STUDY PROTOCOL

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Team-focused implementation strategies to improve implementation of mental health screening and referral in rural Children's Advocacy Centers: study protocol for a pilot cluster randomized hybrid type 2 trial

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Abstract

Background Children's Advocacy Centers (CACs) use multidisciplinary teams to investigate and respond to maltreatment allegations. CACs play a critical role in connecting children with mental health needs to evidence-based mental health treatment, especially in low-resourced rural areas. Standardized mental health screening and referral protocols can improve CACs' capacity to identify children with mental health needs and encourage treatment engagement. In the team-based context of CACs, teamwork quality is likely to influence implementation processes and outcomes. Implementation strategies that target teams and apply the science of team effectiveness may enhance implementation outcomes in team-based settings.

Methods We will use Implementation Mapping to develop team-focused implementation strategies to support the implementation of the Care Process Model for Pediatric Traumatic Stress (CPM-PTS), a standardized screening and referral protocol. Team-focused strategies will integrate activities from effective team development interventions. We will pilot team-focused implementation in a cluster-randomized hybrid type 2 effectiveness-implementation trial. Four rural CACs will implement the CPM-PTS after being randomized to either team-focused implementation (*n* = 2 CACs) or standard implementation (*n* = 2 CACs). We will assess the feasibility of team-focused implementation and explore between-group differences in hypothesized team-level mechanisms of change and implementation outcomes (implementation aim). We will use a within-group pre-post design to test the effectiveness of the CPM-PTS in increasing caregivers' understanding of their child's mental health needs and caregivers' intentions to initiate mental health services (effectiveness aim).

Conclusions Targeting multidisciplinary teams is an innovative approach to improving implementation outcomes. This study will be one of the first to test team-focused implementation strategies that integrate effective team development interventions. Results will inform efforts to implement evidence-based practices in team-based service settings.

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Contributions to the literature

- This study protocol describes the development and testing of team-focused implementation strategies to support mental health screening and referral in a team-based setting.
- This study will be among the first to develop team-focused strategies to enhance implementation.
- Findings from this study will inform efforts to implement new practices in team-based settings.

Background

Child maltreatment and associated mental health problems are critical concerns, particularly in rural areas [1–4]. Children in rural areas are nearly twice as likely as their urban peers to experience child maltreatment [4], and they have high rates of unmet mental health needs [1, 2, 5, 6]. Maltreatment substantially increases the risk for mental health disorders [7–12]. Youth in rural areas are less likely to receive mental health care and experience greater impairment than those in urban areas [1, 2, 13, 14]. In addition, youth suicide rates in rural areas are nearly twice those in urban areas [5] and rising more rapidly [6]. Despite these high needs, implementation of evidence-based practices has lagged behind in rural areas [15–20].

Children's Advocacy Centers (CACs) are intended to provide coordinated, interagency responses to maltreatment allegations and have wide reach into rural areas [21]. CACs are well-positioned to identify children at risk for mental health problems and suicide and to facilitate access to evidence-based treatments. There are approximately 1000 CACs in the USA, and more than 90% of children live in areas served by a CAC [22]. More than half of these CACs serve predominately rural populations [21, 23].

CACs are often families' first link to services following maltreatment [24, 25]. Accreditation standards for CACs require "evidence-supported, trauma-focused" mental health services to be available to all children served by the CAC [26]. These services may be provided on-site (23.3% of CACs), through linkage agreements with local providers (33.8% of CACs), or through a combination of onsite services and linkage agreements (43%) [27]. Availability of evidence-based treatments (EBTs) through CACs has increased rapidly; in 2020, 98% of CACs reported they offer access to at least one EBT (100% of urban CACs; 98% of rural CACs) [28]. Trauma-Focused Cognitive-Behavioral Therapy (TF-CBT; [29]) is the most common EBT, offered by 94% of CACs [28].

