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Core competency model self-directed violence prevention training program for corrections: a hybrid feasibility-effectiveness trial

Skyler D. Prowten[1], Sam C. Cacace[1], Jessamyn Moxie[1], Ava Peters[1], Adria Corral[2], Marvella Bowman[2], Lewis J. Peiper[2] and Robert J. Cramer[1,3*]

Abstract

Background Self-directed violence encompasses both suicide and self-injury. United States correctional settings face high self-directed violence rates. Training correctional behavioral health clinicians (BHCs) in evidence-based self-directed violence prevention practices represents one solution. The Core Competency Model for Corrections (CCM-C) is a self-directed violence prevention training program addressing clinician self-management (e.g., managing personal reactions to self-directed violence) and clinical care (e.g., eliciting evidence-based risk and protective factors) skills. The present study held aims to: (1) assess CCM-C feasibility, appropriateness, acceptability, and usability; (2) evaluate short-term impacts on BHC self-directed violence knowledge, attitudes, and skill usage; and (3) explore short-term impacts on BHC compassion fatigue.

Methods The present study was a statewide hybrid feasibility-effectiveness trial evaluating the CCM-C taking place between January and December 2024. Pre-training feedback was gathered from a corrections advisory panel ($N=7$). For the trial implementation, we conducted a waitlist control sequential cross-over design. BHCs ($N=60$) were randomly assigned to two training groups: Baseline training versus waitlist control. BHCs provided quantitative and qualitative survey input on CCM-C feasibility outcomes (aim 1), and completed self-report inventories of self-directed violence-related outcomes (aims 2 and 3). Descriptive statistics and thematic analysis assessed feasibility outcomes. Repeated-measures analysis of variance (ANOVA) tests examined CCM-C outcomes.

Results CCM-C was highly acceptable, appropriate, feasible, and usable. Recommended improvements included removing non-corrections content, enhancing opportunities for BHC participation and interaction, and creating participant handout packages. CCM-C increased BHC self-directed violence prevention knowledge, perceived skill mastery, intent/actual use of training content, and lowered compassion fatigue levels. Attitudes toward intervening with a suicidal person only improved for the waitlist control group. Attitudes towards incarcerated individuals who self-harm remained unchanged.

*Correspondence:
Robert J. Cramer
rcramer4@charlotte.edu

Full list of author information is available at the end of the article

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Discussion Early results show CCM-C to be a feasible, effective self-directed violence prevention training program for correctional BHCs. Results support broader CCM training literature and a social-cognitive training model. Statewide partners will generate the *CCM-C Toolkit*, a package comprising training materials, implementation guidance, and train-the-trainer materials. The Toolkit will provide accessible resources for further CCM-C implementation, adaptation, and evaluation.

Trial registration This study was registered at clinicaltrials.gov (NCT06359574).

Keywords Suicide, Self-injury, Self-directed violence, Corrections, Training, Clinician

Background

Self-directed violence, which includes both suicidal and non-suicidal behaviors [1], represents a pressing concern in correctional settings due to its disproportionately high prevalence among incarcerated populations [1]. Incarcerated individuals face unique self-directed violence systems stressors (e.g., systemic overcrowding, isolation) and limited access to care due to staffing shortages or gatekeeping from correctional officers [2–5]. Incarcerated individuals also endure general population self-directed violence risk factors such as symptoms of depression, anxiety, and substance use that can be exacerbated due to loss of social support, witnessing violence, and navigating social hierarchies [5, 6]. The burden of self-directed violence extends beyond individual harm, straining correctional resources and personnel while highlighting gaps in effective prevention strategies tailored for these environments [7–9]. Despite the widespread need, evidence-based training programs for behavioral health clinicians (BHCs) to adequately detect, manage, and treat self-directed violence in correctional settings remain scarce [2].

Self-directed violence in correctional settings

Suicide ranks among the leading causes of death in state and federal prisons [1]. The most recent data from the Bureau of Justice Statistics reported in 2019 that 12.4% of deaths in state prisons resulted from suicide [1]. This was an increase of 85% compared to the number of suicides in 2001. Federal prisons reported an increase of 61% over the same timeframe, and over half of all deaths between 2014 and 2021 were suicide-related [1, 10]. The Office of the Inspector General found policy and operational failures such as incomplete risk assessments, inadequate treatment for individuals in distress, and staffing shortages contributed to suicide by incarcerated individuals [10]. Compared to the general population, the rate of suicide among incarcerated individuals is approximately double [1]. Additionally, self-injury is widespread. Data show self-injury occurs in 98% of prisons, with 2.4% of incarcerated individuals engaging in self-injurious acts [11].

The repercussions of self-directed violence extend to correctional staff and systems, creating operational and financial challenges. Annually, correctional mental health services cost over $1 billion in the United States [12]. Impacting care provision, incarcerated individuals struggle to get the care they need and can wait months after a request is submitted to see a mental health professional [2]. High turnover and vacancy rates compound this strain, with correctional officer turnover reaching 48% and vacancy rates as high as 55% in some states [13]. Exposure to traumatic events and stressful work environments increase the risk of post-traumatic stress disorder, depression, and substance use in correctional staff [13, 14]. Providing clinical services for persons experiencing self-directed violence can be one such traumatic event with negative impacts for BHCs. Addressing self-directed violence for incarcerated individuals in correctional settings requires a comprehensive approach that not only mitigates risk factors but also strengthens protective factors. Interventions promoting social support, resilience, and coping skills can help reduce the occurrence of self-directed violence while fostering a safer, more supportive correctional environment. However, achieving these outcomes necessitates the implementation of empirically-validated training programs that equip BHCs to navigate the unique challenges of correctional care.

Correctional self-directed violence risk assessment and management practices and training

Standards for response and management of self-directed violence in corrections were developed by both the National Commission on Correctional Health Care [15] and the American Correctional Association [16]. These standards provide a framework of mandatory and non-mandatory guidelines for corrections that are designed to be adaptable to the needs of the institution [15, 16]. However, since the guidelines were created with flexibility in mind, there is a lack of structure and evidence-based assessments to address the specific needs related to self-directed violence risk detection and treatment in corrections. In response to these gaps, the Self-Injury Risk Assessment Protocol for Corrections (SIRAP-C) was developed to fulfill legal and professional standards, improve upon existing risk assessment methods, and facilitate intervention and treatment decisions [17]. The SIRAP-C is a structured 25-item clinician-administered

risk assessment protocol covering seven subscales: depressive symptoms, current suicidal thinking, history of self-directed violence, family history of self-directed violence, reasons for living, coping skills, and social connectedness. SIRAP-C subscale scores are used to inform risk level and treatment determinations.

