Portal to care: general practitioners' decision-making on child and youth mental health problems and the influence of their (lived) experience

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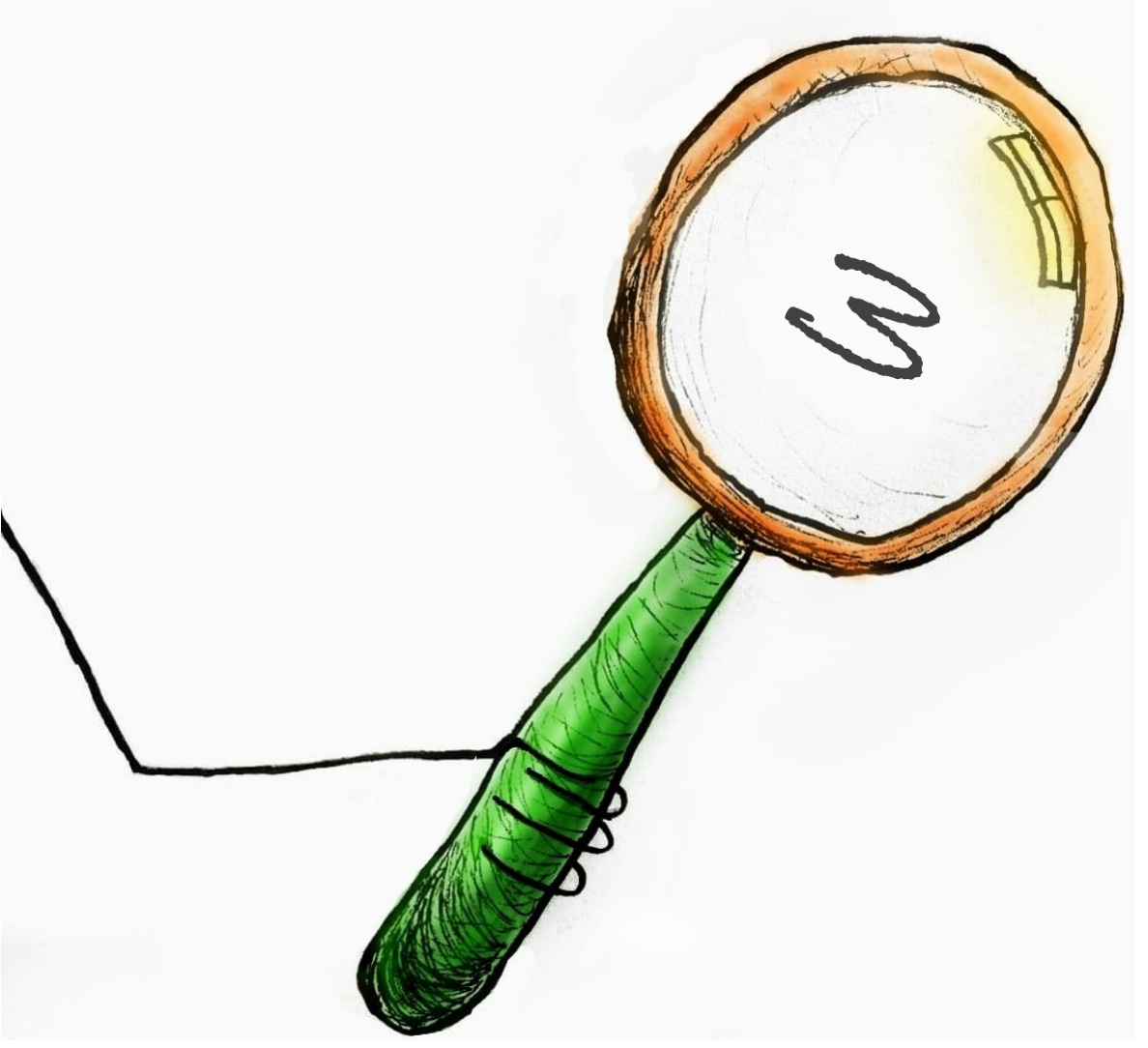

Chapter 3 - Clinical decision support methods for children and youths with mental health disorders in primary care

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Abstract

Background

Mental health disorders among children and youths are common and often have negative consequences for children, youths and families if unrecognized and untreated. With the goal of early recognition, primary care physicians (PCPs) play a significant role in the detection and referral of mental disorders. However, PCPs report several barriers related to confidence, knowledge, and interdisciplinary collaboration. Therefore, initiatives have been taken to assist PCPs in their clinical decision-making through clinical decision support methods (CDSMs).

Objectives

This review aimed to identify CDSMs in the literature and describe their functionalities and quality.

Methods

In this review, a search strategy was performed to access all available studies in PubMed, PsychINFO, Embase, Web Of Science, and COCHRANE using keywords. Studies that involved CDSMs for PCP clinical decision-making regarding psychosocial or psychiatric problems among children and youths (0–24 years old) were included. The search was conducted according to PRISMA-Protocols.

Results

Of 1294 studies identified, 25 were eligible for inclusion and varied in quality. Eighteen CDSMs were described. Fourteen studies described computer-based methods with decision support, focusing on self-help, probable diagnosis, and treatment suggestions. Nine studies described tele-communication methods, which offered support through interdisciplinary (video) calls. Two studies described CDSMs with a combination of components related to the two CDSM categories.

Conclusion

Easy-to-use CDSMs of good quality are valuable for advising PCPs on the detection and referral of children and youths with mental health disorders. However, valid multicenter research on a

combination of computer-based methods and tele-communication is still needed.

Lay summary

Mental health problems among children and youths are common and have impacts, not only on the person affected but also on families and communities. They are often not recognized and acted upon by primary care providers (PCPs), such as general practitioners. This may be due to a lack of confidence in talking to young people or insufficient knowledge about mental health problems. PCPs make decisions about managing or referring these problems to mental health specialists, which can be assisted through clinical decision support methods (CDSM). CDSMs can be divided into electronic and non-electronic. This study provided an overview of both types of CDSMs. We focused on the capabilities of CDSMs and how they help PCPs in their decision-making. More than half of the reviewed CDSMs were electronic CDSMs; several CDSMs involved tele-communication between PCPs and mental health specialists. Two of the CDSMs comprised a combination of components of both types of CDSMs. CDSMs offered patients more information about their health while providing PCPs with suggestions for their decision-making.

Background

Mental health disorders among children and youths are common, as an estimated 10–20% of them experience mental health difficulties (1, 2). All too often, mental health disorders remain underdiagnosed and undertreated (3). A continued disparity exists between the increasing demands for pediatric mental health services and the limited supply of these services, particularly because of a shortage of child and adolescent psychologists and psychiatrists (4-7). To prevent negative long-term consequences for families and economic burdens for communities, accurate and timely detection of mental health disorders and appropriate referrals to youth mental health care are essential (8, 9). One in four 7–12 year olds and four in ten 13–16 year olds who attend primary care have some sort of mental health problem (10). Therefore, primary care providers (PCPs) play an important role in the detection of mental health disorders and referrals to specialist services (10). In most Western countries, general practitioners (GPs) and pediatricians are examples of PCPs (11). Despite their crucial role, PCPs report a profound lack of communication skills with children and adolescents and a lack of confidence and knowledge about mental health difficulties, which negatively affect their clinical decision-making (8, 9, 12). Furthermore, collaborative care between PCPs and specialist child and youth mental health care providers is not satisfactory in terms of interdisciplinary communication and logistic procedures, for example, the quality of provided patient-specific information in referral letters (9).

To improve detection of mental health disorders and referral efficacy, various approaches have been developed to support PCPs in their clinical decision-making, including clinical decision support methods (CDSMs) (8). Currently, no universal definition of CDSM exists. Therefore, this study uses the CDSM definition by Sim et al. (2001): ‘methods that are designed to be a direct aid to clinical decision-making, in which the characteristics of an individual patient are matched to a (computerized) clinical knowledge base and patient-specific assessments or recommendations are then presented to the clinician or the patient for a decision’ (13). Overall, CDSMs are aimed at the clinician analyzing the current condition of the patient and providing support regarding treatment or referral, whereas decision aids are aimed at patients, offering choices regarding medical treatment. However, similar to

decision aids, some CDSMs may encourage patients to participate actively in healthcare decisions (14).

There are remarkable differences between non-computer-based and computer-based CDSMs, although previous research has mainly focused on computer-based CDSMs. One systematic review concluded that there is a need for readily available systems that promote evidence-based practices. These systems should consider regional variations in practice. They should leverage data reuse to generate predictions regarding treatment outcomes and address a broader cluster of clinical disorders. Furthermore, these systems should target primary care practices with limited knowledge and skills regarding child and adolescent psychiatry (8). Research on non-computer-based CDSMs, such as child psychiatry access programs, recommended more investigations on the broad impact of these programs on, for example, patients, families, or health systems instead of more descriptive evaluations focusing on program usage and provider satisfaction (15).

The present systematic review aimed to identify CDSMs for primary care that support clinical decision-making regarding children and youths with mental health disorders. To this end, a distinction was made between non-computer-based and computer-based CDSMs. The objective of this review was to describe the functionalities of CDSMs and their capability to provide diagnostic and referral support. Furthermore, we assessed the content of CDSMs and the quality of the underlying studies.