Evidence-based screening tools can improve CACs' capacity to identify children with mental health needs, and supported referrals (e.g., warm handoffs) can encourage treatment engagement. However, many CACs do not use evidence-based screening tools or standardized referral protocols [27]. Thirty-nine percent of CACs do not provide any on-site mental health screening [27], and referrals are typically provided by bachelor's-level victim advocates with little specialized training in mental health. Implementation of structured screening and referral protocols can improve recognition of suicidality and mental health needs, reduce variability and inefficient use of resources, and facilitate engagement in treatment [30, 31].

The Care Process Model for Pediatric Traumatic Stress (CPM-PTS) is a standardized mental health screening and referral protocol developed at the University of Utah with a grant from the Substance Abuse and Mental Health Services Administration (1U79SM080000) [32–35]. Multidisciplinary stakeholders provided feedback to ensure fit of the CPM-PTS in the CAC context, including consideration of content, timing of administration, data storage, and legal protections. The CPM-PTS uses evidence-based tools to identify children with traumatic stress symptoms (UCLA PTSD Reaction Index Brief Form [36]) and/or suicide risk (Columbia-Suicide Severity Rating Scale [37]). It provides structured clinical pathways and technology-guided decision support to assist frontline CAC staff in understanding screening results, discussing mental health needs with youth and caregivers, and facilitating referrals to EBTs (e.g., TF-CBT [29]).

The CPM-PTS is a promising approach to increasing engagement in evidence-based treatment for children at high risk for posttraumatic stress and other mental health problems. Care process models like the CPM-PTS aim to improve efficiency, increase accuracy, and decrease variability and have been shown to increase the provision of evidence-based care and reduce costs [38–41]. Electronic decision support tools have been shown to increase adherence to clinical guidelines and decrease cognitive load [42]. The core components of

the CPM-PTS, including use of evidence-based screening tools, discussion of results with families, and referrals to evidence-based treatment, are hypothesized to increase engagement in mental health services by increasing caregivers' understanding of their children's mental health needs and their intentions to initiate services (Fig. 1). However, the effect of the CPM-PTS on family-level outcomes has not yet been tested. In addition, effective strategies for implementing mental health screening/referral protocols such as the CPM-PTS in the unique context of CACs are needed.

CAC accreditation standards require the use of a multidisciplinary team, including members from law enforcement, child welfare, prosecution, medicine, mental health, and victim advocacy [26]. Small rural CACs may have as few as one employee, relying primarily on team members employed by independent organizations (e.g., child welfare, mental health agencies). CACs lack a conventional hierarchical structure (e.g., frontline staff, mid-level managers, a central executive) and require cross-sector collaboration and effective teamwork to be successful [43]. In this context, the multidisciplinary team is likely to play a central role in the implementation of evidence-based practices. Our research applies the science of teams and team effectiveness to implementation and use of evidence-based practices in rural CACs in the USA.

Figure 2 illustrates our conceptual model of team performance and implementation outcomes, based on the Input-Mediator-Outcome model [44–47]. We focus on team interdependence and functioning [48–50], as team structure and task demands are relatively constant across CACs because of national accreditation standards [26]. *Interdependence* is the extent to which the team's work requires exchanges of resources and coordinated workflows (i.e., task interdependence) and the extent to which outcomes are measured and rewarded at the team (vs. individual) level (i.e., outcome interdependence) [48, 51]. *Team functioning* refers to processes (e.g., coordination) and emergent states (e.g., cohesion) that may be affective, behavioral, or cognitive [49, 50]. Within organizations, team interdependence and functioning are positively associated with team performance [48–55], and in healthcare settings, patient safety and clinical outcomes [56–58].

In CACs, qualitative research has identified clear interagency policies and procedures as key facilitators of cross-sector collaboration [59–61], and one study found that greater interdependence (i.e., more frequent case review meetings, use of a joint performance evaluation system) was associated with higher quality team relationships [62]. Our prior research with CAC multidisciplinary teams found that affective and cognitive functioning were positively associated with team performance [43]. But, little research has examined teams' impact on implementation processes and outcomes [63, 64]. Some evidence suggests that problems with team functioning (e.g., low cohesion, ineffective communication, high conflict) impair implementation of new practices [65–69].
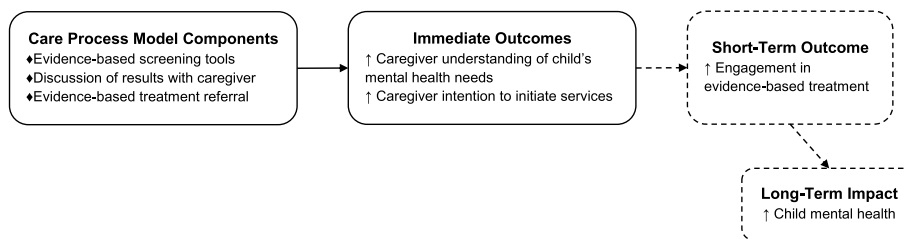