The National Commission on Correctional Health Care and American Correctional Association standards suggest that BHCs receive in-depth mental health training at the beginning of their employment along with at least 12 h of annual continuing professional education while employed [15, 16]. Although both sets of national standards specifically recommend suicide prevention training, there is currently a deficit of empirically evaluated, evidence-based self-directed violence prevention training programs for BHCs in corrections. In fact, most existing mental health and suicide prevention trainings are focused on correctional officers, showing promise to positively impact knowledge, attitudes, and skill demonstration [18]. Existing correctionally-oriented trainings for BHCs have not been evaluated for feasibility or effectiveness. Magaletta and colleagues [19] outlined role play activities that could be used in suicide risk assessment training in corrections; however, no training implementation or evaluation was reported. Private sector training exists, such as Question, Persuade, Refer (QPR) for Corrections [20]. The training addresses suicide focused content, such as suicide myths and facts, suicide warning sign recognition, and how to communicate and get incarcerated persons to appropriate clinical help. Although authors note that QPR for Corrections is appropriate for correctional officers and health professionals, the skills addressed are limited. The depth of training does not cover detailed clinical risk assessment, therapy strategies, the realities of handling self-injury, and clinician self-management skills (e.g., self-care). No evaluation of QPR for Corrections could be located.

To fill this gap in research, the Core Competency Model for Corrections (CCM-C) builds on the foundation of the Core Competency Model (CCM) [21] and the social-cognitive model of suicide prevention training [22] to provide BHCs self-directed violence prevention practice tools. It advances the limited literature on self-directed violence training for BHCs in several ways. Self-injury is a pressing problem for correctional settings [11, 23]. The prevalence and impacts of correctional self-injury begs for training that addresses the full scope of self-directed violence. Also, CCM-C training adds a unique focus on the clinician (e.g., BHCs managing their attitudes, engaging in self-care), which is currently lacking training for correctional BHCs. Finally, our pilot trial advances evaluation of any correctional self-directed violence focused training, regardless of audience, by addressing implementation or process outcomes as a primary outcome.

The core competency model of suicide prevention training

The CCM is a mental health provider suicide prevention training program grounded in social-cognitive model of training [24, 25]. The CCM includes ten core skills across two domains: clinician self-management and clinical care skills. The CCM includes the following 10 core competency areas [25]:

- Know and manage your attitude and reactions toward suicide.
- Maintain a collaborative, empathetic stance toward the client.
- Know and elicit evidence-based risk and protective factors.
- Focus on current plan and intent of suicidal ideation.
- Determine level of risk.
- Develop and enact a collaborative evidence-based treatment plan.
- Notify and involve other persons.
- Document risk, plan, and reasoning for clinical decisions.
- Know the law concerning suicide.
- Engage in debriefing and self-care.

The CCM was designed with the intention of flexibility, allowing it to be tailored to meet the needs of a specific population [25, 26]. CCM training approaches draw on social-cognitive activities such as psychoeducation, interactive techniques (e.g., case study discussions), and considerable resource provision. A key aspect of the CCM training approach is the inclusion of the Suicide Competency Assessment Form (SCAF) [26, 27], which is used to assess BHC perceived mastery of the 10 core competencies. Like the CCM training approach, flexibility is built into the SCAF, with self-report and observer-report versions available.

This model has shown positive impacts on BHCs' knowledge, attitudes, and skills in various settings [25, 28, 29]. Results from these investigations suggest that participation in CCM training leads to suicide prevention outcomes such as improved knowledge, more positive prevention attitudes, enhanced skill self-efficacy, and objective risk determination judgments and use of screening practices [24, 25, 28, 29]. Promising results in community and university settings have led to an adaptation of the model for correctional environments, referred to as the CCM-C [21].

Core competency model for corrections (CCM-C)

The CCM-C [21, 30] training program addresses suicide and self-injury, considering the unique context of correctional facilities. There are several noteworthy adaptations of the traditional CCM approach. For example, although CCM-C is based on the social-cognitive model of suicide

prevention training, mechanisms of training impact (e.g., knowledge improvement) address the full scope of self-directed violence [21]. The training program reflects infusion of corrections-specific content across the curriculum (see Online Supplement Table 1 for final training summary). Examples include self-assessing attitudes toward incarcerated persons who engage in self-injury (competency 1), reframing rapport building to a professional, therapeutically detached stance (competency 2), and discussing limitations of self-directed violence risk management, therapeutic, and social interventions in corrections (competencies 6 and 7) [30]. Perhaps the best illustration of adaptation of the CCM for corrections can be seen in how suicide and self-injury aspects of self-directed violence are differentiated throughout the training. Referring to Online Supplement Table 1, examples of how the training addresses the differences between suicide and self-injury include:

- Educational overview of key self-directed violence and persistent self-injury (PSI) terminology [30–32].
- Review of general self-directed violence self-report tools to assess personal attitudes toward suicide prevention.
- Overview of the Interpersonal Theory of Suicide [33, 34] followed by discussion how it can be used in risk assessment versus Overview of functional models (e.g., Four Function Model [35]) of self-injury and their applicability to corrections [36]).
- Separate reviews and resource provision regarding suicide and self-injury risk and protective factors.
- Provision and review of existing suicide (e.g., Suicidal Behaviors Questionnaire-Revised [SBQ-R] [37]) versus self-injury (e.g., Deliberate Self-Harm Inventory [DSHI] [38]) risk assessment tools.
- Multiple-choice question activities differentiating suicide versus self-injury terminology.
- Review of leading self-directed violence-specific treatments: Dialectical Behavior Therapy (DBT) [39] and Brief Cognitive-Behavioral Therapy for Suicide (BCBT) [40], and their evidence for suicide versus self-injury.

Adapting the training model for correctional considerations therefore resulted in some rewording of the competencies as well [30]. CCM-C development and evaluation featured pre-implementation input from correctional behavioral health experts, and an assessment of self-directed violence and corrections attitudes [30]. This study is the first implementation and evaluation of CCM-C.