Methods

Search strategy

To identify all available studies, published between 2009-2021, that have described CDSMs for mental health disorders in children and youths in primary care, PubMed, PsychINFO, Embase, Web Of Science and COCHRANE were searched in August 2021. A combination of the following keywords was used in the search strategy: ‘Efficacy’, ‘clinical decision-making’, ‘support’, ‘triage methods’, ‘general practitioner’, ‘psychiatry’, ‘mental health disorders’, ‘child’, ‘adolescent’, ‘primary care’ and ‘secondary care’. By consensus, LV, VR, and an information expert specifically selected

each keyword and potential synonym. Questions related to keyword selection were discussed with MC. The detailed search strategy is described in the Supplementary Material.

Inclusion and exclusion criteria

Inclusion and exclusion criteria were determined prior to the keyword search. Peer-reviewed studies that described CDSMs for mental health disorders among children and youths (0 to 24 years) were included. By 'CDSM,' the authors mean a method (a procedure, e.g., digital support) that assists PCPs in assessing children and youth with mental health symptoms and in deciding the need for referrals to specialized mental health care, preventive care, or primary care support. The search was limited to publications in English and Dutch. Studies were excluded if the recruited participants were all aged 25 years or older and if the methods used fully consisted of a dichotomous screening instrument (16).

Selection procedure

Titles and abstracts from all identified studies were reviewed by LV and VR based on inclusion eligibility. Based on the inclusion and exclusion criteria described above, titles and abstracts were categorized into 'to include,' 'questionable,' and 'to exclude.' Questions raised with regard to studies labeled as 'questionable' were discussed with MC prior to being labeled as 'to include' or 'to exclude.' For example, there was a discussion about whether some studies fulfilled the criteria for CDSM; that is, the method was more focused on the assessment of mental health problems instead of supporting the decision regarding follow-up care. Full-text studies labeled as 'to include' were read by LV and VR while extracting information as described below. Figure 1 describes a detailed flow-chart concerning the inclusion and exclusion process. The systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-Protocols) (17).

Variables extracted

Based on study methodology as mentioned in previous research., categories of information to be extracted were assembled by LV, VR, and MC by reaching a consensus (8). No efforts were made to

synthesize outcomes because of the variability of the results presented by the studies reviewed. Extracted variables regarding the content of the CDSM were (abbreviated) method name, target population, targeted professionals, goal, content and organization of the method, and phase(s) of clinical decision-making that are supported by the CDSM: diagnosis, assessment of severity, and management (18). We also extracted variables regarding study design: objectives, methods, outcomes on provider (e.g., user satisfaction), patient level (e.g., referral efficacy), measurement moments and study duration, name of intervention, control group characteristics, target group characteristics, number of study participants, gender ratios, and mean ages of patients, as well as results at the provider and patient levels. The quality of the included studies was appraised by LV and VR using the Crowe Critical Appraisal Tool (CCAT), which helps in rating the studies included in a systematic review (19). CCAT helps readers with different levels and types of knowledge to reach similar conclusions about a research paper. The CCAT is one of the few instruments that has undergone both reliability and validity evaluations and is able to appraise different research study designs. The tool has been used broadly in previous research (19-22). The CCAT consists of a 22-item form divided into eight categories—preliminaries, introduction, design, sampling, data collection, ethical matters, results, and discussion of a study—which are scored by readers on a 6-point scale from 0–5. Each study is assigned a score on these categories, and the total score is obtained as a sum of all category scores (ranging from 0 to 40) (23). LV scored all included studies before reaching agreement on scores with VR.

Results

After removal of duplicates, the search strategy yielded 1294 studies across different databases. Some studies were excluded based on eligibility of titles and abstracts. Another set of studies was excluded because they met the exclusion criteria based on reading their full texts. Lastly, we added studies found in the reference lists of some of the included studies. In total, 25 studies describing 18 different CDSMs were included in the review (Figure 1). All studies were written in English or Dutch.

Computer-based decision-support methods (CBDSM)

Of all identified CDSMs, more than half were computer-based decision-support methods (CBDSM) directed at patients 0–75 years old. CBDSMs provided electronic support on (clinical) reasoning for patients and providers (24-37). For patients, these methods provide tools for assessing (future) symptom severity (34-37) and consecutive self-management of their mental health (33). The methods were also used to integrate service users' and practitioners' expertise about mental health to allow shared decision-making (24). Providers were given probability diagnoses following evidence-based algorithms based on routine data (27) and surveys (28, 29, 31, 34-37). Furthermore, some methods offered providers treatment suggestions (24, 25), such as medication management (26, 32) and referral support (25, 35, 36). To achieve this output from the system, specific patient- and provider-related input was necessary. Patient-related input included vital signs and laboratory test results (e.g., body mass index, systolic and diastolic blood pressures, blood lipids, glucose metabolism), as well as questions on a variety of mental health areas (e.g., symptoms, side effects, treatment preferences, adherence, and response) (24, 32, 34-37). Non-medical information, such as social life, finances, and school performance, was also retrieved in some methods (24, 28-31). Provider-related input comprised information in the child's electronic health record (34), health risk questions based on this information, and screening questions following a decision tree (27-31). Most computer-based methods focused on a variety of diagnoses (24, 27-29, 31, 35-37). However, some focused on one specific disorder or symptom, such as autism spectrum disorder (25, 30, 34), attention-deficit/hyperactivity disorder (ADHD) (26), and psychosis (33). More than half of the CBDSMs supported all phases of clinical decision-making, that is, support of diagnostics, assessment of severity, and management (25, 26, 28-31, 34-37). Other methods supported two phases, that is diagnostics and assessment of severity (24, 33) or diagnostics and management (27, 32) (Table 1).

Observational (24, 25, 27-29, 37), comparative (26, 29, 32, 33, 34-36), or validation study designs (30, 31) were used to study the implementation (including clinical and cost effectiveness) or the validation of the CBDSMs. The observational studies found that the CBDSMs were generally appreciated by both patients and care providers, for example, regarding a shared understanding of mental health risks, which facilitated implementation into primary practice (24, 27, 37). However, barriers related to workflow were also reported, such as challenging and confusing access to the method, hardware- and

software-related difficulties, the need for duplication during the transition from paper to the electronic system, and issues regarding computer literacy (24, 25, 27). The comparative studies showed a reduction in psychological distress compared to usual care (35, 36) and an increase in the rate of diagnostic assessments compared to (community) control samples, which resulted in, for example, more prescriptions and visits (26, 28, 32, 34). Furthermore, these studies showed a higher quality of care with respect to ADHD diagnosis (26). The studies reported fewer or no side effects (35, 36) and a reduced weight gain when patients used medication (32). In one study, the use of the CDSM led to an increased PCP understanding of patient mental health compared to an attention-comparison group, in which daily activities were monitored without monitoring mood and stress (33). All validation studies were directed at the Development and Well-Being Assessment (DAWBA). This method showed good test capabilities when compared between groups of low to high risk of autism spectrum disorder or eating disorders, with high sensitivity (88–100%), specificity (85–94%), positive predictive (82–88%), and negative predictive values (90–100%) (30, 31) (Table 2). The average study quality of the CBDSMs was three stars (total score of 30.61), according to the CCAT (24-37). Lower total scores were attributed to poor description of design and sample of the study, whereas higher scores were attributed to a clear description of the data, as well as results and discussion sections (24-37) (Table 3).

Tele-communication methods

Less than half of the identified CDSMs were tele-communication methods targeted at 0–21 year olds. The tele-communication methods consisted of a practice in which PCPs are advised on mental health management through (video) conferences between psychiatrists and patients (38-46). These methods offered patients psychoeducation on medication (45), illness and diagnostic issues, exercise and lifestyle issues (43), and providers recommendations on referral (39, 46). Some tele-communication methods also offered (peer) training for PCPs as part of the method (38-40, 45, 46), face-to-face assessments for patients if necessary (39, 43), and strategies for practice transformation to integrate the tele-communication method (45). All but one method (42) focused on multiple mental disorders at once (38-41, 43-46). In one tele-communication method, there was no contact between psychiatrists and patients, but physicians received advice from psychiatrists on starting dosages of medication based on effect rating scales (42). Almost all tele-communication methods supported all phases of clinical decision-making (38-41, 43-46); one method supported two phases, that is, assessment of severity and management (42) (Table 1).

To investigate the tele-communication methods, almost all the studies used an observational design (38, 39, 43-46). One study used a comparative design (42). The studies showed behavioral improvement of the child compared with a sample of children not participating in the CDSM (42), provider's and patient's satisfaction with the method (44), PCPs' knowledge and confidence regarding mental health disorders (38, 39, 43, 46), and collaborative treatment between PCP and family (39) after implementation of the method. Furthermore, the studies reported alleviation of the gap between youth needing quality behavioral health services and those receiving them (45), improved mental health in a convenience sample over time (41), more psychotropic medication prescriptions compared to a group of PCPs not receiving training for the CDSM (40), and increased psychotherapy, medical behavioral health visits, and guideline congruent medications prescriptions (45) (Table 2). The average CCAT score for the tele-communication methods was two stars (total score of 26.20), with lower scores mainly attributed to description of design and used data, and higher scores attributed to description of results and discussion (38-46) (Table 3).