Fig. 1 Hypothesized effects of the care process model for pediatric traumatic stress on family outcomes
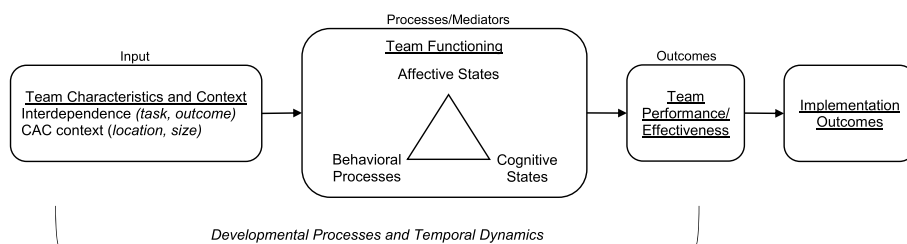

Figure adapted from McGuier et al., 2023

Fig. 2 Input-mediator-outcome framework of team effectiveness

In prior research with CACs, we evaluated a statewide initiative to implement the CPM-PTS [32]. We found that affective functioning (i.e., trust, liking, and respect within the team) and team performance were associated with greater acceptability, appropriateness, and feasibility of the protocol [70]. Task interdependence was positively associated with reach, with teams with greater exchanges of resources and coordinated workflows achieving higher screening rates during the first two years of implementation [70]. Our findings suggest that strategies that improve team interdependence and functioning may enhance implementation outcomes in team-based settings.

Current study

The current study is a hybrid type 2 effectiveness-implementation pilot cluster randomized trial in four rural Children's Advocacy Centers. Hybrid type 2 studies give roughly equal emphasis to evaluating implementation strategies and intervention effectiveness [71, 72]. We will develop and pilot team-focused strategies to enhance the implementation of the CPM-PTS in CACs. The primary goal of the trial is to assess the feasibility of the implementation strategies and trial methods [73–77]. We will explore between-group differences in hypothesized team-level mechanisms of change and implementation outcomes (implementation aim). We will use a within-group pre-post design to test the effectiveness of the CPM-PTS in increasing caregivers' understanding of their child's mental health needs and caregivers' intentions to initiate services (effectiveness aim).

Study aims and hypotheses

Aim 1: Develop team-focused strategies to facilitate implementation in rural CACs.

Aim 2: Conduct a pilot cluster-randomized controlled effectiveness-implementation hybrid Type II trial in 4 rural CACs.

Aim 2a (implementation aim): Assess the feasibility of team-focused implementation strategies and explore between-group differences in team interdependence and functioning and implementation outcomes (i.e., days to adoption, reach, acceptability, appropriateness, feasibility).

Hypothesis (primary): Team-focused implementation will be judged to be feasible, acceptable, and appropriate (scores ≥ 4 on 1-5 scale).

Hypothesis (exploratory): Team interdependence and functioning will be greater in CACs randomized to team-focused implementation than comparison CACs.

Hypothesis (exploratory): Implementation outcomes, including days to adoption (i.e., days from training to first use), reach (i.e., percent of children screened), and CPM-PTS acceptability, appropriateness, and feasibility, will be greater in CACs randomized to team-focused implementation than comparison CACs.

Aim 2b (effectiveness aim): Test the effect of CPM-PTS implementation on caregivers' understanding of their child's mental health needs and caregivers' intentions to initiate mental health services.

Hypothesis (primary): Understanding of mental health needs and intentions to initiate mental health services will be greater for caregivers served after the CPM-PTS is implemented than caregivers served before the CPM-PTS is implemented.