The present study

The present study featured a hybrid feasibility-effectiveness pilot trial of CCM-C for BHCs from a state prison system. The pre-registered article detailing the full implementation and evaluation backdrop can be found in the literature [30]. The three study aims, with associated research questions (RQ) and hypotheses (H) were:

Aim 1: To assess CCM-C feasibility, appropriateness, acceptability, and usability.
RQ1: What are the barriers and facilitators of CCM-C implementation?
RQ2: What CCM-C improvements can be made to the training program?

No hypotheses are offered for Aim 1 because CCM-C is a new training program and qualitative analysis of CCM-C implementation is incompatible with a-prior hypotheses.

Aim 2: To evaluate short-term impacts on BHC self-directed violence knowledge, attitudes, and skill usage.
H1: Participation in CCM-C training will result in improved self-directed violence prevention knowledge.
H2: Participation in CCM-C training will result in improved self-directed violence prevention attitudes (reduced stigmatizing beliefs).
H3: Participation in CCM-C training will result in improved perceived self-directed violence prevention skill mastery.
H4: Participation in CCM-C training will result in improved intent/actual use of CCM-C training content.

H1 to H4 are substantiated by the existing general CCM training evaluation literature demonstrating consistent impacts on BHC suicide prevention training knowledge, attitudes, stigma, perceived skills, and objective skill performance [24, 25, 28, 29]. They are also supported by the social-cognitive suicide prevention training model that suggests training should lead to positive gains in all of these areas [21, 22].

Aim 3: To explore short-term impacts on BHC compassion fatigue.
RQ3: Does compassion fatigue change after CCM-C participation?

No hypotheses are provided for Aim 3 due to the lack of prior relevant BHC training evaluation for impacts on compassion fatigue.

Methods

This paper has been written in accordance with the CONSORT 2010 guidelines extension for randomized pilot and feasibility trials [41].

Design

We employed a type-3 hybrid implementation effectiveness trial [42]. Primary implementation outcomes were defined as feasibility, acceptability, appropriateness, and usability. Secondary clinician outcomes were defined as impact of the training on self-directed violence prevention knowledge, attitudes, and perceived skill efficacy. We conducted a waitlist control sequential cross-over design. BHCs were randomly assigned to two training intervention groups: Training Group 1 vs. Training Group 2 (waitlist control). All BHCs were asked to complete three survey assessments termed baseline, follow-up 1 (four weeks after baseline), and follow-up 2 (four weeks after follow-up 1). Training Group 1 completed the CCM-C just prior to follow-up 1, whereas Training Group 2 completed CCM-C just before follow-up 2. The study took place between January and December 2024.

Participants

Participants were BHCs from the North Carolina Department of Adult Correction (NC DAC) who met the following inclusion criteria: *(1)* working as a BHC; *(2)* aged 18 years or older; *(3)* residing in United States; and *(4)* employed at NC DAC. Participants were excluded if they possessed decisional or cognitive impairments that inhibited ability to give consent or if they were serving as a member of the study's correctional advisory panel (CAP) [30]. At the time of the study, the NC DAC Behavioral Health Services unit consisted of BHCs in psychology, clinical social work, and clinical mental health counseling. We planned for a sample of 50–100 BHCs to participate in the pilot trial based on similar suicide prevention training pilot evaluations [43, 44].

Randomization

A list of eligible BHCs ($N = 85$) was provided by NC DAC. A smaller number of eligible BHCs were identified compared to the initial number planned in the study protocol [30] because contractors were eliminated from the pool. This change resulted in imbalanced eligibility by geographic training region. Therefore, simple random sampling by region was not conducted; all eligible BHCs were included in the recruitment process. Randomization therefore featured two steps. In the first group randomization step, eligible BHCs were stratified according to years of clinical experience, creating five strata designated by the 10th, 25th, 75th, and 90th percentiles, resulting in five groups (1 = 3 years or less; 2 = more than three years to eight years; 3 = more than eight years to 25 years; 4 = more than 25 years to 30 years; 5 = more than 30 years). Then, blocked randomization was used to create similarly weighted training groups (Training Group 1 and Training Group 2) using the randomizr package [45] in Stata v. 18.0 [46]. Randomization procedures were conducted by the lead statistician on this project (author SC).

Ethical procedures

The UNC Charlotte Institutional Review Board approved the research protocol (#24–0209). The clinical trial registration number is NCT06359574.

Intervention

The intervention is the CCM-C training program [21, 30]. Prior to conducting the pilot trial, we employed a CAP, composed of seven administrative BHCs from NC and several other states. CAP demographic composition was 71% (5/7) men, 71% (5/7) white, and 86% (6/7) clinical psychologists. They provided expert review of all training content and materials prior to delivery of the training intervention to either Training Group 1 or Training Group 2. They also completed aim 1 feasibility assessment information.

The complete CCM-C training program module content and training approaches can be found in Online Supplement Table 1. The piloted CCM-C training consisted of two in-person sessions delivered over a two-day (10-hour) period. The CCM-C training was based on the structure of the CCM competencies while being specifically tailored to application in a correctional setting in accordance with the social-cognitive model of CCM-C training [21]. Ten training modules were delivered, each containing a combination of psychoeducation, resource provision, self-reflection tools, and interactive case study discussions [30]. Training was delivered by the same set of presenters (authors LJP and RJC). The presentation team consisted of experts in correctional behavioral health (LJP) and self-directed violence prevention (RJC).

Study questionnaire and data collection procedures

Data were collected via Qualtrics online survey software. Responses were requested and two reminders deployed over the course of a week for each assessment. Each assessment included randomized measures assessing the outcomes of suicide competency, attitudes toward intervening with a suicidal person, attitudes towards incarcerated individuals who self-harm, self-directed violence knowledge, importance and intent to use training, and compassion fatigue. Each training group only completed implementation outcomes (e.g., feasibility, acceptability, appropriateness, and usability) at the time period immediately following their CCM-C attendance. Implementation outcomes were assessed before randomized

effectiveness measures. At the beginning of each survey, the Completely Automated Public Turing Test to tell Computers and Humans Apart (CAPTCHA) was used to ensure data quality.