Combination of CDSMs

Two identified CDSMs were CDSMs consisting of a combination of computer-based decision-support- and tele-communication method-related components. These CDSMs were directed at patients between 16 months of age and patients older than 75 years (47, 48). One CDSM started with an algorithm in the patient's electronic health record, which decided whether the patient health questionnaires were completed (47). If the questionnaires indicated that the patient needed to be referred based on depression symptoms, there was an option for the PCP to have contact with a child and youth mental health care provider on medication prescriptions (47). The other CDSM comprised a screening instrument via the patient's electronic health record, with the possibility of referring the patient to a multidisciplinary team for autism evaluation as part of the method (48). Both CDSMs were directed at one specific disorder (47, 48). The CDSM described by Thompson (2019) supported all phases of clinical decision-making (47). The CDSM described by Campbell (2021) supported two phases: diagnostics and management (48). Thompson's (2019) study used a comparative design with which the effectiveness of screening, referrals, and treatment uptake were measured via analysis of electronic health record data and screening of patients using the Patient Health Questionnaire 2 and 9 (47). The study by Campbell (2021) consisted of a comparative design that implemented process

changes in intervention clinics (48). Comparisons were made between these intervention clinics and community clinics (which only received automatic reminders as part of the process changes), as well as between phases of change (48). Both studies showed an increase in screening and referral rates (47, 48). The average quality of Thompson (2019) and Campbell (2021) was one and two stars (total score of 24.76), respectively, with lower scores attributed to poor descriptions of ethics and higher scores attributed to well-described introduction sections (47, 48) (Table 3).

Discussion

The present literature review aimed to provide a description of the functionalities of CDSMs and their capability to provide diagnostic support and support for management or referral by primary care practitioners (PCP). Furthermore, we examined the content of CDSMs and quality of underlying studies. This review yielded 25 studies describing 18 CDSMs used in primary care.

The majority of the CDSMs were CBDSMs, which provide electronic support on clinical reasoning following an algorithm. These CDSMs assist patients by offering tools for assessing the severity of (future) symptoms and consecutive self-management of their mental health. Moreover, they assist PCPs by offering probability diagnoses and suggestions for further management or referrals. Some functionalities of this category of CDSMs include monitoring tools (33, 37), screening forms (25, 26, 34, 37), a patient registry, a patient encounter scheduler, trial management (27) and (self-)assessment instruments (24, 27, 35, 36) with structured or open-ended questions (28-31). The CBDSMs are directed toward mental health disorders and provide PCPs with advice on diagnosis based on data collected before the consultation.

Less than half of the identified CDSMs were tele-communication methods. Through video conferences between psychiatrists and patients, these methods offer patients psychoeducation on multiple mental health topics. Additionally, these methods advise PCPs on mental health management or referrals. Contrary to CBDSMs, tele-communication methods are used to generate advice on diagnosis and referral based on concerns of the PCP during the consultation. Their functionalities comprise education for PCPs to improve detection of mental health disorders (38-40, 42, 45), referral

support by phone, e-mail and/or video (41, 42, 44-46), and face-to-face evaluations with patients if necessary (38-40, 43, 46). We found two CDSMs that consisted of a combination of CBDSM- and tele-communication method-related components (47, 48).

There are several pros and cons of the identified CDSMs with regard to their usability in the primary care process as well as their relevance for clinical practice. CBDSMs provide the PCP with more information about possible mental health disorders based on electronic health records (34) and, if applicable, a previous consultation, information that can be used to structure the next consultation with the child (32). For some CBDSMs, this notice is based on data from large studies (28). Moreover, children and their parents can have the opportunity to prepare for the consultation, because the CBDSMs stimulates them to think about relevant medical information that may also be discussed with their PCP (32). Another advantage is that no other care providers are involved in using the CDSM, except for the PCP (25). Therefore, the invested time and costs are limited. There are also disadvantages. First, CBDSMs should not be used in urgent situations because input from children and their parents may be quite time-consuming (30). Second, for some patients, computer-based decision support may be difficult to use due to their mental status (32). Third, a set of questions received beforehand may give too much direction to the consultation, which may impede children and their parents from talking about one set of problems more than others (35, 36).
An advantage of tele-communication methods over CBDSMs is their usability during consultation with the child. Therefore, information gathered during the conversation can be used directly for the tele-communication method (41). Furthermore, tele-communication methods provide room to take the context of the child and its problem into account while generating advice on diagnosis and referral, information that might be missed when using predetermined questions (44). A disadvantage of tele- communication methods is that their usage requires time investment from both PCPs and mental health care providers, which also makes them more costly compared to the one-off purchase of CBDSMs (39). CDSMs that consist of CBDSM- and tele-communication method-related components may have a combination of the abovementioned advantages and disadvantages (47, 48).

CBDSMs were directed at 0–75 year olds, tele-communication methods at 0–21 year olds, and a

combination of these CDSMs at 16 months old, as well as patients older than 75 years. Since this is a broad age range, it should be noted that the applicability of individual CDSMs differs by age category. For example, younger children should be assisted by their parent and/or caregiver while providing information for a CDSM. By contrast, adolescents may be capable of providing information without any help, depending on their age and capability of self-determination (28-31). Therefore, PCPs should be aware of national care regulations with regard to the self-determination of young people (49).

The quality of the underlying studies of CDSMs was variable. Compared to studies describing tele-communication methods, studies describing CBDSMs had a higher quality, that is, with regard to description of the data. The aims of the studies describing CBDSMs were to describe the functional capabilities of the CDSM (27), to validate the CDSM (28, 30, 31), to describe PCP user satisfaction regarding the CDSM (24, 33, 37), to compare care with the CDSM and care without the CDSM with respect to screening rates (34) and cost-effectiveness (35, 36). Furthermore, these studies assessed the impact of the CDSM on the patient's view of their own life and health (24, 32) and explored the effect of using a CDSM on PCP's knowledge, beliefs, and self-reported practice regarding mental health disorders (25). The aims of studies on tele-communication methods included a description of the impact of CDSMs on care (e.g., medication prescriptions, treatment plans) (33, 40, 42) and costs (45), effectiveness of detection of mental health disorders (39), PCP-reported satisfaction with the CDSM, and PCP's knowledge and confidence regarding mental health disorders (38, 39, 44-46). It is notable that almost all the studies on tele-communication had an observational study design, implying a need for more comparative research designs (38 39, 43-46). Studies describing CDSMs consisting of a combination of both CDSM types were of low average quality. These studies aimed to analyze the effectiveness of screening, referrals, and treatment uptake of the CDSM, as well as to assess quality improvement related to screening and referrals while implementing process changes (47, 48).

There were a few studies with outcomes specifically directed at ensuring accurate and timely detection of mental health disorders and appropriate referral, mentioned earlier as essential factors for preventing the long-term consequences of mental health disorders in children and youths (8, 9). Two studies showed an increased rate of diagnostic assessments (26, 47), while other studies reported more medication visits and prescriptions (32, 40, 42, 45). These findings raise discussion about the possible

overdiagnosis and overtreatment of mental health disorders due to the usage of CDSMs. Earlier research has confirmed overdiagnosis and overtreatment in children and youths with ADHD (50). However, improved detection of these mental disorders may counteract the underdiagnosis and undertreatment that also exists in this population.

Strengths and limitations

This study has several limitations. First, it was difficult to compare the different studies due to differences in quality, study designs, and outcome measures. Second, some identified CDSMs were directed at a broad age range, including those of 25 years and older, and had generic output (e.g., self-reported medication visits and vital signs). Therefore, it was not always clear how these CDSMs could be beneficial for children and youths specifically. Third, in some studies it was unclear whether they included also children and youths. However, these studies were included because it was plausible studied CDSMs were directed at adults, children and youths. Fourth, most studies originated from the United States of America (USA) (25, 26, 32-34, 38, 40, 41, 43, 45-48), the United Kingdom (UK) (24, 28-31), and Australia (35-37), which indicates that region-specific healthcare regulations must be taken into account while interpreting the review results. The health systems of the USA, the UK, and Australia are similar in many ways. In these countries, GPs or primary care pediatricians can be

approached for first-contact medical care. However, there are also notable differences, such as the 'gatekeeper' role for GPs in the UK and Australia (51-53). Furthermore, in the USA, access to mental health care can be inadequate, with more than 5000 mental health professionals in shortage areas, mostly situated in rural areas (54). The aforementioned factors influence which CDSMs are suitable for a particular general practice setting. For example, computerized CDSMs might be more suitable if a GP is the only point of entry for care by a specialist, while tele-communication methods might be more appropriate in regions with a shortage of and longer traveling distance to mental health professionals.

This study also has strengths. First, to include relevant studies, the authors used a priori inclusion and exclusion criteria. Second, to minimize errors in the selection and reading process, there were two searchers and readers of studies. Third, this study provides an overview of different types of CDSMs, which may be useful for PCPs with tight schedules, such as GPs. To the best of our knowledge, no current scientific literature provides such an overview.