Hypothesis (exploratory): Referrals to mental health services and initiation of mental health services will be greater for children served after the CPM-PTS is implemented than children served before the CPM-PTS is implemented.

Community engagement

A community-engaged approach with bi-directional involvement of researchers and community stakeholders will be used throughout the study [78–81]. A community advisory committee of multidisciplinary team members and CAC leadership will provide feedback on research questions, study methods, interpretation of results, and dissemination plans. The committee will meet via videoconferencing at least once a quarter, and engagement processes and proximal outcomes will be assessed following best practice recommendations [81–85]. For example, we will assess the frequency and duration of engagement, committee members' experiences of decision-making, and changes in project methods (e.g., methods, recruitment) and interpretation of results based on committee input [82, 83]. Committee members may change during the study; we will strive to maintain diverse representation from the disciplines involved in CACs and individuals from rural and urban areas.

Aim 1 methods

Development of team-focused implementation strategies

We will use Implementation Mapping to develop and refine implementation strategies. Implementation Mapping is a systematic, participatory, theory-based process based on Intervention Mapping [86–92]. Table 1 lists the five steps in the process identified by Fernandez and colleagues [89].

Step 1 will be completed in collaboration with our community advisory committee. The committee will begin by reviewing findings from our evaluation of the statewide CPM-PTS implementation effort [32]. They will identify

Table 1 Implementation mapping steps [89]

Step	Task(s)
1	Conduct a needs assessment and identify adopters and implementers.
2	Identify adoption and implementation outcomes, performance objectives, and determinants; create matrices of change.
3	Choose theoretical methods; select or create implementation strategies.
4	Produce implementation protocols and materials.
5	Evaluate implementation outcomes.

individuals likely to be responsible for adopting, using, and sustaining the CPM-PTS and generate additional relevant determinants.

Steps 2 and 3 will be completed through close collaboration of the research team and a subset of committee members. First, we will refine the study's conceptual model and identify key team-related determinants (e.g., interdependence, supportive behavior). This step will include reviewing recent developments in the scientific literature and will be informed by our prior research on how specific types of team interdependence and functioning relate to implementation outcomes [70]. The research team will present summaries of relevant research for discussion and create initial drafts that committee members will review and revise during recurring meetings over a 3-month period.

The development of team-focused strategies will be informed by research on team development interventions. We will focus on two well-established types of team development interventions—team training and team building [93–98]. Team training targets team members' knowledge, skills, and attitudes through strategies such as team self-correction, coordination and adaptation training, and cross-training and is effective in improving affective, behavioral, and cognitive team functioning [56, 93, 98–101]. Team building targets goal-setting, relationship management, role clarification, and/or problem-solving and is effective in improving team processes (e.g., coordination) and affective outcomes (e.g., cohesion) [94, 102].

We will design practical implementation strategies using strategies generated by committee members and adapted from existing team development interventions (e.g., TeamSTEPPS [99, 103–106]). Strategies will incorporate effective training methods (e.g., role play, feedback) and follow evidence-based recommendations for team interventions [95–98]. Table 2 presents examples of intervention targets, evidence-based intervention strategies, and practical examples of activities.

Step 4, creation of implementation protocols and materials, will be completed by the research team. We will operationalize team strategies (e.g., determining sequence, delivery method) and produce materials to support their use. Examples include a team intervention manual, scripts and worksheets for specific team activities (e.g., goal setting exercise, role play debriefing), and templates for protocol documents and interagency agreements. The community advisory committee will provide feedback on drafts and will be encouraged to test materials with their own teams to obtain additional feedback. Materials are intended to have potential for broad dissemination into low-resource settings providing team-based care, although some are specific to CACs.

Our final team-focused implementation plan will integrate team-level strategies with standard implementation strategies based on the Replicating Effective Programs (REP) model [107]. REP is a low-intensity approach to implementation that focuses primarily on the development and provision of an intervention package or toolkit, provider training, and technical assistance [108, 109]. Team-focused strategies will be integrated with standard implementation strategies provided to all sites (i.e., toolkit, training, technical assistance). For example, education on communication skills (team training activity) could be integrated with CPM-PTS training (REP strategy), and feedback on team progress (goal-setting activity) could be integrated with technical assistance calls (REP strategy). To flexibly adjust to variations in team needs, we will incorporate opportunities for CACs to choose specific activities.