Outcome measures

Training Implementation (e.g., Feasibility)

Drawing on best practices for mixed methods feasibility assessment in pilot trials [47], we assessed CCM-C implementation using two strategies. First, we selected best available measures to quantitatively assess the training's feasibility, acceptability, appropriateness, and usability. We did so by using the Feasibility of Intervention Measure (FIM), Acceptability of Intervention Measure (AIM), and Intervention Appropriateness Measure (IAM) [48]. Each of these measures contains four items measured on a 5-point Likert scale (1 = completely disagree; 5 = completely agree). Each item was tailored to the CCM-C intervention (e.g., "CCM-C seems possible"). In the current study, the FIM demonstrated good to excellent reliability (Cronbach's α follow-up 1 = 0.88; Cronbach's α follow-up 2 = 0.93), the AIM demonstrated excellent reliability (Cronbach's α follow-up 1 = 0.94; Cronbach's α follow-up 2 = 0.94) as did the IAM (Cronbach's α follow-up 1 = 0.94; Cronbach's α follow-up 2 = 0.97). Because usability was not covered in these measures, based on models of technology implementation [49], we added four items assessing intervention usability. We titled this set of items Usability of Intervention Measure (UIM); a sample item is "CCM-C seems usable." The UIM demonstrated good to excellent reliability (Cronbach's α follow-up 1 = 0.82; Cronbach's α follow-up 2 = 0.93). For each implementation scale (e.g., FIM), scores were summed across the four scales items for analysis. The second qualitative strategy we used to assess implementation was the creation of eight open-ended questions (two per domain of feasibility, acceptability, appropriateness, and usability). Questions were aligned with each feasibility domain in order to provide BHCs with the opportunity for specific elaboration on that domain [47]. Online Supplement Appendix B contains all items and open-ended questions. We interpreted qualitative and quantitative findings in tandem in order to gain an integrated picture of CCM-C feasibility, acceptability, appropriateness, and usability.

Suicide competency assessment form

Perceived self-directed violence prevention skills were assessed via an adapted version of the SCAF [26, 27]. The SCAF contains a total of 10 items, each capturing one core competency in the CCM-C training. Participants responded on a four-point scale of perceived competency (1 = incapable; 4 = advanced). In the present study, each item was adapted such that the term "suicide" was replaced with "self-directed violence" to better capture perceived competency of self-directed violence-focused skills. Scores were summed with higher scores indicating higher perceived self-directed violence skill mastery [27]. Since this measure has four anchors, an ordinal alpha was calculated in accordance with recommendations from Gadermann and colleagues [50]. In each assessment, the SCAF was found to have excellent estimated reliability among our sample (ordinal α baseline = 0.95; ordinal α follow-up 1 = 0.96; ordinal α follow-up 2 = 0.95).

Attitudes about intervening with a suicidal person

The Attitudes about Intervening with a Suicidal Person (AIBS) [51] questionnaire measured prevention-focused attitudes along with willingness to intervene in another's self-directed violence event. Participants were asked to rate their approval of 14 items on a 5-point Likert scale (1 = strongly disapprove; 5 = strongly approve). After reverse-coding seven items, all items were summed to derive a total score. Higher scores indicated greater intention to intervene with a suicidal person [51, 52]. The AIBS was found to have marginal to acceptable overall estimated reliability across time points (Cronbach's α baseline = 0.76; Cronbach's α follow-up 1 = 0.69; Cronbach's α follow-up 2 = 0.80).

Attitudes toward prisoners who self-harm scale

Attitudes about incarcerated persons engaging in self-injury were measured through the Attitudes toward Prisoners who Self-Harm Scale (APSH) [53, 54]. The APSH contains 25 items scored on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). After reverse-coding 14 items, items are summed to derive a total score. Higher scores denote more favorable views of incarcerated individuals who engage in self-harm. The APSH demonstrated marginal to acceptable estimated reliability across time points (Cronbach's α baseline = 0.68; Cronbach's α follow-up 1 = 0.81; Cronbach's α follow-up 2 = 0.71).

Core competency model for corrections knowledge quiz

Knowledge was measured by adapting the CCM knowledge quiz [25] for corrections (CCM-C KQ). Ten multiple-choice questions were developed or adapted to match CCM-C training content. Consistent with Bloom's approach to constructing test items [55], questions were designed to assess basic factual knowledge, comprehension, and application of CCM-C content. Answer choices were dichotomized such that 1 = correct and 0 = incorrect. Correct answers are summed for a total score, where higher scores indicated greater CCM-C knowledge. Kuder-Richardson 20 (KR20) formula [56] was used for binary outcome reliability. Estimated reliability across time points was poor (KR20 baseline = 0.49; KR20 follow-up 1 = 0.53; KR20 follow-up 2 = 0.50).

Importance and intent to use training

BHCs' perceived importance (pre-training) and intent to use (post-training) the CCM-C training material and content was evaluated by the intention to use training content scale [25]. This instrument is comprised of seven items, where each item queries the participant's intent to use self-directed violence prevention content or skills (e.g., self-reflection tools). Items are rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) and summed for a total score, where higher scores indicate greater intent to use the training. The perceived importance/intention to use training content scale was found to have good to excellent estimated reliability across time points (Cronbach's α baseline = 0.88; Cronbach's α follow-up 1 = 0.92; Cronbach's α follow-up 2 = 0.86).

Compassion fatigue-short scale

The Compassion Fatigue-Short Scale (CF-SS) [57] was used to assess compassion fatigue, conceptualized as secondary traumatic stress and job burnout. This measure contains 13 items, with each item rated on a 10-point Likert scale (1 = rarely; 10 = very often). Items were summed to derive a total score for analysis, where higher scores suggest greater compassion fatigue. The overall CF-SS demonstrated excellent estimated reliability across time points (Cronbach's α baseline = 0.92; Cronbach's α follow-up 1 = 0.90; Cronbach's α follow-up 2 = 0.90).

Analytic plan

The full analytic plan is described in the pre-registered protocol [30].