Conclusion

To assist PCPs in early detection and management of mental health disorders among children and youths, easy to use CDSMs of good quality are needed which can provide advice on management or referral (8, 9, 12). Based on the current review, methods consisting of a combination of CBDSMs and tele-communication methods are advised. While this advice applies to healthcare systems in which there are sufficient resources and care providers, it does not apply to healthcare systems in which there are shortages and where choices have to be made regarding care provision; that is, where CDSMs may be used as an aid for triage. In these systems, clinical assessments of experts in the context of tele-communication methods may be restricted to 'severe' cases, as graded by an electronic system as part of a CBDSM. Electronic systems may be used by PCPs in 'mild' and 'moderate' cases without further clinical assessment by an expert in secondary mental health care. As for future research, we suggest more comparative multicenter studies (e.g., with a prospective cohort design) on a combination of CBDSMs with tele-communication methods in different health systems and different degrees of

problem severity. These combined methods may consist of existing or newly researched CDSMs. Identified CDSMs that support multiple phases of clinical decision-making should have priority in future efforts.

Declaration

Ethics: The systematic review was in accordance with the Declaration of Helsinki.

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Conflict of interest: None.

Data availability statement: The data underlying this article are available in the article and in its online supplementary material.

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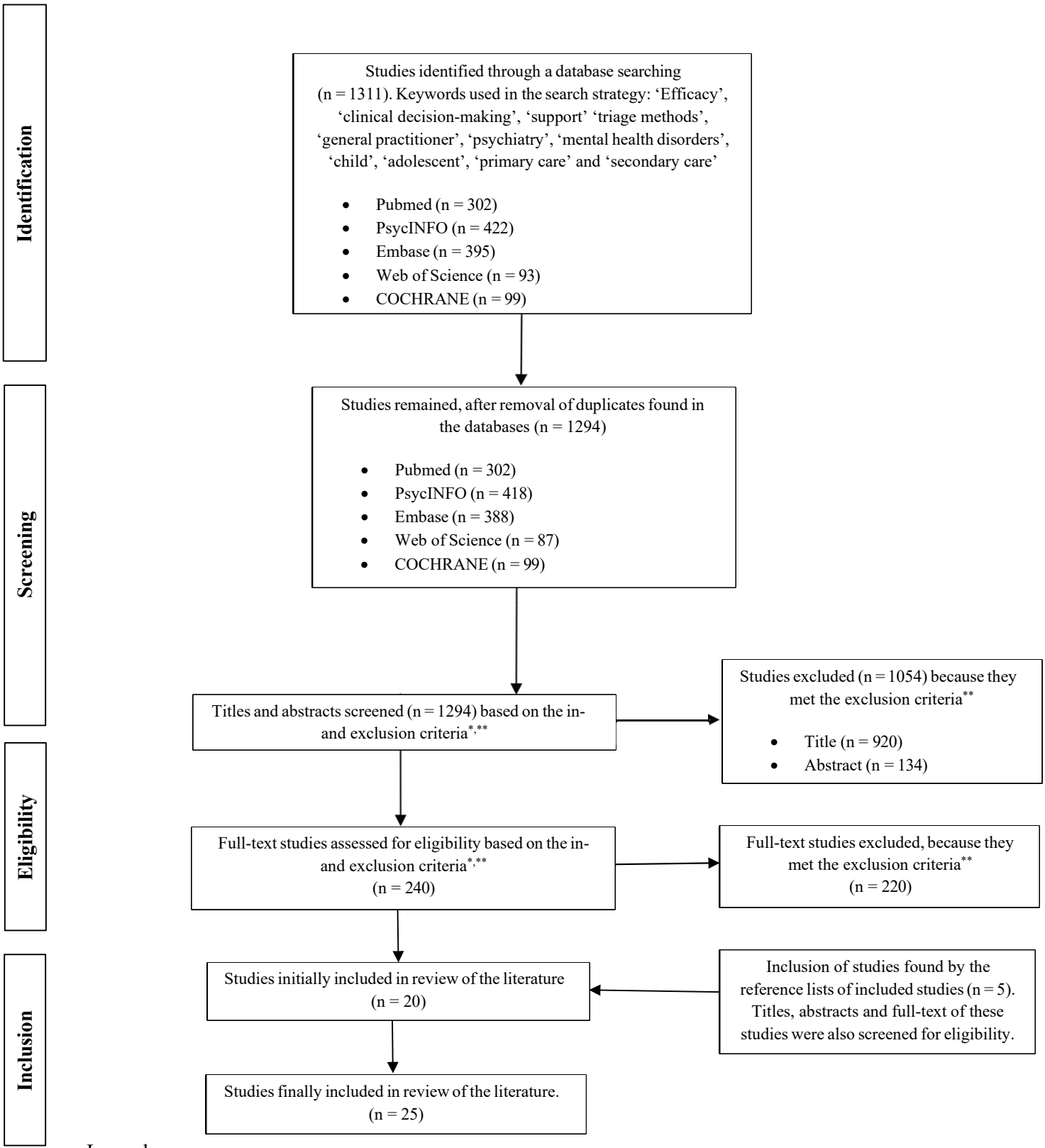
Figure 1: flowchart regarding selection of literature, 1294 studies published in 2009-2021



Legend

* Peer-reviewed studies that described CDSMs for mental health disorders among children and youths were included.

** Studies were excluded if the recruited participants were all aged 25 years or older and if the methods used fully consisted of a dichotomous screening instrument.

Table 1: Functionalities and content of clinical decision-support methods described in the included studies (N=25)

Study (authors, year)	Name	Target	Target children/youth	Targeted professionals	Goal	Content	Organization	CDM-phase(s) which CDSM supports*
Buckingham (2015)	MyGRaCE	Mental health (in general), associated risks of suicide, self-harm, harm to others, self-neglect, and vulnerability	Children/young persons who comply to criteria of targeted disorder(s)	Practitioners, type n.e.m.i.t.	To help service users assess and manage their own mental health collaboratively with practitioners	Decision support system which integrates service user and practitioner expertise about a variety of mental health areas. Data is collected as the service user answers questions based on a tree structure. Usage by practitioners requires a training workshop	Computer based decision-support methods	Diagnosis, assessment of severity
Bauer (2015)	Child Health Improvement through Computer Automation (CHICA) – ASD-module	Autism Spectrum Disorder (ASD)	Children of 18 years or younger with risk of ASD	PCPs	To improve management of ASD	Computer decision support system promoting adherence to clinical guidelines. It is designed to automate various aspects of preventive care and chronic disease management in the busy workflow of pediatric practice. CHICA produces a pre-screener form containing 20 health risk questions selected based on information in the child's EHR, which is completed by the parent or child (>12 years) prior to seeing the PCP. The form is scanned, after which a physician worksheet is generated which contains 6 prompts to guide PCP decision-making. Added ASD-module consists of validated screening questions specifically for ASD and it provides referral support	Computer decision support system and electronic health record (EHR)	Diagnosis, assessment of severity and management**
Downs (2019)	See Bauer (2015) – ASD module	Autism spectrum disorder (ASD)	Children aged 18 to 24 months	Pediatricians	To screen for autism spectrum disorders	The system communicates with the underlying electronic health record so that when a patient registers for care, CHICA analyzes the child's record (demographic characteristics, morphometric characteristics, diagnoses and medications) and selects the highest priority 20 yes or no questions, covering a wide range of primary care issues to ask the family. These are displayed on a sheet of scannable paper or an electronic tablet that is given to the family to complete in the waiting room	Computer-based decision support intervention	See Bauer (2015)
Carrol (2013)	See Bauer (2015) – ADHD-module	Attention Deficit/Hyperactivity Disorder (ADHD)	Children between 5-12 years old at risk for ADHD	PCPs	To assist physicians in the diagnosis and treatment of ADHD	See Bauer (2015). Added ADHD-module consists of screening questions following an algorithm based on the American Academy of Pediatrics. The module provides suggestions for ADHD-diagnosis, medication adjustments, mental health referrals and visits	See Bauer (2015)	See Bauer (2015)

Fortney (2013)	Net Decision Support System (NetDSS)	Primarily depression severity, suicide risk, secondarily cognitive impairment, generalized anxiety, panic, posttraumatic stress disorders and mania	Young people with depression symptoms and risk for suicide (approximately <5% of total study population was between 18-24 years old)	Depression care managers, who facilitate communication with e.g. PCPs and their patients	To provide evidence-based depression care management	NetDSS guides the care manager through a real-time self-documenting patient encounter using evidence based-scripts, self-scoring instruments, and clinical algorithms to identify new trials, treatment phases, and outcome milestones such as nonadherence, treatment response, remission, and relapse. It has the following functional capabilities: patient registry, patient encounter scheduler, trial management, clinical decision support, progress note generator, and workload and outcomes report generator	Web-based clinical decision support system	Diagnosis, management
Goodman (2000)	Development And Well-Being Assessment (DAWBA)	Among others ADHD, emotional, conduct, oppositional, posttraumatic stress, obsessive-compulsive, oppositional-defiant and conduct disorders. Separation anxiety, specific and social phobia, generalized anxiety and depression	Children and adolescents of 5-16 years old, susceptible for a variety of diagnoses	Child's clinician(s)	To generate ICD-10 and DSM-IV psychiatric diagnoses	DAWBA contains a package of questionnaires, interviews and rating techniques. Parents, teacher and children (if 11-16 years old) complete a structured interview after which parents can describe the problems in an open-ended questions-section. The different sorts of information are brought together by a computer program which produces summary sheets. Experienced clinical raters can use these sheets to accept or overturn the likely diagnoses generated by the computer. DAWBA requires little training, by reviewing online materials	Integrated computer based package of measures consisting of quantitative and qualitative information	Diagnosis, assessment of severity, management (n.e.m.i.t.)
Ford (2013)	See Goodman (2000)	Emotional, behavioural, autism spectrum, attention deficit hyper-activity, eating, feeding and tic disorders. Attachment issues	Children of 5-10 years, susceptible for a variety of diagnoses	See Goodman (2000)	See Goodman (2000)	See Goodman (2000)	See Goodman (2000)	See Goodman (2000)
McEwen (2016)	DAWBA-ASD-section	Autism Spectrum Disorder (ASD)	Children and adolescents in community mental health settings, at risk for ASD (all study partici-pants were aged	See Goodman (2000)	See Goodman (2000). In addition: to diagnose ASD	See Goodman (2000). In addition: the ASD module gathers information required to diagnose ASD. It can be completed by parents online or by interview and takes approximately 20 minutes to complete	See Goodman (2000)	See Goodman (2000)