Step 5 will be completed by the research team in collaboration with the committee. Committee members will review and refine the evaluation plan proposed by

Table 2 Examples of team-level targets, strategies, and activities

Intervention target	Strategy	Activities
Outcome interdependence	Goal-setting	Team goal-setting exercise Feedback on team progress toward goal
Supportive/backup behavior	Cross-training	Train additional team members in CPM-PTS Role play CPM-PTS administration
Learning behavior	Self-correction	Education on communication skills Debriefing exercises

the research team to ensure its appropriateness in the setting. The evaluation will include an assessment of team-level determinants hypothesized to be mechanisms of change for team-focused implementation strategies.

Aim 2 methods
Study design
The pilot trial is a cluster-randomized hybrid type 2 effectiveness-implementation study. It is designed to evaluate the feasibility of team-focused implementation and explore differences in team and implementation outcomes (Aim 2a—implementation) as well as test the effectiveness of the CPM-PTS (Aim 2b—effectiveness). Four rural CACs will implement the CPM-PTS after being randomized to either team-focused implementation ($n = 2$ CACs) or standard implementation ($n = 2$ CACs). Supplemental File 1 includes the SPIRIT checklist [110, 111], StaRI checklist [112, 113], and CONSORT checklist and flow diagram [114] for this protocol paper. The trial is registered on clinicaltrials. gov (NCT05679154).

Site recruitment and randomization
CACs ($N = 4$) will be recruited through the Pennsylvania Chapter of CACs, which provides training, support, and technical assistance to CACs, as well as direct outreach to CAC staff. Eligible CACs must be interested in implementing a mental health screening and referral protocol and in a county designated as rural by the Center for Rural Pennsylvania. CACs with members that participated in Aim 1 will not be eligible for the pilot trial. After completion of baseline data collection, CACs will be randomized to standard implementation ($n = 2$) or team-focused implementation ($n = 2$). We will aim to balance team size across conditions by creating pairs of CACs with similarly sized teams that are then randomized to condition by the study statistician using a random number generator. CACs will be informed of their study condition after baseline data collection is completed.

Methods for Aim 2a (implementation aim)
Participants
All members of multidisciplinary teams at participating CACs will be invited to participate (estimated $N = 70$ [25 team members per CAC; 70% participation]). We expect team members to change over time and will include only current team members at each timepoint (0, 6, and 12 months), as individuals no longer on the team will not be able to accurately report on team functioning. We will work with our community advisory committee to develop effective recruitment and retention strategies.

Implementation conditions
CACs randomized to standard implementation ($n = 2$) will receive CPM-PTS implementation strategies based on the REP model and used in the Utah statewide implementation. They will receive a toolkit of CPM-PTS materials (e.g., manual, REDCap surveys, referral protocols), a short interactive training, and 6 months of technical assistance. CACs randomized to team-focused implementation ($n = 2$) will follow the plan developed in Aim 1 that integrates team strategies with standard training and technical assistance strategies, delivered over 6 months.

Team data collection procedures
Data will be collected through online surveys of team members at 0, 6, and 12 months. Consent forms and surveys will be constructed in REDCap, a secure, web-based software platform [115, 116], and individual survey invitations will be emailed to all team members at each timepoint. We will also conduct semi-structured qualitative interviews assessing team functioning with two team members from each CAC at baseline, 6 months, and 12 months. Interviews are intended to complement quantitative survey data by providing opportunities for elaboration and greater depth of understanding of team functioning. Interviews will be conducted via videoconference, audio-recorded, and transcribed.

Ethnographically informed "periodic reflections" on the implementation process [117] will be conducted approximately monthly during the 6 months of implementation support. Reflections will be conducted via videoconference and audio-recorded; the interviewer will take notes and summarize each interview immediately after it is completed. Participants will be paid for completing surveys and/or interviews. All procedures are approved by the University of Pittsburgh Institutional Review Board.