Aim 1: Descriptive and qualitative analyses of implementation outcomes We reported descriptive statistics regarding the feasibility, acceptability, appropriateness, and usability of the training for all participants and by training group. Furthermore, we examined each implementation outcome in relation to prior self-directed violence exposure and suicide prevention training. Qualitative analyses were conducted for data concerning pre-training CCM-C editing and to answer primary study implementation questions. Specifically, qualitative analyses were run using Dedoose online qualitative software [58] to conduct the content analyses of responses to the eight open-ended implementation outcome questions. While we originally intended to conduct thematic analysis along with content analysis [30], narrative feedback responses were too brief to facilitate the depth and richness of data necessary for derivation of themes [59]. As such, we conducted directed content analysis [60] in which we first used a deductive approach grounded in prior theories, followed by an inductive approach to develop sub-categories within those categories [60]. This approach began with the examination of acceptability of content and activities, appropriateness of topics, feasibility of participation in training intervention, and usability of training in BHCs' everyday practice. We divided open-ended responses into meaningful units, coded them into sub-categories. The sub-categories were then examined to combine as patterns emerged [61] (see Online Supplement Appendix A for codebook). To aid with interpretation of brief survey responses, field notes recorded during training delivery to both Training Group 1 and Training Group 2 were taken and used to help contextualize participant responses [62].

Three independent raters coded participant responses such that each response was coded twice. Inter-rater reliability was calculated using Cohen's kappa scores via Dedoose's "test" function, with scores ranging between 0.20 ("Engagement") and 0.85 ("Time"). If kappa scores were less than 0.6 (indicative of less than substantial agreement) [63], the three coders discussed until consensus had been reached and the codebook was refined. Specifically, "Engagement", "Content-Acceptable", and "Content-Appropriate" were refined. The coders met regularly to discuss analytic challenges, as recommended in qualitative team analysis [64]. Implementation outcome domains (e.g., acceptability) were treated as parent codes by the qualitative team.

Aim 2 and 3: Effectiveness and exploratory analyses Our original intention was to run a multi-group interrupted time-series analysis on each outcome variable (for a total of five models) [30]. However, there was a large amount of missing data in the follow-up surveys, with about half of each training group only completing one time-point. Upon inspection of missing data patterns, we discovered significant differences in missing data by demographic characteristics (see Online Supplement Table 2 for further detail) indicating data were not missing at random [65]. Further, participants primarily skipped full scales (98.8%), as opposed to individual items within each survey, preventing effective use of modern missing data handling techniques [66]. Due to these limitations and the small sample, we could not reliably run the planned factored regression analysis for missing data, or the interrupted time-series analysis on outcomes.

Instead, we kept participants' baseline data (pre-intervention) and follow-up data for the survey submitted closest to completion of training (post-intervention). Participants primarily (96%) responded to the evaluation survey immediately post-training for their training group. We used these scores to run a series of repeated-measures analysis of variance (ANOVA) tests to examine whether the intervention had a significant impact on each outcome variable. Each outcome measure was entered as a repeated-measure, and training group (Training Group 1 vs. Training Group 2) entered as a between-groups

predictor. Assumptions for repeated-measures ANOVA (e.g., homogeneity of variance and sphericity) were examined for each outcome, and met for each model, except intention to use training material (hereafter referred to as intention). As the intention model presented with heterogeneity of variance between training groups, we included the Greenhouse-Geisser correction [67], and discovered the findings remained unchanged. All missing data and repeated measures analyses were done using Stata v. 18.0 [46].

Results

Recruitment and participant flow

Selected participants were first introduced to the study at an in-person all staff meeting led by an NC DAC investigator. At this meeting, the training was summarized, and it was clarified that survey participation as part of the current study was voluntary. A follow-up email was then sent to eligible BHCs with this information. This email summarized how potential participants were randomly selected for inclusion in the study, the study's importance, and what to expect if they chose to participate [30].

A total of 85 BHCs were deemed eligible to participate and were assigned to one of two training dates. Of those, several ($n = 8$) indicated they would be unable to attend either of the scheduled training dates, thereby dropping from possible study participation. Therefore, a total of 77 BHCs were contacted to participate in the training evaluation (training group 1 $n = 37$; training group 2 $n = 40$). Of those contacted, 60 BHCs consented to participation in the baseline survey. BHCs could then choose whether to participate in assessments at follow-up 1 and follow-up 2 time periods. Participation in follow-up 1 did not impact the opportunity to participate in follow-up 2. Participant flow is depicted in Fig. 1.

Pre-training CAP feedback

The findings of the initial CAP review of CCM-C training materials (i.e., before implementation of the training) point to high acceptability of content topics and clear articulation divided by competency. Along with aesthetic suggestions for the slides, participants highlighted a need to focus on the experience of clinicians (e.g., less focus on theory) and an explicit relevancy for DAC (e.g., include relevant case studies to engage participants). Case studies, knowledge checks, and videos were suggested to enhance participant engagement. As a result, we enhanced slide aesthetics and what theories were included as training content. Findings also highlight high acceptability of content topics and clear training content articulation organized by competency.

Baseline descriptive characteristics of participants

A total of 60 participants completed the initial baseline survey. In the subsequent follow up 1 and follow up 2 surveys, 47 and 51 responded, respectively. Participants' average age at baseline was 47.86 years old ($SD = 9.39$). The sample was mostly women ($n = 40$; 66.7%) and did not identify as Hispanic or Latino ($n = 57$; 95%). Most participants' highest degree achieved was a master's ($n = 50$; 83.3%). Professional disciplines varied, with the majority specializing in psychology ($n = 44$; 73.3%), followed by social work ($n = 14$; 23.3%), and counseling ($n = 2$; 3.33%). Participants indicated an average of 17.16 years ($SD = 11.05$) of clinical experience and 23.25 h ($SD = 29.74$) of completed suicide prevention training. While the majority of participants did not know someone who engaged in self-injury in their personal life ($n = 32$; 53.3%), an overwhelming majority did know someone through work who engaged in self-injury ($n = 44$; 74.6%). Similarly, the majority of participants did not know someone who attempted suicide in their personal life ($n = 31$; 52.5%), but did know someone through work that had attempted suicide ($n = 41$; 69.5%). Finally, approximately half of the participants did not know someone in their personal life ($n = 29$; 49.2%) or work life ($n = 30$; 50.9%) that had died by suicide. Overall, each participant lost approximately one patient to suicide ($SD = 4.55$).

Preliminary analyses[1]

The median time for survey completion was approximately 23-minutes ($M = 477.19$; $SD = 1776.02$). Missing data analysis revealed only $n = 30$ participants fully completed the survey at all three time points as instructed. The remaining participants ($n = 23$; 76.7%) completed the baseline survey and only one follow-up survey (either follow-up 1 or follow-up 2). To maximize available data and satisfy aims to assess outcomes, we kept participants' baseline data (pre-intervention) and follow-up data for the survey submitted closest to completion of training (post-intervention). This resulted in an approximately equal amount of analyzable data from each training group (Training Group 1 $n = 26$; Training Group 2 $n = 27$).