			8-16 years)					
Moya (2005)	DAWBA-ED-section	Eating disorders (ED), such as anorexia, bulimia nervosa and partial syndromes	Children and adolescents at risk for ED, especially girls (7-17 years old)	See Goodman (2000)	See Goodman (2000). In addition: to generate DSM-IV and ICD-10 based diagnoses regarding eating disorders	See Goodman (2000). In addition: The ED-section begins with structured questions about eating-related symptomatology and its impact on the child's life. If definite symptoms are identified by the structured questions, clinicians use semi-structured open-ended questions to get respondents to describe the problems in their own words	See Goodman (2000)	See Goodman (2000)
Robinson (2018)	COMPASS (NAVIGATE)	First episode of psychosis	Patients aged 15 to 35 years (70.3% of total study population was 24 years or younger)	Prescribers	To facilitate patient-prescriber communication	Participants enter information about symptoms, side effects, treatment preferences, medication adherence and attitudes, and substance use into the system before consultation. Vital signs data and laboratory test results are entered. Data is summarized by the COMPASS program for review by the prescriber at the beginning of each medication visit. Integrating participant treatment priorities and the prescriber's assessments, COMPASS provided suggested guideline treatment, such as monthly assessments in the first two years of treatment	Computerized clinical decision making tool	Diagnosis, management
Reid (2013)	Mobiletype clinical assistant tool	Mental health symptoms (in general)	Young people with mild or more severe emotional/mental health issues (14-24 years old)	General practitioners	To assist in general practitioners' assessment and management	The *mobiletype* program is a mobile phone mental health assessment and management application which monitors mood, stress and everyday activities over eight areas of functioning, then transmits this information to general practitioners via a secure website in summary format for medical review	Mobile phone application	Diagnosis (n.e.m.i.t.), assessment of severity
Fletcher (2019 and 2021)	Link-me (randomized controlled trial)	Depression and anxiety symptoms	Youth aged 18-25, adults 26-75 years (19.5% of study partici-pants were aged 24 years or younger)	General practitioners	To test whether a patient-completed Decision Support Tool, which predicts future severity of depression and anxiety symptoms and triages individuals into care accordingly, is clinically effective and cost-effective relative to usual care	The first component of Link-me is a brief patient-completed decision support tool that draws on an individual's responses to 23 items to predict their anxiety and depressive symptom trajectory over the next 3 months and stratify them into one of three prognostic groups. The second component is a recommendation for treatment pathways, which depend on the predicted symptom severity	A model of Stepped Mental Health Care, a patient-completed decision support tool	Diagnosis, assessment of severity and management
Parker (2020)	Youth StepCare	Depression and anxiety	Youth patients aged 14 to 17 years	General practitioners	To identify youth with unidentified symptoms of mental illness	The service consists of three components: screening, treatment recommendations and patient monitoring. In the first component, practice staff offer a mobile tablet to patients	Web-based universal screening service on a mobile tablet	Diagnosis, assessment of severity and management

						and parent upon arrival for a GP appointment, patient completes the questionnaire on a mobile tablet in the waiting room (approximately 3 minutes). In the second component, symptom scores and clinical recommendations are sent to the GP's medical inbox, the GP discusses the results and forms a treatment plan with their patient. In the third component, fortnightly questionnaires are sent to patients who screened at mild, moderate or severe at baseline, results of monitoring questionnaires are sent to GP for review and follow-up		
Kaye (2017)	Child and Adolescent Psychiatrists Primary Care program (CAP PC)	Mild-moderate mental health problems	Children and adolescents aged 5 to 21 years	PCPs	To increase ability to assess and manage. To promote collaboration and integration of health and mental health services	Formal education of PCPs, consultation support by phone, assistance with linkage/referral and face-to-face evaluations in selected situations. CAP PC is unique in its collaboration among 5 university-based child psychiatry divisions. All CAP PC programs are provided free of charge to PCPs and include CME credit	Site teams with 2-3 senior child and adolescent psychiatrists, and 1 liaison coordinator	Diagnosis, assessment of severity and management
Gadomski (2014)	Training and Education for the Advancement of Children's Health (Project TEACH)	ADHD, depressive, anxiety and bipolar disorders; psychosis, sleep problems	Children with behavioural or emotional issues (age group n.e.m.i.t.)	PCPs	To provide training, consultation and referral support to build child and adolescent mental health expertise among primary care providers	Project TEACH refers to two programs, Child and Adolescent Psychiatry Education and Support Program for Primary Care Physician (CAPES) and CAP PC, that have similar aims but differ in scale, structure and service areas. Both offer free training, telephone consultations to PCPs, advice on referrals, and the ability to provide face-to-face evaluations if necessary. In both programs, calls from PCPs are handled by a central number and coverage is provided on a rotating basis	Combined program which integrates mental health services with primary care	Diagnosis, assessment of severity (n.e.m.i.t.) and management
Kerker (2015)	See Gadomski (2014). Study focusses on CAP PC	ADHD, psychosis, depression, anxiety, bipolar disorders	Children aged 0 to 21 years	PCPs	To correctly identify paediatric behavioural problems, effectively manage psychopharmacology and create and implement treatment plans by linking to existing resources	See Gadomski (2014). In addition: CAP PC consists of 15 hours in-person training, web-based learning tools, followed by a six-month distance learning program	See Gadomski (2014)	See Gadomski (2014)
Yellowlees (2008)	e-Mental Health (eMH)	Mood, anxiety, psychotic, pervasive developmental,	Children and adolescents younger than 18	PCPs	To provide multidisciplinary consultations by	In the eMH-program a consulting specialist meets with the patient who have been referred to UC Davis Medical Center via	Consultation-liaison model between PCPs, psychiatrists and a	Diagnosis, assessment of severity and management

		conduct and impulse control, attention-deficit/hyperactivity, adjustment, substance abuse and cognitive disorders. Mental retardation and childhood, emotional disturbances	years		videoconference, telephone, and e-mail as well as provider education	videoconferencing. At the end of the session, they would be joined by their PCP to discuss options, such as psychoeducation on medication, illness and diagnostic issues, exercise and lifestyle issues; a referral for therapy or testing if needed	clinical psychologist	
Epstein (2007)	Collaborative consultation treatment service	Attention Deficit/Hyperactivity Disorder (ADHD)-related symptoms	Stimulant-naïve children in first through fifth grades with an ADHD-related problem (mean age was 7.8 years)	Community-based physicians, pediatricians	To promote the use of titration trials and periodic monitoring during medication maintenance	Physicians are taught to prescribe 4 different weekly dosages of stimulant medication during a titration trial. These packaged medications were made available through local pharmacies. Weekly behavioural and side effect rating scales from parents and teachers are sent to a psychiatrist with ADHD-expertise who determined a best starting dosage of medication. A report describing the titration results, behavioural deteriorations or appearance of side effects (if this is the case) is sent back to physicians	Collaborative consultative service between community pediatricians and psychiatrists	Assessment of severity, management
Williams (2006)	Consultation-liaison	Mental health problems (in general)	Children	General practitioners	To assist general practitioners in making diagnoses and management plans	Psychiatrists participate in a roster and are on call to answer phone calls from general practitioners and to provide them with advice within 24 hours. In addition, if general practitioner, patient and psychiatrist agreed on this pathway, psychiatrists see the patient for face-to-face assessment within 14 days, with feedback to the general practitioner in a short time frame, preferably by an immediate telephone call, with written feedback within 14 days	Consultation-liaison service to general practitioners, provided by a cohort of private and public psychiatrists	Diagnosis, assessment of severity and management
Jacob (2012)	Telepsychiatry	Among others, major depressive disorder, generalized anxiety, seasonal affective and oppositional defiant disorders, ADHD; anxiety not otherwise specified	Children susceptible for a variety of diagnoses (aged 4-18 years)	PCPs	To diagnose and treat a wide range of psychiatric disorders, and to increase access to psychologists, psychiatrists and other therapists	A psychiatrist sees a child via videoconferencing for a limited number of sessions and then provides a treatment plan to that child's PCP and family	A telepsychiatry consultation practice between psychiatrist and PCP	Diagnosis, assessment of severity and management
Walter (2019)	Behavioral Health Integration	Common psychiatric disorders, such as anxiety, depression	Children (median age was 11	PCPs	To provide in-depth behavioural health education, on-demand	The behavioural health integration program consists of the following components: an education component which comprised 10	Multicomponent, transdiagnostic integrated	Diagnosis, assessment of severity and management