Measures

Feasibility   The primary goal of the trial is to assess the feasibility of the trial methods [73–77]. Accordingly, we will track site recruitment and retention, assess CAC characteristics that may affect implementation outcomes (e.g., team size, co-location, budget), and track team turnover, survey response rates, and missing data. Periodic reflections with key informants in each CAC (e.g., director, coordinator) will provide detailed information on the implementation process as it occurs. These structured reflections will include questions about implementation progress and completion of specific activities, barriers and facilitators to implementation, feedback on implementation strategies, and events and external influences that may impact implementation (e.g., leadership changes, new policies) [118–120]. Team members in

CACs randomized to team-focused implementation will also rate the acceptability, appropriateness, and feasibility of team-focused implementation [121].

Team outcomes   At 0, 6, and 12 months, team members will complete an online survey assessing team interdependence, functioning, and performance. Measures are listed in Table 3. We will also assess other relevant determinants (e.g., leadership, resources, individual characteristics) [122–125]. Changes to measures may be made prior to the start of the trial to ensure an effective assessment of the hypothesized mechanisms of change for the team-focused implementation strategies developed in the Aim 1 Implementation Mapping process.

Implementation outcomes   Adoption and reach will be assessed with data from CPM-PTS electronic administration and CAC administrative data. Data are collected in REDCap as the CPM-PTS is administered; we will use timestamps to determine the date of the first completed screening and assess the number of completed screenings each month. CACs will provide data on the number of children served each month. Adoption will be indicated by the number of days from training to the first completed screening. Reach will be indicated by screening rates (i.e., completed screenings/eligible children) and calculated for monthly and quarterly periods. Team

members will rate the acceptability, appropriateness, and feasibility of the CPM-PTS at 0, 6, and 12 months [121].

Statistical analyses

Feasibility   We will examine descriptive statistics (e.g., mean, median, range) for quantitative measures of feasibility, acceptability, and appropriateness [121]. We expect mean scores to indicate agreement that team-focused implementation is feasible, acceptable, and appropriate (i.e., scores ≥ 4 on 1–5 scale; primary hypothesis). We will evaluate data completeness and quality and look for patterns of missing data.

Quantitative analyses   This study is not powered to detect between-group differences. We will explore differences in team outcomes (i.e., interdependence, functioning, performance) and implementation outcomes at 6 and 12 months (exploratory hypotheses). For team outcomes, we will construct mixed effects models to estimate effect sizes and confidence intervals. We will create separate estimates and confidence intervals for each condition (i.e., team-focused implementation vs. standard implementation). Analyses will not account for the matched pairing of CACs given the low number of clusters. For implementation outcomes, we will aggregate scores for

Table 3 Team member survey measures

Domain	Construct	Number of items, rating scale
Team Member Characteristics	Age, race/ethnicity, gender Discipline, experience, tenure	7 items
Team Interdependence	Task interdependence [51]	5 items, 5-point Likert scale
	Outcome interdependence [51]	2 items, 5-point Likert scale
Affective Team Functioning	Liking [126]	4 items, 5-point Likert scale
	Psychological safety [127]	7 items, 7-point Likert scale
	Team roles and respect [126, 128]	5 items, 5-point Likert scale
Behavioral Team Functioning	Learning behavior [127]	7 items, 7-point Likert scale
	Supportive behavior [129]	4 items, 5-point Likert scale
	Communication – information exchange [130]	4 items, 5-point Likert scale
	Relational coordination [131]	7 items, 5-point Likert scale
	Conflict management [132]	5 items, 5-point Likert scale
	Reflexivity [133]	4 items, 5-point Likert scale
Cognitive Team Functioning	Clear direction [127]	3 items, 7-point Likert scale
	Shared awareness [134, 135]	6 items, 5-point Likert scale
Team Performance	Team member-rated performance [127]	5 items, 7-point Likert scale
Implementation Determinants	Implementation climate [122]	4 items, 5-point Likert scale
	Leadership engagement [122]	4 items, 5-point Likert scale
	Available resources [122]	7 items, 5-point Likert scale
Implementation Outcomes	Acceptability, appropriateness, and feasibility [121] -Of CPM-PTS -Of team-focused implementation	12 items, 5-point Likert scale

outcomes rated by team members and examine descriptive statistics (e.g., mean, range) across CACs.