[1] Average implementation outcome ratings were analyzed in relation to prior self-directed violence exposure and suicide prevention training (See Online Supplement text and Online Supplement Table 3). Descriptive statistics for program effectiveness outcomes at each assessment period and pre- vs. post-training can be found in Online Supplement Tables 4 and 5, respectively. Pre-to-post training intervention values generally fell in expected directions. Correlational analyses supplemented by data visualization were conducted to assess associations between prior exposure to self-directed violence and suicide prevention training to pre-intervention outcomes (see Online Supplement text, Online Supplement Table 6, and Online Supplement Figs. 1 through 3) and post-intervention outcomes (See Online Supplement text, Online Supplement Table 7, and Online Supplement Figs. 4, 5 and 6).

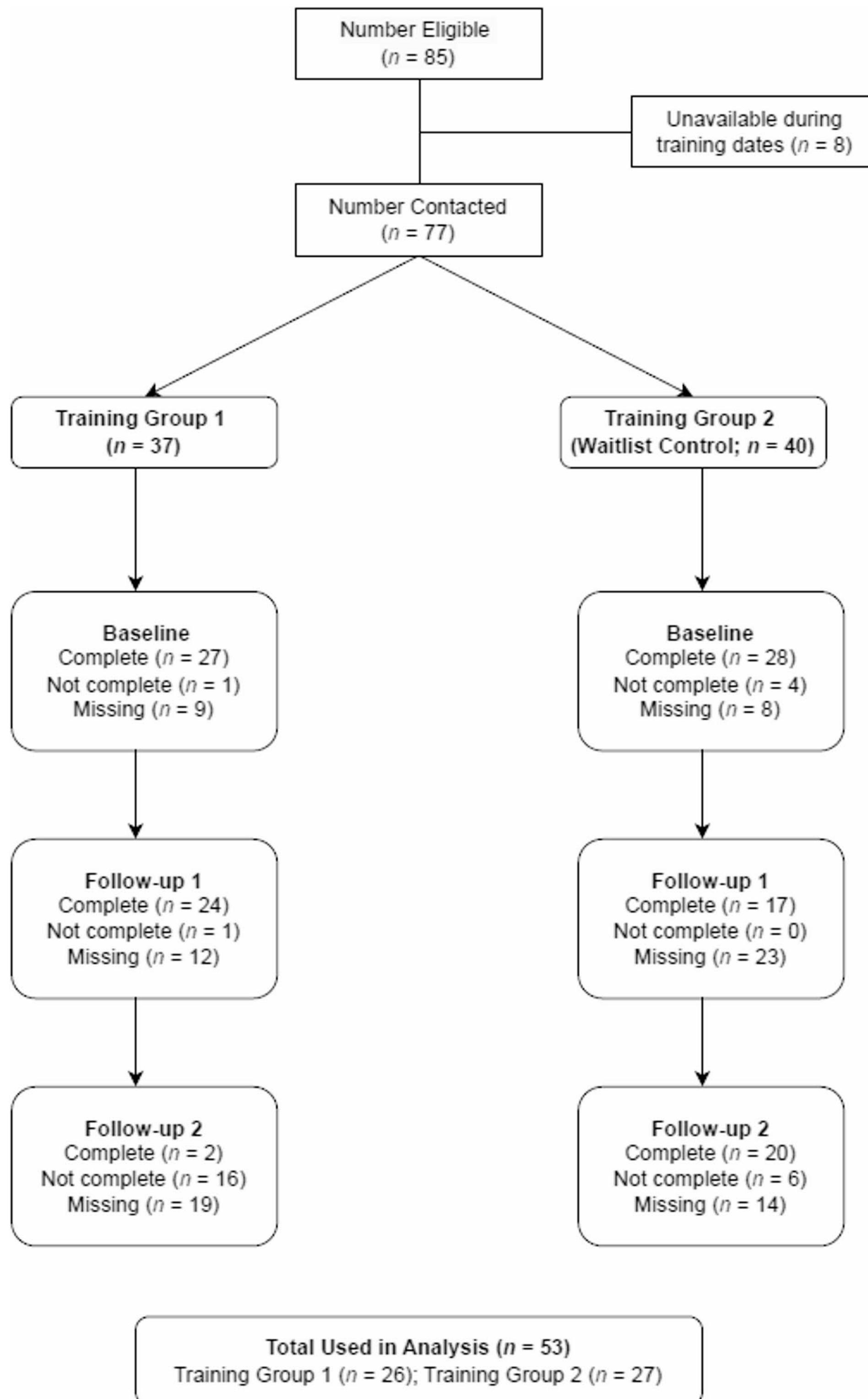

Fig. 1 Flow chart of behavioral health counselors' participation. Note. Analysis consisted of five repeated measures ANOVA models

Table 1 Descriptive statistics of training implementation outcomes

Scale	TG 1		TG 2		Total	
	M	*SD*	*M*	*SD*	*M*	*SD*
Acceptability	4.26	0.64	4.33	0.57	4.29	0.60
Appropriateness	4.33	0.53	4.30	0.58	4.32	0.55
Feasibility	4.09	0.59	4.11	0.58	4.10	0.58
Usability	4.20	0.47	4.19	0.63	4.20	0.54
Overall	4.22	0.49	4.23	0.52	4.23	0.50

Outcomes rated on 5-point Likert scale

TG Training Group

Table 2 Parent- and sub-category codes

Parent Code	Sub-code	Definition
Acceptability	Content	Preferences in content and resources
	Engagement	Referred to audience engagement
	Facilitation	Pertained to presenters and training atmosphere
Appropriateness	Appropriate for Experience Level	Referred to position and time in role
	Content	Mentioned relevance of content and resources
	Legal	Directed toward legal aspects mentioned in Competency 9
Feasibility	Logistics	Mentioned room, furniture, location, and overnight accommodations
	Delivery	Preferences in training structure, including break schedule
	Time	Discussed time in their larger work context
Usability	Usability	General aspects useful/not useful
	Good in Theory	Described suggestions from training as not practical

Positive and negative tonality was also assessed

Aim 1: CCM-C feasibility, appropriateness, acceptability, and usability

Descriptive analyses

Participants rated training implementation highly in acceptability, appropriateness, feasibility, and usability (see Table 1).

