"[tiab] OR "depression"[tiab] OR "attention deficit"[tiab])

*Youth.* "Child"[Mesh] OR "Adolescent"[Mesh] OR "Minors"[Mesh] OR "adolescenc\*"[tiab] OR "teen\*"[tiab] OR "youth"[tiab] OR "children"[tiab])

*Primary care.* Primary Health Care"[Mesh] OR "Adolescent Medicine"[Mesh]) OR "General Practice"[Mesh] OR "Pediatrics"[Mesh] OR "General Practitioners"[Mesh] OR "Physicians,

Family"[Mesh] OR "Physicians, Primary Care"[Mesh] OR "primary care"[tiab] OR "pediatric\*"[tiab] OR "paediatric\*"[tiab])

*Screening.* "Screen\*"[tiab] OR "mass screening"[MeSH:noexp] OR "questionnaires"[Majr] OR "Risk Assessment"[Mesh:noexp])

Key domains are listed above in bold. Domains were joined using the Boolean operator "AND." Due to the high number of search hits, we added the following exclusion terms to the PubMed search, using the Boolean operator "NOT"

### EXCLUSIONS

NOT ("developmental disabilities"[MeSH] OR "developmental disabilities"[tiab] OR "autism"[tiab] OR "asthma"[MeSH] OR "asthma"[tiab] OR "obesity"[MeSH Terms] OR "obesity"[tiab] OR "chronic pain"[tiab] OR "cancer"[tiab] OR "cardiac"[tiab] OR "diabetes"[tiab] OR "epilepsy"[tiab] OR "infection"[tiab] OR "oral"[tiab] OR "dental"[tiab] OR "allergy"[tiab] OR "hypertension"[tiab] OR "inflammatory bowel disease"[tiab] OR "congenital"[tiab] OR "arthritis"[tiab] OR "musculoskeletal"[tiab])

**TABLE S1** Study Setting, Instruments, Scoring, Follow-Up, and Clinical Impact of Screening

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Applegate 2003 <sup>1</sup>	Residents (4); 52 patients age 6–16 y coming for WCC	PSC with or without parent handout	Residents taught “how to use and score.” Taught about importance of intervention	Resident decides how to use results and handouts	Increased behavioral discussions but not related to PSC score; authors speculated residents did not use screener to identify children needing more intervention	No increase in behavioral interventions from baseline
Asarnow 2005 <sup>2</sup> ; Asarnow 2009 <sup>3</sup> ; Wells 2012 <sup>4</sup>	4,002 youth 13–21 y screened, 418 enrolled and then randomized, range of primary care settings	Set of items for depression/ dysthymia from CIDI and CES-D	Study staff (enrolled patients randomized to usual care or QI intervention for depression)	In QI condition care manager of PhD level clinician supported PCP with evaluation, patient education, treatment, referral; usual care PCPs trained on evaluation and treatment	No difference in satisfaction with mental health care between QI and usual care group	QI group patients had fewer depression symptoms at follow-up
Ballard 2012 <sup>5</sup> ; Horowitz 2010 <sup>6</sup>	Convenience sample of 156 ED ages 10–21 y	15 or 30 item version of Suicidal Ideation Questionnaire	Not stated	On-site ED psychiatric staff evaluate positive results while patient waits for ED provider	Those requiring psychiatric evaluation did not have longer visits	Not stated
Berger-Jenkins 2012 <sup>7</sup>	229 children 5–12 y in primary care	Initial screening question about concerns; if positive get PSC-17	Nurse scores and puts on chart	Providers introduced to PSC and rationale for scoring; encouraged to use own judgment about results; on-site MH consultant 1 day/week	Increase in chart notes re: MH concerns but no change in proportion with MH diagnosis	Referrals decreased
Briggs 2012 <sup>8</sup>	3,169 children 6–36 mo in primary care	ASQ-SE given a 6-month intervals	Psychologist scores	Positive screens given to co-located psychologist, who consults with PCP about treatment	Not stated	MH intervention reduced subsequent scores
Chisolm <sup>b</sup> 2008 <sup>9</sup>	1,021 youth 11–20 y in primary care	Health eTouch behavioral risk screen (computerized)	Scored electronically, positive results and individual items given to provider	No discussion of provider training or assistance	Not stated	Not applicable