	Program	and ADHD	years)		psychiatric consultation, operational and clinical support for integrated practice transformation and on-site clinical behavioural health service	sessions (16 hours), a consultation component which provides real-time telephone consultation by child and adolescent psychiatrists, a transformation component focussing on i.a. clinical and business workflows and electronic health record documentation, and an on-site clinical behavioural health service focussing on screening, guided self-management and psychopharmacology	behavioural health model	
Malas (2019)	Michigan Child Collaborative Care (MC3) Program	Among others, ADHD and mood disorders	Children and youths under the age of 24	PCPs	To offer embedded behavioural health consultants within primary care practices, telephonic consultation, video consultation and embedded care	This program offers several levels of consultation and collaboration: behavioural health consultants who can provide referrals to local resources, brief in-person consultation, evaluation and non-pharmacologic intervention; formal telephone consultation with child and adolescent psychiatrists within the same business day of consult placement; videoconferencing with patients and families for more comprehensive telepsychiatric consultation; group case consultation for a group of PCPs in several areas of the state who wish to learn and discuss a series of cases together; and opportunities for embedded psychiatric care or in-person consultation	Telepsychiatry service	Diagnosis (n.e.m.i.t.), assessment of severity and management
Thompson (2019)	Collaborative care for depression intervention	Depression	Adolescents (12-25 years), adults (26->75 years)	PCPs	To support PCPs with screening, referral and treatment uptake of depressive symptoms	Patients are screened with the Patient Health Questionnaire-2 and the Patient Health Questionnaire-9 on the basis of an eligibility algorithm. Electronic health record data are used for sample characteristics, screening rates, referrals and treatment pathways	See column 'Name'	Diagnosis, assessment of severity and management
Campbell (2021)	Process changes of universal screening for autism	Autism Spectrum Disorder (ASD)	Patients aged 16 to 30 months	Resident and attending pediatricians	To identify children at risk for ASD who may be referred for further evaluation	The process change consisted of three phases. Phase 1 was changing the screening instrument (from M-CHAT-R to the POSI) and adding decision support. Phase 2 was adding automatic reminders. Phase 3 was adding a referral option for autism evaluations in primary care	A combination of a shorter and more sensitive screening instrument, staff training, clinical decision support, electronic health record automatic reminders, and primary care integration of autism evaluations	Diagnosis, management

Legend

PCP = Primary Care Physician

CDSM = Clinical Decision Support Method

N.e.m.i.t. = Not Explicitly Mentioned in Text

* According to Bajaj (2011)

** Including referral

Table 2: Studies supporting clinical decision-making methods for mental health disorders in children and youths in primary care (N=25)

Study (authors, year)	Objectives	Methods	Outcomes (provider)	Outcomes (patient)	Measurement moments	Intervention	Control	Targeted group	(N) Study participants	% Gender female (provider)	% Gender female (patient)	Mean age (patient)	Results (provider)	Results (patient)
Buckingham (2015)	To describe the development of a CDSS that integrates service user and practitioner expertise	Interviews, focus groups, agile software development and implementation of MyGRaCE	Satisfaction regarding MyGRaCE	Patient ability to assess their (un)safety, life changes, view of others, symptoms of unease, joint clinical decision-making and self-care	N.e.m.i.t.	MyGRaCE	N.a.	Service users with risk of suicide, self-harm, harm to others, self-neglect and vulnerability	115 service users	N.e.m.i.t.	N.e.m.i.t.	N.e.m.i.t.	Despite differences in assessing risks and safety, there was improved shared understanding of mental health risk between patients and practitioners	A challenge was how to provide flexible access without overwhelming and confusing users
Bauer (2015)	To add an Autism Spectrum Disorder (ASD)-module to an existing CDSS	Cross-sectional survey	PCP knowledge, beliefs and self-reported practice related to ASD	N.a.	0, 12, and 24 months after implementation.	ASD-module for CHICA	CHICA system without ASD-module	PCPs already using CHICA	Total of 126 participants control group size n.e.m.i.t.	Intervention 56%, control group: 62%	N.a.	N.a.	Self-reported use of validated screening tools for ASD. No changes in knowledge or attitudes	N.a.
Downs (2019)	To determine whether computer-automated screening and clinical decision support can improve Autism Spectrum Disorder (ASD) screening rates in pediatric primary practi-	Cluster randomized clinical trial, comparing ASD-screening rates in samples with or without screening module built into an existing	Clinician's response rates to screening results in the computer system	Screening rates, rates of positive screening results, new cases of ASD identified	The cluster randomized clinical trial was conducted between November 16, 2010 and November 21, 2012, outcomes were measured per patient	Decision support with the CHICA, integrated with workflow and with the electronic health record	N.e.m.i.t., 'control clinics' and 'without an ASD screening module built into an existing decision support software system'	Children aged 18 to 24 months in urban pediatric clinics of an inner-city county hospital system	274 children	N.e.m.i.t.	38.4%	N.e.m.i.t., age range 23-30 months	Among the 265 patients with positive screening results, physicians indicated any response in CHICA in 151 (57.0%)	Screening rates in the intervention clinics (not in the control clinics) increased from 0% at baseline to 68.4% in 6 months

	ces	decision support software system											and to 100% in 24 months. Screening results were positive for 265 of 980 children screened
Carrol (2013)	To determine if implementting Attention-Deficit/Hyperactivity Disorder (ADHD) diagnosis and treatment guidelines in a CDSS would result in better care, including higher rates of adherence to clinical care guidelines	A cluster randomized controlled trial in which the diagnosis and management of ADHD was studied after implementation of a CDSS in 4 practices. In the control group, screening was left to the discretion of the physician	Rate of use of structured diagnostic assessments	Number of ADHD core symptoms noted at time of diagnosis. Medication adjustments, reassessment of symptoms, mental health referral and visits	Data collection began 6 months after the module turned on in CHICA, continued until 6 months after the last patient was diagnosed with ADHD	CHICA ADHD-module	The 'traditional' CHICA system without the ADHD guidelines	Children with symptoms or signs of ADHD	A total of 84 patients. In the intervention and in the control group 42 patients	N.a.	In intervention group 31%, in control group 26%	N.e.m.i.t. (age range 5-12 years)	The rate of use of structured diagnostic assessments inceased significantly	The number of ADHD core symptoms noted at time of diagnosis vastly increased, preliminary analyses showed an increase in ADHD management
Fortney (2010)	To describe the development and functionality of a decision support system for the chronic care	Observational study on a joint development of the program by a cross-	Functional capabilities of NetDSS: clinical decision support, progress note generator, and workload and outcomes report	Number of patients being subjected to the NetDSS. Functional capabilities of NetDSS: patient	N.a.	Net-DSS	N.a.	N.e.m.i.t. ('patients', 'chronic', 'depression')	N.e.m.i.t. ('three collaborative care implementation research	N.e. m.i.t.	N.e. m.i.t.	N.e. m.i.t.	Intervention protocols can be successfully converted to Web-based decision support systems that facilitate the implementation of	The NetDSS has been used to provide evidence-based depression care ma-

	model of depression treatment, known as collaborative care	functional design team of psychiatrists, depression care manager, information technology specialists, technical writers and researchers	generator	registry, patient encounter scheduler, trial management					projects' 'involving 11 DCMs and 845 patients')			evidence-based chronic care models into routine care with high fidelity	nagement to more than 1700 primary care patients. See Results (provider)
Goodman (2000)	To describe and validate the DAWBA based on community and psychiatric clinic samples	Observational study on DAWBA diagnoses, independent correlates and SDQ-profiles (emotional, conduct-oppositional and ADHD - hyperkinetic disorders)	Outcomes related to DAWBA as an epidemiological measure (i.e. reliability and validity), mental health & service provision	See 'Outomes (provider)'	At baseline and after 4-6 months.follow-up	DAWBA	N.a.	Children and adolescents of 5-16 years old	A total of 530 participants, 491 in community and 39 in clinical sample	N.a.	49% in community and 21% in clinical sample	Community sample 9.9 years, clinical sample 11.0 years	The rates of all psychiatric disorders were higher in the clinic than in the community sample. Subjects with and without DAWBA diagnoses differed markedly in external characteristics and prognosis. In the clinical sample, there was considerable overlap between DAWBA and case note diagnoses	See Results (provider)
Ford (2013)	To explore the application of the DAWBA as an adjunct to clinical practice with children in the UK	Randomized controlled trial of the disclosure of the DAWBA to the assessing practitioner versus assessment at normal	Outcomes related to parents and the child's teacher, who filled in the SDQ; as part of the DAWBA	Probability diagnoses of psychiatric disorder(s). Level of functioning for the child was measured using the Children's Global Assessment Scale	An initial assessment at baseline, and a second after 6 months follow-up	DAWBA-disclosed assessment	Assessment at normal	Patients susceptible for emotional, behavioural, autism spectrum, attention deficit hyperactivity, eating, feeding and tic	In total 235 participants. In intervention group 117, in control group 118	N.e. m.i.t.	N.e. m.i.t.	Children of 5-10 years	Exposure to the DAWBA increased agreement between the DAWBA and practitioners about anxiety disorders, but detected no other statistically significant increased agreement for other disorders, nor a reduced need for further assessment,	See Results (provider)