Content analyses

Each parent and child code, along with responses with participant identification numbers, are described in depth below. A summary of categories and their definitions can be found in Table 2 (see Online Supplement Appendix A for full codebook).

Acceptability

Three subcodes emerged: content, engagement, and facilitation. In terms of general acceptability, participants reported that they found the material generally acceptable and described it as *"comprehensive"* (1008) and *"interesting"* (1018). The comprehensiveness may have been seen as less acceptable by some, as one participant described a counternarrative in which they did not appreciate the type and amount of content: "*I felt like I was being 'lectured to' and basically being told 'What you're doing isn't good enough, and if you don't do better, you will be successfully sued*'" (1065). There were specific content areas that participants repeatedly provided favorable and constructive comments about: responding to self-directed violence, resources provided, and fit with DAC environment (see Online Supplement for sample quotes).

In relation to self-directed violence, participants liked the inclusion of facets of self-directed violence, such as "*[d]ifferentiating intent when assessing risk*" (1024). Participants also responded positively to the idea of therapeutic detachment, describing it as "*new and interesting*" (1029), and giving "*[c]onfirmation that it's ok to present as 'careless' and that it can be useful with this population*" (1084).

Participants often mentioned the volume of provided resources as both appreciated and overwhelming. Provided resources were commonly viewed as *"...helpful in the provision of services"* (1072). Participants also indicated appreciation of SIRAP-C inclusion: *"I appreciate that now have worksheet to take to [self-injury risk assessment] encounters"* (1038). Participants expressed dislike towards sharing of resources that were not specific to corrections, and suggested inclusion of a table of contents to aid in resource navigation.

The fit with the DAC environment was a component of acceptability with mixed perceptions. Some appreciated the alignment, "*I liked how the examples and assessment documents were relevant to the population we serve*" (1020), and *"I enjoyed that the data was pulled from our experience in NC DAC"* (1049). Others needed more explicit connections to the environment. When asked to express what they disliked about the training,

one participant commented "*having to determine which instruments or theories will work for DAC*" (1037). This same participant (1037) made a specific suggestion for tailoring to the DAC environment related to motivation: "*You must often times put more energy and effort into enlisting honest motivation to improve or maintain safety with those in corrections.*"

Engagement The general set up of the training was described as engaging. One example was a participant who stated that "*[u]se of scenarios for discussion and other examples or questions posed to participants*" (1048) were listed as effective elements. Case law was a specific topic where one participant suggested more engagement: "*While case law was important, perhaps presenting it in a different way would engage the audience more*" (1049). To enhance audience engagement, participants wanted more discussion, participation in response to vignettes, breakout groups, or activities to facilitate greater exploration of the topics. Lastly, one participant suggested more incorporation of other media. "*More mixed media would've been a nice bonus (videos, news articles, etc.)*" (1018). Presenters were described as "*knowledgeable*" (1055) and "*interesting*" (1086). Participants appreciated the interaction with facilitators (1071), the "no judgement zone" (1016), humor (1018), and being able to compare experiences with their peers (1018).

Appropriateness

Three appropriateness subcodes emerged: appropriate for experience level, content, and legality. Most participants found the training appropriate for their work in corrections ($n = 31$). A participant voiced how the training was "*relevant to corrections which is hard to find in community-based training*" (1081). Those further in their career found the information "*to be more of a refresher course*" (1048), stating "*many of the competencies are based on things I am already doing or only require a small adjustment to come in line with CCM-C*" (1009). Newer clinicians found it helpful to be with individuals with more work experience, mentioning they "*appreciated being in a room with peers who shared their experiences and things they have learned throughout their career*" (1001).

The appropriateness of a few content areas that were mentioned repeatedly by participants including resources provided, fit within the DAC environment, responding to self-directed violence, and the legal aspect of training. For example, participants appreciated the practical and conceptual content in relation to their work setting, stating they liked the "*different theoretical approaches used with this population*" (1084), the "*conceptual models for suicide and self-injury risk*" (1016), and learning the "*process of guiding treatment*" (1080). BHCs appreciated the resources given stating they "*appreciated the BCBT for SI book [Brief Cognitive Behavioral Therapy for Suicide Prevention] and new SIRAP-C*" (1038) but the handouts could be more helpful with a few participants suggesting sample treatment plans or documentation.

There were mostly positive reviews of the amount of data in the training, with some feeling like it was useful and relevant to the job, "*I enjoyed the data was pulled from our experience in NC DAC and that it addresses the many aspects of self-harm*" (1049). However, one participant reported it was "*too academic, lacked a practical approach*" (1070). Another content area that had mixed reviews was clinicians' attitudes. While most individuals spoke positively about content related to knowing and managing attitudes, one individual felt differently: "*I think it's a shame that so many of my peers have negative connotations regarding helping [incarcerated persons] that endorse and/or exhibit [self-directed violence]-almost as if such [incarcerated individuals] are a nuisance, burden, and impediment…Future training may want to consider focusing on the attitudes of our staff and shifting towards being proactive and not reactive*" (1008).

The largest critique from participants was learning about instruments that are not pertinent to their work in correctional settings. They mentioned several of the assessments were "*not practical*" (1038) in the prison setting and it would be helpful to focus on tools applicable to the correctional setting (see Online Supplement for additional sample quotes).

When it came to the legal aspect of training most individuals expressed appreciation of its inclusion. Participants found it important to lessen the likelihood of liability: "*Documentation topic is very important to help keep clinicians protected*" (1009). Some suggested "*expanding the discussion of applicable legal issues*" (1047), and "*going more in depth with documentation*" (1034). Regarding legal issues, one dissenting opinion stated that the legal issue was over discussed, and recommended future iterations of the training "*tone down the fear mongering about being sued. We live with that fear everyday of our working lives already.*"

Feasibility

Three feasibility subcodes emerged: logistics, delivery, and time. When asked about what made it easy for them to participate, participants focused on distance from home, food (and coffee), acoustics of the room. A handful of participants commented on aspects of training delivery that made participation difficult. One participant observed that there was "*[l]ots of information presented in a short amount of time. I think having a few more breaks would have been effective*" (1085). Regarding the length of the training, a few participants reacted negatively to "*the length of time it took*" (1086) away from work duties (see additional quotes in Online Supplement).