Qualitative analyses   We will conduct thematic analysis of team member interviews using a primarily theoretical (deductive) approach [136]. A preliminary codebook will include a priori codes for specific dimensions of team functioning (e.g., psychological safety, supportive behavior, conflict management) and implementation determinants (e.g., implementation climate, knowledge, and beliefs). Two coders will read all transcripts and refine and add codes as needed through an iterative analysis process. After finalizing the codebook, all transcripts will be independently coded by two coders and discrepancies will be resolved through consensus.

We will conduct rapid analysis of periodic reflections [117, 137, 138]. Interviewers will take detailed notes and summarize each reflection using a spreadsheet template. The template will list multiple domains (e.g., implementation progress, challenges, suggestions for change) and provide space for key points and exemplar quotes in each domain. To enhance validity, we will ask each CAC to provide feedback on findings (i.e., member checking) [139–141].

Mixed methods analyses   We will integrate survey and interview data on team functioning to examine triangulation (i.e., compare results from each method; function: convergence) and elaborate on quantitative findings (i.e., deepen understanding; function: complementarity) [142, 143]. Quantitative data on implementation will be used to assess outcomes, and qualitative data from periodic reflections will be used to understand process (function: complementarity). Qualitative findings will also be used to explain quantitative findings and explore any unexpected findings (function: expansion) [142, 143]. We will integrate quantitative and qualitative data on implementation to refine team-focused implementation strategies. For example, if we identify implementation activities with low completion, we will use qualitative data to identify barriers and suggestions for improving these activities.

Methods for Aim 2b (effectiveness aim)
Participants and procedures
Anonymized caregiver data will be collected continuously through an existing Outcome Measurement System [144] over an 18-month period. No caregivers or children will be enrolled in the study. At the end of their CAC visit, caregivers complete a brief anonymous survey assessing satisfaction with their experience. We will obtain post-visit survey data for caregivers served in the

6 months preceding CPM-PTS implementation and data for caregivers served in the 12 months following CPM-PTS implementation. We estimate a total sample of 288 caregivers (4 CACs*10 caregivers/month*40% response rate*18 months). We will also collect administrative data from CAC case management systems documenting referrals to mental health services and when available, data on initiation of mental health services for cases served during the 18-month study period.

Measures
In the post-visit survey, caregivers will rate two items assessing their understanding of their child's mental health needs and their intention to initiate mental health services. For each child served during the study period, we will extract two dichotomous (yes/no) variables from administrative data to indicate (1) if the child was referred to mental health services and (2) if the child initiated mental health services.

Statistical analyses
First, we will examine data completeness and patterns of missing data for caregiver survey ratings and CAC administrative data on referrals and initiation of mental health services. We will test the effect of CPM-PTS implementation on caregivers' understanding of mental health needs and intentions to initiate services (primary hypothesis) using multilevel linear regression models. Models will use caregiver data from all sites and include a fixed effect of pre- vs. post-implementation and a random effect of CAC to account for clustering. If model convergence becomes a problem, we will apply robust standard errors to adjust for clustering. We will also explore outcomes using an interrupted time series regression model [145, 146]. Because differences in implementation between CACs may affect our estimates of CPM-PTS effectiveness, we may conduct exploratory "dosage adjusted" analyses using weighted regression models with weights proportional to screening rates to account for differences in use of the CPM-PTS between CACs. Lastly, if there are sufficient data, we will explore changes in mental health referrals and treatment initiation after CPM-PTS implementation (exploratory hypothesis). For each CAC, we will calculate the proportion of children referred to mental health services and the proportion initiating treatment during the 6 months preceding CPM-PTS implementation and the 12 months following CPM-PTS implementation and look for changes from pre-implementation to post-implementation.