TABLE S1 Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Chisolm <sup>b</sup> 2009 <sup>13</sup>	996 youth 11–20 y in primary care	Health eTouch behavioral risk screen (computerized)	Scored electronically, positive results and individual items given to provider (randomized to get immediate versus delayed)	No discussion of provider training or assistance	Not stated	Increased use of medical and MH services over next 6 mo; positive screen increased depression care (vs. negative screen) but substance care unrelated to screen result
Stevens <sup>b</sup> 2008 <sup>14</sup>	878 youth 11–20 y in primary care	Health eTouch behavioral risk screen (computerized)	Scored electronically, positive results and individual items given to provider (randomized to get immediate versus delayed). Increased cut-off during study when providers “overwhelmed.”	No discussion of provider training	Increased provider recognition of behavioral and substance concerns in immediate vs. delayed results, but even with immediate feedback 45% of youth with concerns missed by PCPs	Not applicable
Gardner <sup>b</sup> 2010 <sup>15</sup>	1,547 youth 11–20 y in primary care	Health eTouch behavioral risk screen; this article focuses on suicide screen, PHQ-A	Scored electronically, positive results and individual items given to provider (usually before visit) and suicide prevention team	PCP not trained; had option of discussing results with family or referring to on-site social worker and suicide prevention team; assistance with scheduling follow-up MH visit	Social workers spoke to 98% of those with SI; PCP role not discussed	65% of those referred for MH follow-up received it in next 6 months
Diamond 2010 <sup>16</sup>	415 youth 12–21 y in primary care	Behavioral Health Screen	Scored electronically, PCP receives printout with scaled scores by domain	Those with behavioral need “referred appropriately;” no discussion of training (though instrument designed to “focus clinical conversations about risk”	Providers thought BHS useful for facilitating visit, planning conduct of visit, guiding follow-up questions	Not applicable

TABLE S1 Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Fein 2010 <sup>17</sup>	857 youth 14–18 y in ED	Behavioral Health Screen-ED	Scored electronically, ED provider receives printout with scaled scores by domain	Clinical staff followed “routine care” which could include SW or psychiatric consult; training not discussed	Increased identification of patients with psychiatric illness	Increased ED-based SW and psychiatric assessments
Pailler 2009 <sup>18,19</sup>	Pilot: Youth 14–18 y in ED, number not stated Interviews pre-pilot: 60 non-acute ED patients 12–18 y and parents	Behavioral Health Screen-ED	Scored electronically, ED provider receives printout with scaled scores	Nurses and ED technicians received on-site training; other ED staff made aware. Providers instructed to “follow their routine care” of positive screens; consultation available. Database of referral resources	Not discussed	Mentions comparison of patient outcomes and referrals before and after implementation but does not provide data
Gall 2000 <sup>20</sup>	383 youth 13–18 y in school-based health center	PSC-Y plus additional questions, including, “Do you have emotional or behavioral problems for which you want help?”	Score recorded in medical record; who scores not stated	No mention of training. Students with positive screen who asked for referral received one. Agreement with MCO to provide referrals	Not discussed	Positive score strongly associated with referral (81% of positives versus 8% of negatives); referral related to later decreased absences and tardiness
Garrison 1992 <sup>21</sup>	1,378 well-child visits to urban primary care clinic and 3 private practices; 327 cases in which parent raised psychosocial concern	1-page bilingual survey with demographics, parent concerns, indication of desire to talk to PCP	Placed in chart after parent completes it; evidently even if parent did not wish to discuss with PCP	No mention of training; in urban setting more often asked patients to return for further discussion; in private practice gave reassurance and guidance	Providers did not address concern in 35% of visits where parent had concern and wanted to talk about it. Parents with fewer concerns more likely to have them discussed	Medicaid families more likely to be referred
Gruttadero 2011 <sup>22</sup>	554 family respondents of Web-based survey of caregivers of children and youth with mental illness	Survey of experiences with primary care providers	Not applicable	Not applicable	Not applicable	Not applicable

TABLE S1 Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Hacker 2006 <sup>23</sup>	1,668 youth 4 y/11 mo to 19 y at well visits in primary care	PSC or PSC-Y plus additional questions about parent concerns	Provider scores once visit has begun	Providers instructed to discuss results with family; make handoff to co-located SW in person. Children who score positive and not already in care, and those negative but parent has concern, are referred, but provider can refer anyone if desired	Not described	Number of MH referrals doubled from year before screening; of those referred, 41% had positive PSC
Hacker 2009 <sup>24</sup>	1,033 youth 4 y/11 mo to 19 y at well visits in primary care who had more than 1 screen over time	PSC or PSC-Y plus additional questions about parent concerns	Provider scores once visit has begun	Same as Hacker 2006	Not described	Referral of youth at index visit associated with drop in PSC score at follow-up but not related to whether referral appointment kept
Hartung 2010 <sup>25</sup>	328 children 3–12 y in primary care	Primary Care MH Screener	Instrument not scored—PCP to review items Need impairment to justify referral; no strict cut-off score	PCPs trained: -items matching particular symptom clusters -look for often or very often items -criteria for asking follow-up questions -general probes asking for examples and related functional problems -referral list	Not described (article focuses on psychometrics)	Not described (article focuses on psychometrics)