		and analyzed by 'intention to disclose'		(CGAS)				disorders. Attachment issues					the number of difficulties recognized or influence on outcomes	
McEwen (2016)	To test the DAWBA as a tool for diagnosing Autism Spectrum Disorder (ASD) in community mental health settings	A general population sample was screened with the Childhood Autism Spectrum Test (CAST) (low score <12, high score ≥ 15). Parents filled in the ASD module of the DAWBA, families were visited at home; also the Autism Diagnostic Interview–Revised (ADI-R) and the autism diagnostic observation schedule (ADOS) were completed	Sensitivity, specificity, PPV, NPV and the rate of correct classification by the tool	See Outcomes (provider)	Specific measurement moments unspecified, DAWBA interview online or by telephone, ADI-R and ADOS during home visits	DAWBA ASD-section	Children at risk of ASD	Children and adolescents presenting in community mental health settings, at risk for ASD	A total of 377 participants, 101 unaffected co-twins of children with a diagnosis of ASD, 164 adolescents with low and 112 with high risk of ASD	N.a.	ASD-group 17%, co-twins group 47.5%, co-twins and low-risk group: 39%	ASD-group 10.0 years, affected co-twin group 9.9 years and unaffected co-twin group 11.6 years	DAWBA shows good test specifications: sensitivity (0.88) and specificity (0.85), high PPV (0.82-0.95) and NPV (0.90). 86% of children were correctly classified. Improved performance when used in conjunction with ADOS. High ASD-score correlation with ADI-R	See Results (provider)

Moya (2005)	To develop and validate the Eating Disorder (ED)-section of the DAWBA	Girls divided into three groups were assessed with the ED-section of the DAWBA	Sensitivity, specificity, predictive values and test-retest reliability	See Outcomes (provider)	Two measurement moments. Baseline at the beginning of the study, re-test after 2-3 weeks	DAWBA ED-section	Clinical controls with depression, obsessive-compulsive disorder or gastro-intestinal disease; community controls	Girls at risk for an ED	A total of 174 participants. 48 with an ED, 55 clinical controls in treatment for unipolar depresssion, obsesssive compulsive disorder or gastro-intestinal disease; 71 community controls	N.a.	100%	ED-group 16.0 years, clinical controls group 14.5 years, community controls group 15.5 years	For the detection of any DSM-IV and ICD-10 ED, the final DAWBA diagnosis had a sensitivity of 100%, specificity of 94%, PPV of 88%, and a NPV of 100%. There was 95% agreement between the initial and repeat diagnoses (k = 0.81)	See Results (provider)
Robinson (2018)	To compare COMPASS to community clinician-choice treatment for the recovery from an initial psychotic disorder-episode	Cluster randomized study	N.a.	Self-reported medication visits and prescriptions side effects, Adherence Estimator-scale. Biological outcomes: Vital signs, blood glucose	Prescription data monthly. Outcomes (patient) at 0, 3, 6, 12, 18 and 24 months	COMPASS (NAVIGATE)	Community clinician choice	Patients aged 15-40 years	Total of 414 participants, 233 in intervention, 181 in control group	N.e.m. i.t.	27%	23 years	More medication visits & antipsychotic prescriptions. Fewer side effects. Less sedation and anticholinergic side effects. No effect on other side effects. Less nonadherence beliefs. Less increase of BMI. No effects on other vital signs and cardiometabolic laboratory findings	See Results (provider)
Reid (2013)	To examine the *mobiletype* program in primary care, in particular the extent to which the *mobiletype*	Referred and eligible patients were randomly assigned to a group in which mood,	General practitioners assessed the program. Doctor-patient rapport was assessed using the General Practice Assessment Questionnaire –	Perceived understanding of patient mental health, assistance in clinical decision-making about diagnosis and	Both groups self-monitored areas of functioning for 2 to 4 weeks	Mobiletype	Attention-comparison	N.e.m.i.t. ('mild or more mental health concerns')	A total of 114 participants were included, intervention group 68 and at-	N.e.m. i.t.	71.9%	18.1 years	Mobiletype: improved general practitioners' understanding of functioning and clinical decision-making regarding medication/referral/ deciding about	See Results (provider)

	could provide clinical assistance, enhance doctor-patient rapport and lead to pathways to care	stress and daily activities were self-monitored or a group in which only daily activities were self-monitored. Monitoring data were collaboratively reviewed with their general practitioner	Communication and Enablement subscales and the Trust in Physician Scale. Pathway to care was measured using the Party Project's Exit Interview. Researchers were double blinded to group allocation	medication/referral					tention-comparison group 46				diagnosis; positive impact on communication, no impact on general practitioner-patient rapport nor pathways to care	
Fletcher (2019 and 2021)	To determine whether systematic identification of patients' symptom severity using a Decision Support Tool in general practice and provision of tailored treatment recommendations is clinically and cost effective compared to usual care	Pragmatic stratified randomised controlled trial. Participants were recruited and classified into three prognostic groups	N.a.	Psychological distress, measured on the 10-item Kessler Psychological Distress Scale	Six months post randomisation	Prognosis matched care	Usual care plus attention control	Adults aged 18-75 years reporting depressive or anxiety symptoms or use of mental health medication	1671 patients	N.a.	72.5%	15.0 years	N.a.	Prognosis-matched care was associated with greater reduction in psychological distress than usual care plus attention control at 6 months. This reduction was seen in the severe prognostic group, but not in the

														minimal/ mild group. No serious adverse effects were recorded
Parker (2020)	To assess the feasibility and acceptability of delivering the Youth StepCare service in Australian general practices	A 12-week uncontrolled trial in two general practices in NSW, Australia. Symptoms were assessed using two questionnaires for depressive and anxiety symptoms; feasibility and acceptability using a battery of questionnaires	General practitioner (GP) satisfaction with the service	Self-reported symptoms of anxiety or depression	Per patient, between August 2018 and January 2019	A web-based universal screening service delivered via a mobile tablet, Youth StepCare	N.a.	Youth patients aged 14 to 17 years who visited a participating GP during the screening period	Five GPs and 6 practice staff. Of 46 youth patients, 28 consented and 19 completed the screening instrument	N.e.m. i.t.	68.4%	15.21 years	GPs and practice staff were satisfied with the service, reporting that there was a need for the service and that they would use it again	Nine reported symptoms of anxiety or depression, two of which were new cases
Kaye (2017)	To describe a large collaborative care program that covers most of New York	Observational study since 2010 and pre-post evaluation of training	Number of registrations, phone calls and face-to-face evaluations. Two-weekly self-reported satisfaction, pre-post training knowledge, skills,	N.a.	PCP satisfaction 2-weekly after phone consultation. Perceived knowledge, skill and confidence anually 2013-2015	CAP PC	N.a.	PCPs	1931 registered PCPs	N.e. m.i.t.	N.e. m.i.t.	12.5 years	CAP PC has provided 8013 phone consultations and 17523 CME credits over 6 years. PCPs report very high levels of satisfaction and growth in confidence	N.a., practice level and patient level data are available when there is enough funding for future

			confidence											research
Gadomski (2014)	To describe how project TEACH engages PCPs, lead to changes in practice and what factors influence sustainability	Semi-structured interviews among two groups of PCPs, trained and untrained	Participation motivation, self-reported confidence, impact on clinical outcomes, such as medication prescription and developing treatment plans	PCP perceived impact on patient outcomes, such as aversion of bad outcomes, more effective detection of problems	Summer and fall of 2012	Project TEACH, study focusses on CAP PC	N.a.	PCPs	Total of 40 participants. 30 trained and 10 untrained PCPs	62%	N.a.	N.a.	Increased confidence and collaborative treatment in primary care. Sustainability depends on PCP practice context and implementation support	See Results (provider)
Kerker (2015)	To describe the impact of Project TEACH on the identification and treatment of mental health conditions	Observational study on trained (pre- to post-comparison) and untrained PCPs	N.a.	Prescription practices, diagnoses and follow-up care	Pre- and post-training: after 0 and 6 months and 27 hours	CAP PC	Random sample of PCPs	Project TEACH-trained PCPs	A total of 376 participants, 176 in intervention, 200 in control group	N.e.m. i.t.	N.e.m. i.t.	N.e. m.i.t. (age range 0-21)	N.a.	More psychotropic medication prescription in the trained group. Less (unconfirmed) effect on depression diagnoses, medication use and follow-up care
Yellowlees (2008)	To examine the diagnostic characteristics and referral outcomes for eMental Health from 10 primary care clinics in California	Analysis of 139 previous referrals of children via videoconferencing	N.a.	Rate of diagnosis of psychiatric disorders such as anxiety, cognitive decline, depression and psychosis	Per patient, initially and at 3 months follow-up	eMH	N.a.	Children and adolescents younger than 18 years old	139 participants	N.a.	N.e.m. i.t.	10.7 years	N.a.	Improved assessment of psychiatric disorders, especially attention deficit and mood