Power consideration for our primary effectiveness hypothesis (i.e., changes in caregivers' understanding of mental health needs and intentions to initiate services)

is based on testing regression coefficients in multilevel models. To detect a standardized effect size of Cohen's $d = 0.35$ from pre-implementation to post-implementation using a two-sided *t*-test at the 5% significance level with 80% power, a "standard design" with no clustering would require 292 caregivers. We multiplied this sample size by the design effect (DE) to account for clustering. The DE is equal to (1-ICC) because the implementation predictor has zero between-cluster variation, making the multilevel design more efficient than the standard design for this aim. Incorporating the DE reduces the required sample sizes to 278 and 263 for ICCs of 0.05 and 0.10, respectively. With our estimated sample size of 288, we will achieve at least 80% power to detect small-to-medium effects ($d = 0.35$) for a range of ICCs.

Data and safety monitoring

The principal investigator will hold primary responsibility for monitoring the safety of this trial. The trial involves a non-pharmacological intervention provided to adult team members and the risk for serious adverse events is low; therefore, a Data and Safety Monitoring Board will not be appointed for this study. We will report any serious and unexpected adverse events to the Institutional Review Board (IRB) in accordance with IRB policy. The research team will meet regularly to discuss administrative issues and raise any concerns, and mentorship team meetings will include review and discussion of participant safety and privacy and the integrity, validity, and confidentiality of data collection and analyses. All participant information and data will be stored on a secure server. Any changes to study procedures will be approved by the IRB and reported in an update to the registered trial protocol. Members of the mentorship team can access the data by request after obtaining IRB approval.

Dissemination plans

Study findings will be disseminated locally and nationally through multiple means, including (1) presentations to the community advisory committee; (2) presentations to participating CACs and CAC-related organizations, such as the Pennsylvania Chapter of CACs; (3) presentations at scientific and practice-oriented conferences; and (4) peer-reviewed journal articles. We will use the International Committee of Medical Journal Editors [147] criteria to make authorship decisions. The community advisory committee will be actively involved in determining strategies for disseminating results, particularly to CACs and associated stakeholder groups (e.g., leadership, team members, caregivers). This will help ensure that study findings and their implications can be immediately communicated to support practice initiatives and guide subsequent research investigations.

Discussion

This study is innovative in its focus on CACs, a non-traditional setting, in rural areas. Extending the reach of evidence-based practices to the 13.4 million American children living in rural areas is crucial to public health impact. Effective screening and referral protocols can increase accurate identification of mental health needs, facilitate access to care, maximize efficient use of limited resources, and ultimately reduce rural disparities in mental health care. We will test the effectiveness of the CPM-PTS in increasing caregivers' understanding of mental health needs and intentions to initiate services and explore its effectiveness in increasing treatment referrals and treatment initiation for children served by CACs.

Our team-focused implementation strategies reflect an innovative approach to improving implementation outcomes and are aligned with broader movements toward team-based care. We will use a rigorous Implementation Mapping process to develop team strategies and will adapt strategies proven to improve functioning in business and acute healthcare settings to non-acute settings. Consistent with calls to examine mechanisms in implementation science [148–150], we will assess possible team-level mechanisms of change for these strategies. Although this pilot trial is not powered to detect group differences in team and implementation outcomes, it will provide important feasibility data to support a future fully powered trial. The team strategies developed in this study may be generalizable to other teams with limited resources providing care across organizational and disciplinary boundaries and relying on cross-sector collaboration. Understanding how multidisciplinary teams affect the implementation process, and subsequently developing team-focused strategies to enhance implementation, can advance efforts to deliver evidence-based practices in team-based service settings.

Supplementary Information

Authors' contributions

EAM is the study principal investigator, developed the study concept and design, and drafted the manuscript. DJK and GAA are co-mentors for EAM's

Availability of data and materials
Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Declarations

Ethics approval and consent to participate
All study procedures are approved by the University of Pittsburgh Institutional Review Board.

Consent for publication
Not applicable.

Competing interests
Gregory Aarons is a member of the Editorial Board for the journal. The authors declare that they have no other competing interests.

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McGuier *et al. Implementation Science Communications*   (2023) 4:58

Page 12 of 14

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