TABLE S1 Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Hayutin 2009 <sup>26</sup>	174 children aged 4–16 y in primary care and pediatric GI clinic	PSC	Parents randomized (according to their provider) to no screen, to score screen themselves, or to have nurse or medical assistant score	Providers told that purpose of study was to evaluate waiting-room intervention to increase communication about emotional and behavioral problems; providers received 5-min training and written instructions on interpretation of PSC	Screening increased discussion of psychosocial issues among those with higher scores, regardless of who scores; staff scoring associated with more physician initiation of discussion; parent scoring associated with higher ratings of “enough” discussion	No impact of screening on referrals (rate very low)
Horwitz 2008 <sup>27</sup>	376 families of children up to age 8 y scheduled for well care in primary care	“CHADIS” system of multiple (23) screeners on-line plus asking for ranked concerns	Computer scored	30-min session on epidemiology and diagnosis. System includes on-line materials for providers and families.	Too time consuming for provider, better for assistant; not always aware that screening completed; providers did not find on-line material useful	Not applicable
Husky 2011 <sup>28</sup>	483 youth 13–17 y coming for well care in primary care	DPS-8	Computer-generated summary of disorder and total scores	No information about training or preparation of providers, but provider review “privately with adolescent” is recognized as second stage of screen	Not described.	Screening regardless of outcome resulted in more MH and pediatric follow-up, but positive screen more so; doubled proportion thought to need care
Jee 2011 <sup>29</sup>	195 youth 11–17 y in foster care	SDQ	Not formally scored until after visit	Providers review SDQ during visit; training not discussed; SW available to make referrals	Doubled detection rate of social-emotional problems from 27 to 54%	Not known
Jellinek 1999 <sup>30</sup> Wasserman 1999 <sup>31</sup>	21,065 youth aged 4–15 y in primary care practice-based research networks	PSC	Not stated who scores	Training video for practices but details not provided	Not stated, providers did not have access to PSC results	Not stated

TABLE S1 Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Kelleher 1997 <sup>32</sup>	10,250 youth ages 4–15 in primary care practice-based research networks	PSC	Not stated who scores	Training video for practices but details not provided	Not stated and providers did not have access to PSC, but in independent report providers agreed with positive PSC 54% of the time. Agreement more likely if provider identified the patient as their own	Not stated
John 2007 <sup>33</sup>	124 youth 8–18 y selected by nursing students in a variety of ambulatory pediatric settings	Short Mood and Feeling Questionnaire and four additional questions on PDA system (PDA-DSS)	Not stated whether PDA scores instrument	Discussion suggests need for additional training on how to share results with patients and develop therapeutic relationship; PDA-DSS does include some teaching and “counseling interventions”	Not stated	Not stated
King 2009 <sup>34</sup>	295 youth aged 13–17 y at ED	Multiple instruments for depression, SI, alcohol abuse as initial screen and 4 others for second stage	Screening administered and scored by research staff and informs ED physician	Article focuses on validity and utility vs. prior diagnosis	Not applicable	54% of those positive for SI had come for other reasons (MH and medical); 56 of those positive already in treatment
King 2012 <sup>35</sup>	245 youth aged 13–17 y at ED	Multiple instruments for depression, SI, alcohol abuse	Screening administered and scored by research staff	Article focuses on whether telling youth that a staff member will review the results influences answers	Not applicable	Not applicable
Kuhlthau 2011 <sup>36</sup>	Claims data for Massachusetts Medicaid pre- and postmandatory MH screening in primary care	Not specified	Not specified	Not specified	Not specified	25% increase in number of children with behavioral health evaluations