														disorders Video-conferencing improved mental health
Epstein (2007)	To test if a collaborative consultative service model would improve patient outcomes	Paediatric practices were assigned to a group (not) receiving access to the service	Use of evidence-based practices by paediatricians, knowledge related to the use of titration trials	Children's Attention Deficit/Hyperactivity Disorder (ADHD) symptomatology by systematic monitoring of medication effectiveness and by use of the Conners Parent and Teacher Rating scales	Self-reported provider outcomes pre- and post-intervention. Child outcome measures 0, 3 and 12 months after start of the trial	Titration trials in the context of collaborative consultation treatment services	Periodic medication maintenance	Children with ADHD-related symptoms	Fifty two pediatricians and their 377 patients	N.e.m. i.t. ('the two groups did not differ in sex composition')	36.3%	7.8 years	Increased use of evidence-based practices. However, many paediatricians did not fully use the services	Reduction in core ADHD-symptoms
Williams (2006)	To evaluate General Practitioner (GP) satisfaction and outcomes of a consultation-liaison service provided by psychiatrists	Evaluation of telephone advice and one-off assessment with feedback if necessary	GP and psychiatrist satisfaction & perceived barriers	N.a.	N.e.m.i.t.	Consultation-liaison	N.a.	GPs & psychiatrists	167 GPs and 27 psychiatrist	N.e.m. i.t.	N.e.m. i.t.	N.e.m.i.t.	High GP and psychiatrist satisfaction. Increase in GPs' knowledge and confidence while managing mental health problems. 100% retention of psychiatrists throughout the project	N.a.
Jacob (2012)	To establish a telepsychiatry consultation practice for children in rural areas	A 2-session telepsychiatry consultation, consisting of a psychiatric evaluation session and	PCP satisfaction	Parental satisfaction	N.e.m.i.t. regarding satisfaction. Child Behavior Checklists (CBCLs) at 0, 3 and 6 months	Telepsychiatry consultation practice	N.a.	PCPs	15 children	N.e.m. i.t.	33%	9 years	Satisfaction as reported by PCPs was high	Parental satisfaction was high. Not enough follow-up CBCLs were returned to determi-

		a recommendation session											ne changes in patient symptoms
Walter (2019)	To assess the structure and process of pediatric behavioural health integration and outcomes in patient experiences (access and quality), cost and provider satisfaction	Evaluation of a multicomponent, transdiagnostic integrated behavioural health model in a large pediatric primary care network in Massachusetts, launched in 2013	Practice-level behavioural health integration, ambulatory behavioural health spending, self-efficacy and professional satisfaction from participation	Practice-level psychotherapy, medical behavioural health visits and guideline-congruent medication prescriptions	At baseline and 5-year follow-up	Behavioral Health Integration Program	Care as usual (n.e.m.i.t.)	Pediatric primary care practitioners	~105 PCPs serving ~114000 patients	N.e.m.i.t.	N.e.m.i.t.	N.e.m.i.t.	Increased practice-level behavioral health integration, total ambulatory behavioral health spending increased by 8% in constant dollars over 5 years, mainly attributable to task-shifting from specialty to primary care. Total emergency behavioral health spending decreased by 19%. Providers reported high behavioral health self-efficacy and professional satisfaction from participation	Increased practice-level psychotherapy and medical behavioral health visits, guideline congruent medication prescriptions for anxiety, depression and ADHD
Malas (2019)	To obtain qualitative and quantitative information from PCPs relating to their experience in using telephonic consultation services with child and adolescent psychiatrists through the Michigan Collaborative Child Care Program	A survey was conducted over a 5-year period to assess PCP attitudes and perception regarding MC3 consultation, including measures of efficiency, user-friendliness and confidence in provi-	See 'methods'	N.a.	Over 5 years, following each consultation	Michigan Child Collaborative Care (MC3) Program	N.a.	PCPs	1241 PCPs enrolled in MC3 (44% response rate)	N.e.m.i.t.	N.e.m.i.t.	N.e.m.i.t.	Common themes elicited included perception of improved patient care, improved comfort and confidence, greater comfort with prescribing and monitoring of psychotropics and improved access to mental healthcare	N.a.

		ding mental health-care											
Thompson (2019)	To analyze effectiveness of screening, referrals and treatment uptake of a collaborative care for depression intervention across 10 primary care clinics in Chicago	Patients were screened with the Patient Health Questionnaire -2 and -9. Electronic health record data were analyzed	N.a.	Depression symptoms. Sample characteristics, screening rates, referrals and treatment pathways	Between November 2016 and December 2017	Collaborative Care for Depression of Adults and Adolescents	N.a.	Adults and Adolescents with symptoms indicative of Major Depressive Disorder	1008 patients	N.a.	63.0%	N.e.m. i.t., 20% of the sample were between ages 12 and 25, and 19% were between ages 26 and 35	N.a.	Screenings, referrals and uptake occurred proportionately across subgroups except for patients ages 12-17. Adolescent age was associate with disproportionate Patient Health Questionnaire-9 screenings and with treatment disengagement
Campbell (2021)	A quality improvement study to 1) increase the proportion of visits with screening for autism and 2) to increase the proportion of visits with	Process changes were implemented in 3 phases: 1) changing screening instrument and adding decision	N.a.	Proportion of visits with autism screening at 2 intervention clinics before and after implementation of process changes versus 27 community	During primary care visits, over 2 years (baseline and phased improvements)	Process changes of universal screening for autism	Care as usual, n.e.m.i.t. (‘community clinics’)	Children susceptible for autism	12233 well-child visits	N.a.	48.0% in intervention and 48.8% in community sample	45.3% <24 years in intervention, 55.0% in community sample	N.a.	Improved autism screening and referrals. Autism screening increased by 52% in intervention,

referrals for autism evaluation	support 2) adding automatic reminders & 3) adding a referral option for autism evaluations	clinics	21% in community clinics. See study for results per phase

Legend

CDSM = Clinical Decision-Support Method
PCP = Primary Care Physician
N.a. = Not Applicable
N.e.m.i.t. = Not Explicitly Mentioned in Text

Table 3: Quality appraisal scores of 25 included studies (published 2009-2021), using the Crowe Critical Appraisal Tool (CCAT)

	Total (max = 40)	Score*	Prelim	Intro	Design	Sample	Data	Ethics	Results	Discussion
Buckingham (2015)	★★	24	4.75	5	2.75	3.33	0.83	2	2.25	3.17
Bauer (2015)	★★★	28.67	5	5	3.5	3.17	2.5	2	3.5	4
Downs (2019)	★★★★	33.38	5	5	3.25	5	3.97	3.5	4.5	3.16
Carrol (2013)	★★★	30.40	5	5	3.75	2.83	3.83	2.5	3.5	4
Fortney (2010)	★	20.49	4.5	5	2.5	1.17	2.17	1	1.32	2.83
Goodman (2000)	★★★	29.83	5	2.5	4.25	4.67	4	3	3.25	3.17
Ford (2013)	★★★★	35.17	5	5	4.75	3.83	4.67	3	4.25	4.67
McEwen (2016)	★★★★	34.42	4.75	5	4.5	4.67	4	3	3.5	5
Moya (2005)	★★★	32.33	3.75	5	4.5	5	3.33	2	3.75	5
Robinson (2018)	★★★★	32.83	4.75	5	4.5	4	3.33	2.5	3.75	5
Reid (2013)	★★★★	35.08	5	5	4.5	4.83	3.33	3.5	4.25	3.83
Fletcher (2019 and 2021)**	★★★	32.23	5	5	2.69	4.91	3.89	3.75	3	3.99
Parker (2020)	★★★	29.15	4.75	5	2.61	3.66	3.14	3.5	3	3.49
Kaye (2017)	★	22.68	5	5	2.76	3.33	2.83	2	3.75	3.5
Gadomski (2014)	★★	25.96	4	5	2.63	3	3.33	1	3.5	3.5
Kerker (2015)	★	21.22	3.50	3	2.95	2.91	1.92	1.11	2.19	3.64
Yellowlees (2008)	★★★	29.67	4.75	5	3.42	3.5	2.5	2.5	3	5
Epstein (2007)	★★★	32	4.75	5	4.25	3.83	2.83	3	3.75	4.5
Williams (2006)	★	21.33	4.75	5	2.58	2.5	1.17	1	2	3.33

Jacob (2012)	★★	25.87	4.75	5	2.37	2.17	2.83	2.5	2.75	3.5
Walter (2019)	★★★	29.23	4.75	5	2.85	4.15	2.98	3	2,5	4
Malas (2019)	★★	27.8	4.75	5	3.09	3.49	2.81	2.5	2.5	3.66
Thompson (2019)	★	22.3	3.75	5	2.5	2.32	2.15	1.5	2.25	2.83
Campbell (2021)	★★	27.21	4.75	5	3.25	2.32	2.15	2.5	2.75	4.49

Legend

Max = Maximum
Prelim = Preliminaries
Intro = Introduction

*One star: more than 1 SD below average; two stars: between 1 SD below average and average; three stars: between average and 1 SD above average; four stars: more than 1 SD above average.
**Because Fletcher (2019) consists of a protocol which is expanded on in Fletcher (2021), displayed scores are mean scores of the two studies. For the categories 'Results' and 'Discussion', scores for Fletcher (2021) are mentioned.