TABLE S1 Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Metz 1976 <sup>37</sup>	983 youth 4–16 y in primary care	“Multiphasic” visit addressing several aspects of psychosocial and developmental risk	All instruments administered by aides and scored	PCP provided with summary of results listing past diagnoses, test failures, parent concerns but since PCP visit not on same day not clear if there is additional contact; follow-up at PCP discretion; supplementary counseling available	PCPs said it was useful	4% of screen patients were “new cases” (57% of those identified as at risk)
Murphy 1996 <sup>38</sup>	379 youth 6–16 y at school-based and neighborhood primary health care centers	PSC with additional questions about function, mental health care, demographics	Not specified	Not specified but PCPs could refer youth regardless of score; additional question about function included on form but use not stated	37% of those positive not referred (reasons not known but 36% of not referred positives had prior care)	Referrals for mental health care increased 6-fold; 69% of referrals had positive screen
Pagano 1996 <sup>39</sup>	117 children 4–5 y at school-based and neighborhood primary care centers	PSC with additional questions about function, mental health care, demographics	Not specified	Questions added to PSC about functioning to help clinicians assess need for referral	Not stated	Parents who believed child needed help or wanted services more likely to be positive (14%) vs. others (1%)
Navon 2001 <sup>40</sup>	570 children and adolescents 2–18 y in urban primary care centers	PSC	Scored by RA	PCP told to use results as “adjunct to their clinical judgment... indicator of need for further services.” Multidisciplinary team meeting at PC site discussed program issues and individual cases. Not clear whether all providers attended	Not stated	Of sub-sample of positives reviewed by team (25), 5 found to be OK, 4/20 with need not previously identified

TABLE S1 Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Olson 2005 <sup>41</sup>	165 adolescents in 6 rural primary care practices	90-item Healthy Teen screener based on GAPS	PCPs involved in screen and follow-up plan development over 4 "PDSA" cycles; in use scored by computer with summary	2-h training on motivational interviewing, goal setting, action plans, patient-centered counseling; authors concluded that more training would have been helpful as would have been handouts	PCPs found it hard to develop action plans except when teen had specific concern; thought it would be better to use action plans for those already engaged; allowed use of time for counseling rather than data gathering	Not applicable
Olson 2009 <sup>42</sup>	1,052 youth 11–19 y in 5 rural primary care practices	90-item Healthy Teen screener based on GAPS (younger and older teen versions)	Computer scores; PCP can see printed report or scan all answers electronically	PCPs involved in development had role in deciding about cut-offs; otherwise training not specified. Part of screener assesses teen readiness to change; these results highlighted for PCP	PCPs found screen helped target most at risk and those interested in change; helped better use time in visit, though trouble if too many risks presented at once and forced to prioritize	Not applicable
Schubiner 1994 <sup>43</sup>	152 youth/young adults, 14–23 y, in primary care	Safe Times Questionnaire	In intervention arm PCP reviews and scores screen	Training on preventive health screening and general guidelines for interviewing and health education, use of mnemonic to remember risk categories, psychometrics of screener	Videotape assessment compared visits with and without screener: screener visits shorter by 4 min (less time in assessment) but no increase in information time	Not applicable

**TABLE S1** Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Smith 1990 <sup>44</sup>	205 youth 10–17 y; urban hospital primary care clinic	STAI, CDI	Not stated who scores instrument	Providers had to assess patient and develop provision diagnosis before receiving screening results; use unexpectedly positive screen to explore psychosocial history. MH assessment available in clinic.	15% of patients had elevated screens but were not identified as having MH problem by PCP	Not applicable
Williams 2011 <sup>45</sup>	399 youth 4–18 y coming to ED	DPS	Computer scored	ED physicians not involved unless “urgent mental health concern” detected; in that case facilitated a referral. On-site SW	≥97% of nurse and physician providers not bothered by screening	Not applicable
Wintersteen 2010 <sup>46</sup>	1,415 youth 12–18 y in 3 urban primary care clinics	Two stage screen with total 8 questions	Not formally scored; questions asked as part of PCP’s interview of patient	90-min training on youth suicide, including epidemiology, risk and protective factors, assessment, management. SW in clinic to make referrals	Increased 3-fold rate of inquiry about SI; increased rate of identifying SI	Increased rate of referral to MH
Zuckerbrot 2006 <sup>47</sup>	734 youth 13–17 y at health maintenance visit or sick visit at suburban primary care practice	Columbia Depression Scale and depression module of DISC-IV as optional second stage	DISC is computer scored; Providers scored CDS. Providers taught how to use instruments and cut-offs; training included discussion of predictive values at various cut-off values	Clinicians “educated” about adolescent and how use score in combination of assessment of positive symptoms; had option to use clinical interview or DISC as second-stage screen; also received list of referral resources	Providers reported low burden to use CDS but DISC harder; interested in continuing use of CDS but mixed opinions of DISC; overall more comfortable assessing depression; CDS helpful for opening discussion	Not applicable

TABLE S1 Continued

First Author, Year, and Reference <sup>a</sup>	Setting and Population	Instrument	Who Scores and Training in Scoring	Follow-up to Screen and Training or Assistance With Follow-up	Impact on Visit	Impact on Referrals and Use
Rausch 2012 <sup>48</sup>	636 youth mean age 16.6 y seen in 3 primary care practices	CDS	Reviewed and scored by provider. Separate scoring sheet indicated cutoffs and had checkbox for suicidality or need for emergency treatment	Providers and support staff got "brief introduction" to adolescent depression, instrument; consider referral is any current or previous suicidal thoughts, score above cut-off, or other concern	Providers reported higher level of confidence for identifying and managing depression and believed youth had greater comfort level; 37% of providers thought too burdensome for sick visit	12.6% of those screened received referral for mental health service; did not seem to be an increase from pre-screening, but not measured

*Note:* Note: CDI = Children's Depression Inventory; CDS = Columbia Depression Scale; CES-D = Center for Epidemiologic Studies Depression Scale; DISC = Diagnostic Interview Schedule for Children; DPS = Diagnostic Predictive Scales; ED = Emergency Department; exam = examining; MH = Mental Health; PC = Primary Care; PCP = Primary Care Provider; PDA = personal digital assistant; PDA-DSS = personal digital assistant-based decision support system; PSC = Pediatric Symptom Checklist; SDQ = Strengths and Difficulties Questionnaire; STAI = State-Trait Anxiety Inventory.

<sup>a</sup>List of articles in alphabetical order by first author except where a series of articles discussed distinct studies carried out by the same group.

<sup>b</sup>Involve similar populations using the same electronic screening system. An article describing the system but not reporting on a particular study (Julian 2007<sup>10</sup>) describes features related to confidentiality during administration and decision assistance for the primary care provider (suggested preventive services and referrals, real-time monitoring of results by a suicide prevention team) that are not mentioned in the reports of the 4 studies. In addition, Stevens 2009<sup>11</sup> describes a trial of enhanced telephone follow-up of a subset of youth who screened positive using the system, and Stevens 2010<sup>12</sup> describes readiness to change among a subset who screened positive for substance use. Neither of these articles provides additional details relevant to the focus of the review.

**TABLE S2** Aspects of Screening Engagement

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
Applegate 2003 <sup>1</sup>	In waiting room (recruited and consented by RA)	Not stated	No change in parent satisfaction pre–post intervention	Parents only	Not applicable	Not applicable	Not stated
Asarnow 2005 <sup>2</sup> ; Asarnow 2009 <sup>3</sup> ; Wells 2012 <sup>4</sup>	RA obtained consent from parent and youth	“Interested in how youth feeling;” important to talk to provider about difficulties including stress or depression	Not stated	Self-administered by youth	Not stated	13% declined screen	Limited to English
Ballard 2012 <sup>5</sup> ; Horowitz 2010 <sup>6</sup>	Approached by study staff member in ED but completed in exam room	Not directly stated but included desire to screen for suicidal ideation	Most youth thought it “OK.” Some felt relief. Minority reported stress. Wanted providers to understand them better, identify risk, prevent harm, connect with resources	Youth administered screen alone in exam room	Youth told that answers would be shared with clinician and parents would be notified if concern for safety	Parents could decide if medical patients would be screened; overall accept rate 60%; reasons for decline included parent not wanting to leave room, too young to be asked about suicide, too ill to be asked	Excluded developmental delay and non-English speakers
Berger-Jenkins 2012 <sup>7</sup>	Given screen by front desk personnel at well visits	Not directly stated; screener asked a first question about concerns for behavior, mood, or learning	Not studied	Parents only	Not applicable	One-third of eligible parents completed at least first surveillance question; reasons for not completing unknown	PSC in English and Spanish
Briggs 2012 <sup>8</sup>	Nursing staff gave screener to parents in exam room	Letter provided reviewing purpose of screening (details not stated)	Not studied	Parents only	Not applicable	64% of eligible children screened at least once (reasons not known)	Screens in English and Spanish, family could ask for help with completion

TABLE S2 Continued

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
Chisolm 2008 <sup>9</sup>	Adolescents invited by clinic registration or research staff but parents had to provide consent if <18 y old; completed on tablet in waiting room	Not stated	Perceived usefulness and trust were positively related to youth satisfaction	Youth responds on tablet in waiting area	Told clinician would see results	Acceptance rate not stated; 9% did not complete after they had started	Not stated, but literacy issues stated as 1 of the reasons for non-participation
Chisolm 2009 <sup>13</sup>	Completed screen in waiting room, how approached not stated	Not stated	Not studied	Youth responds on tablet in waiting area	Told clinician would see results	25% of eligible population screened	Not stated
Stevens 2008 <sup>14</sup>	Approached by registration or research staff	Not stated	Not studied	Youth responds on tablet in waiting area	Told clinician would see results	Recruitment rate for registration staff not known; ranged from 60% to 95% among 3 RAs	Not stated
Gardner 2010 <sup>15</sup>	Approached by registration or research staff	Not stated	Not stated	Youth responds on tablet in waiting area	Told clinician would see results	Recruitment rate for registration staff not known; ranged from 60% to 95% among 3 RAs	Not stated
Diamond 2010 <sup>16</sup>	Recruited by research staff	Not stated	Sub-sample of adolescent responders thought it helped during appointment and favored use in future	Youth reply on computer; location not specified	Not stated	Not applicable	Not stated
Fein 2010 <sup>17</sup>	ED nurse or technician asked adolescents after their medical assessment	Used "tri-fold pamphlet" explaining purpose (details not stated) for recruiting then "slide and audio show" explaining rationale	Not studied	Family members "encouraged but not forced" to leave room while youth uses computer	Introduction explains "standard limits of confidentiality"	65% acceptance rate for screening but overall only 33% of eligible screened	Excluded non-English speakers and those with hearing or visual impairment; did offer option of listening to questions via headphones

TABLE S2 Continued

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
Pailler 2009 <sup>18,19</sup>	Presented by ED nurse or technician once patient had initial assessment	Brochure explained screening initiative and bounds on confidentiality (given to family as placed in exam room); introductory slide show provided rationale for screening and reviewed confidentiality	Parents wanted to be involved and give permission; youth did not want screen to interfere with other concerns; wanted provider to be sensitive and wanted to know about confidentiality; screen earlier to avoid "targeting;" wanted more information about meaning of screening results	Conducted in individual patient rooms; option to listen to introduction on headphones; nurses and technicians requested parents to give youth privacy while completing screen; results not printed to patient room	Adolescents could request confidentiality if not a threat to self or others	About 20% of eligible patients screened; slight decrease after nurses not reminded; apparently related mostly to staff issues; proportion of families accepting not stated	Option to use audio assisted administration
Gall 2000 <sup>20</sup>	All youth attending school-based health center asked as part of registration	Not stated	Not studied	Not stated	Not stated	95% agreed to complete screen	Not stated
Garrison 1992 <sup>21</sup>	Given to all parents at well-child visits; not stated by whom	Not stated, but parents are asked if they are willing to discuss results with pediatrician	Not studied	Parent only	Not applicable	Proportion screened fell over time from 95% to 60% (attributed to repeat screening); of those stating concerns, 37% did not wish to discuss with pediatrician	Screen provided in English and Spanish

TABLE S2 Continued

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
Gruttadaro 2011 <sup>22</sup>	Not applicable	Not applicable	Parents believe that asking about MH at well visits helps normalize these concerns and create comfort	Not applicable	Not applicable	Note applicable	Not applicable
Hacker 2006 <sup>23</sup>	Parents and youth completed screen in waiting room, given by registration staff at annual visit	Not stated	In pilot phase parents welcomed use of tool	Youth completed their own screener in waiting area	Not stated	No refusals in pilot phase; 85% of eligible screened in implementation phase; missing forms and literacy issues	Screening instrument in 6 languages; 4% of screens invalid because of excessive missing items
Hacker 2009 <sup>24</sup>	Parents and youth completed screen in waiting room, given by registration staff at annual visit	Not stated	Not studied	Youth completed their own screener in waiting area	Not stated	70% of eligible had initial screening; not provided, literacy, language, lost form issues	Screening instrument in 6 languages
Hartung 2010 <sup>25</sup>	Given to all parents at well visits by receptionist or on indicated basis if parent or provider had MH concern. Completed in waiting or exam room	Not stated	Not studied	Parent only	Not applicable	Not stated	Not stated; reading level grade 8.8
Hayutin 2009 <sup>26</sup>	Parents approached in waiting room by RA	"Study investigating strategies for improving attention to psychosocial issues..." Parents also given information about interpreting scores and told they could raise concerns regardless of score	Not studied	Parent only	Not applicable	80% agreed to be in study	Not described

TABLE S2 Continued

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
Horwitz 2008 <sup>27</sup>	Introductory letter and reminded by phone before visit; online screen completed at home	Not stated	53% thought that answering the questions would be of some help in discussing concerns; 85% somewhat likely to use screen a second time	Parent only	Not applicable	Overall 11% completion rate (range among 3 sites 9%–19%); most did not remember letter, too busy, technical issues	Not stated
Husky 2011 <sup>28</sup>	Parents offered screening when call for appointment; told it is optional but no cost, asked to come early if interested; nurse obtains consent	Not stated		Youth completes computerized screen alone in exam room; results reviewed privately with adolescent but informs parent if MH concern	Confidential except if danger to self or others, abuse, "significant functional impairment"	45% completed screening, with proportion accepting varying over time	Not stated
Jee 2011 <sup>29</sup>	Nurse gave form to youth in exam room while waiting for provider (also to foster parent if present)	Not stated	Not studied	Youth may or may not be alone in exam room	Not stated	92% of eligible completed screen	Limited to English speakers
Jellinek 1999 <sup>30</sup> ; Wasserman 1999 <sup>31</sup>	Parents approached in waiting areas by clinical personnel	Written consent obtained but framing not stated	Not studied	Parent only	Not applicable	97% of forms received for processing complete; rate somewhat higher in middle and higher SES versus lower; overall acceptance rate not known	No exclusion criteria described
Kelleher 1997 <sup>32</sup>	Parents enrolled by clinician	Written consent obtained but framing not stated	Not studied	Parents only	Not applicable	>82% of eligible children participated	No exclusion criteria described

TABLE S2 Continued

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
John 2007 <sup>33</sup>	Nursing students could use the screen in an ambulatory clinical placement; approached child or adolescent	Not stated	Not studied	Not stated	Not stated	One-third of eligible encounters screened; most barriers seemed to be related to nursing student concerns about appropriateness of screening in ED, specialty, or private practice setting and concern about follow-up	Not stated (but most of those screened were Hispanic or African American)
King 2009 <sup>34</sup>	RAs obtained consent from parent	Not stated	Not studied	Youth completed screen alone	Parent and clinician would be notified if screen at "high risk"	61% agreed to participate	Excluded non English speakers
King 2001 <sup>235</sup>	RAs obtained consent from parent	Not stated	Not studied	Youth completed screen alone	Some youth told their results would be reviewed with them by a staff member	Lower income youth less likely to report depression regardless of review status; lower income less likely to report suicidality if told results would be reviewed	Reading level varied from 0.2 to 6.1
Kuhlthau 2011 <sup>36</sup>	Not applicable (article based on Medicaid claims for screening)	Not applicable	Not studied	Not known	Not known	Making screening mandatory for Medicaid-enrolled children increased proportion of visits with screens to 54%	Not known

TABLE S2 Continued

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
Metz 1976 <sup>37</sup>	Screening takes place as part of hour-long "multiphasic health examination" that is separate from subsequent well visit	Not stated	Not studied	Children interviewed alone by an aide without parent if child willing to separate	Not stated	Parents of about half of children identified as "new cases" accepted MH follow-up interview; but three-quarters of parents asking for interview were of children classified as low risk	Not known; tests and scales administered by trained paraprofessionals
Murphy 1996 <sup>38</sup>	Parent asked to fill out screener in waiting room; not stated where screening conducted once items were read aloud to parents and record answers	Described as voluntary	Not studied	Parent only	Not applicable	Based on logs screens administered to 1/3 to 1/2 of eligible parents; 90% of those approached agreed More positive screens when read aloud versus written administration	English and Spanish forms available; during study noted that parents had difficulty with forms so changed to have RA read the forms to all parents
Pagano 1996 <sup>39</sup>	Parent asked to fill out screener in waiting room; not stated where screening conducted once items were read aloud to parents and record answers	Form explained reason for the psychosocial screening study (exact contents not stated in article)	Not stated	Parent only	Parent only	Acceptance rate not known No difference in positive rate by method of administration (paper vs. oral)	English and Spanish forms available; during study noted that parents had difficulty with forms so changed to have RA read the forms to all parents

TABLE S2 Continued

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
Navon 2001 <sup>40</sup>	All patients approached in waiting area by RA	Clinic including questions about children's emotions and behavior as part of their pediatric visit but voluntary; results would be put in child's record	Not studied	Parent only	Not applicable	About 90% agreed to have child screened	Bilingual RA
Olson 2005 <sup>41</sup>	Not stated; used as routine in participating practices	Not stated	Youth said novelty of PDA was engaging and preferred to "being grilled"; reported being candid and said it made it easier to discuss issues	Youth used PDA with small screen and answers that "disappeared" so confidentiality possible even though administered in waiting area	Not stated	Not known	Not stated
Olson 2009 <sup>42</sup>	Given to adolescents during health maintenance visits	Not stated	Youth said screening resulted in their being listened to more carefully, had fewer unexplored concerns, greater belief in confidentiality	Youth used PDA in waiting area as in Olson 2005	Not stated	Not known	Not stated
Schubiner 1994 <sup>43</sup>	Completed before visit	Part of study where purpose stated as learning how adolescents are interviewed	Study compared structured interview with review of the screener: review led to shorter visit and led to more accurate detection of MH problems	Completed in waiting room	Not stated	Not stated (screening part of randomized trial)	Not stated

TABLE S2 Continued

First Author, Year, and Reference <sup>a</sup>	Where and by Whom Screen Is Introduced	How Purpose Is Explained	Parent/Youth Preferences for Framing (if Studied)	Confidentiality Procedures for Youth	Confidentiality Statements to Youth	Acceptance Rate if Available and Applicable	Accommodation for Literacy or Language
Smith 1990 <sup>44</sup>	Consecutive adolescent clinic patients	"Mood questionnaire given to all new patients"	Not studied	Not stated	Not stated	90% of eligible participated; mostly excluded by language	Excluded non-English speakers
Williams 2011 <sup>45</sup>	RAs approached families and obtained consent	Short orientation to computer program; framing not stated	Most parents and children thought screening acceptable but only 61% thought it helpful; minority parents and those whose children had MH problem more likely to find it helpful	Headphones and audio-assisted administration for confidentiality	Not stated	Not stated	Excluded non-English speakers
Wintersteen 2010 <sup>46</sup>	Suicide questions built into EMR psychosocial template	Framed by other questions in psychosocial template	Not studied	Not stated (part of primary care visit)	Not stated (part of primary care visit)	Adding item to EMR increased rate of inquiry from 37% to 82%	Not applicable
Zuckerbrot 2006 <sup>47</sup>	Front desk staff offered initial paper screen to all eligible youth	Not stated (but results suggest that front-desk staff could provide information about process)	Not studied	Taken to confidential space, sealed screen after completion	Not stated	53% of eligible completed screens; reason for most missing not known; few recorded refusals	Follow-up assessment found that front-desk staff needed training on how to respond to patient and parent queries and concerns
36. Rausch 2012 <sup>48</sup>	Given by medical assistant	Not stated	Not studied	Not stated	Not stated	92% of those approached agreed but assistants gave screener to only about 25% of eligible	CDS available in English and Spanish

Note: CDS = Columbia Depression Scale; ED = emergency department; EMR = electronic medical record; exam = examining; MH = mental health; PDA = personal digital assistant; PSC = Pediatric Symptom Checklist; RA = research assistant; SES = socioeconomic status.  
<sup>a</sup>List of studies in alphabetical order by first author except where a series of articles discussed distinct studies carried out by the same group.

**TABLE S3** PRISMA Checklist for Systematic Review

Topic title	Item	Page
Title	1	1134
Abstract		
Structured summary	2	1134
Introduction		
Rationale	3	1134
Objectives	4	1134
Method		
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Information sources	7	1135
Search	8	1135, Supplement 1 (available online)
Study selection	9	1135
Extraction process	10	1135–6
Data items	11	Tables S1, Table S2 (available online)
Bias in individual studies	12	Not assessed
Summary measures	13	Not applicable—narrative review
Synthesis of results	14	Narrative synthesis
Risk of bias across studies	15	Not assessed
Additional analyses	16	Not applicable
Results		
Study selection	17	1136
Study characteristics	18	1136–8, Tables S1, Table S2 (available online)
Risk of bias within studies	19	Not discussed
Results of individual studies	20	Table 1, Tables S1, Table S2 (available online)
Synthesis of results	21	1137–44
Risk of bias across studies	22	Not assessed
Additional analyses	23	Not applicable
Discussion		
Summary of evidence	24	1144–5
Limitations	25	1144–5
Conclusions	26	1144–5
Funding	27	1146

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