Table 3 Repeated measures ANOVA results

	Pre-Training	Post-Training			
Outcome	***M (SD)***	***M (SD)***	η^2_p	**Effect size magnitude**	**Significant change**
SCAF	30.6 (4.90)	33.0 (4.89)	0.21	Large	Yes***
AIBS	48.9 (4.94)	49.8 (4.81)	0.07	--	No
APSH	93.8 (5.41)	92.3 (6.46)	0.03	--	No
CCM-C KQ	7.22 (1.75)	7.87 (1.56)	0.12	Large	Yes*
Intention	31.3 (3.20)	32.0 (3.04)	0.08	Medium	Yes*
CF-SS	39.1 (21.8)	35.3 (16.8)	0.10	Medium	Yes*

M mean; *SD* standard deviation; *SCAF* Suicide Competency Assessment Form; *AIBS* Attitudes about Intervening with a Suicidal Person Scale; *APSH* Attitudes toward Prisoners who Self-Harm Scale; *CCM-C KQ* Core Competency Model for Corrections Knowledge Quiz; Intention = Intent to employ or actual use of training content; *CF-SS* Compassion Fatigue-Short Scale

*p <.05; ***p <.001

Usability

Regarding usability, many could directly see how they would incorporate training content into their practice: "*The training was particularly germane and practical... There are very few opportunities to be affirmed and understood for what we do, and it is also rare to have a training that so directly has the potential to improve competence*" (1047). In usability, participants highlighted that some content was good in theory but needed tailoring to the DAC environment, provider bias, and resources. In tailoring for the DAC environment, participants suggested addressing power dynamics and realistic responses to self-directed violence. One participant suggested more discussion of power imbalances in the DAC environment: "*There is a level of power differential and sometimes an adversarial relationship between those incarcerated and those housing them. I do not think that this was always taken into account*" (1037). Another participant suggested ensuring that response options presented in training were realistic and comprehensive: "*There were a couple of times there was something about sending someone to [Central Prison's inpatient psychiatric unit] as if that is somewhat simple and always an option when it is sometimes difficult and/or not an option*" (1066).

Again, appreciation of resources was mentioned. In general, participants preferred the shorter assessments and suggested including written explanations for use and interpretation of all resources: "*The extremely long assessment are not practical. I would worry that administering the [Deliberate Self-Harm Inventory – Short Version] DSHI-S to certain people would serve to give them ideas of how to self-harm in the future, and while you may have mentioned it's usefulness during training, there is no written explanation of that or how to interpret it. The same goes for several of the other provided resources*" (1038). The Online Supplement contains elaboration on usability via additional quotes.

Aim 2: evaluate short-term impacts on BHC self-directed violence knowledge, attitudes, and skill usage

A series of repeated measure ANOVA analyses were run. Results are summarized in Table 3.

Suicide prevention perceived skill mastery

The overall model presented good fit to the data, $F(60, 49) = 3.58$, $p<.001$, $\eta^2 = 0.81$, 95%CI (0.38, 0.71). There was a statistically significant large effect of assessment time on SCAF scores, $F(1, 49) = 13.19$, $p<.001$, $\eta^2_p = 0.21$, 95%CI (0.04, 0.39), indicating an increase in SCAF scores from baseline to post-intervention for both training groups. Training group membership had no statistically significant influence on SCAF scores, $F(1, 49) = 0.06$, $p=.812$, $\eta^2_p = 0.001$, 95%CI (0, 0.07), and there was no interaction between training group membership and time, $F(1, 49) = 0.89$, $p=.351$, $\eta^2_p = 0.018$, 95%CI (0, 0.14). The model accounted for about 58.7% of the variance in SCAF score change between baseline and follow-up, suggesting intervention efficacy on increasing SCAF scores.

Attitudes about intervening with a suicidal person

The overall model presented good fit to the data, $F(60, 49) = 2.90$, $p<.001$, $\eta^2 = 0.78$, 95%CI (0.28, 0.66). However, the effect of time on attitudes toward intervention was not statistically significant, $F(1, 49) = 3.44$, $p=.070$, $\eta^2_p = 0.07$, 95%CI (0, 0.22). The interaction between training group membership and time was significant, $F(1, 49) = 8.52$, $p=.005$, $\eta^2_p = 0.15$, 95%CI (0.01, 0.32). Specifically, Training Group 2 showed statistically significant improvement in AIBS scores from baseline to post-intervention, while Training Group 1 did not show statistically significant improvement from baseline to post-intervention. A visualization of this interaction can be found in Online Supplement Fig. 7. Training group membership alone did not influence AIBS score change, $F(1, 49) = 0.01$, $p=.909$, $\eta^2_p = 0.0002$, 95%CI (0, 0.04). These results indicate that the intervention influenced attitudes towards intervention in the later training group only.

Attitudes toward prisoners who self-harm scale

The overall model presented good fit to the data, $F(60, 48) = 4.04$, $p < .001$, $\eta^2 = 0.84$, 95%CI (0.44, 0.74). There was not a statistically significant effect of time on attitudes towards incarcerated persons who self-harm, $F(1, 48) = 1.61$, $p = .211$, $\eta^2_p = 0.032$, 95%CI (0, 0.17). Training group membership alone did not influence APSH scores, $F(1, 48) = 0.39$, $p = .533$, $\eta^2_p = 0.007$, 95%CI (0, 0.10). There was no interaction between training group membership and time, $F(1, 48) = 0.25$, $p = .622$, $\eta^2_p = 0.005$, 95%CI (0, 0.11).

CCM-C knowledge quiz

The overall model presented good fit to the data, $F(61, 48) = 2.60$, $p < .001$, $\eta^2 = 0.77$, 95%CI (0.22, 0.63). There was a statistically significant large effect of time on CCM-C knowledge, $F(1, 48) = 6.42$, $p = .015$, $\eta^2_p = 0.12$, 95%CI (0.004, 0.29), indicating an increase in CCM-C KQ scores from baseline to post-intervention for both training groups. Training group membership had no statistically significant influence on CCM-C KQ scores, $F(1, 48) = 0.01$, $p = .908$, $\eta^2_p = 0.0002$, 95%CI (0, 0.04). There was no interaction between training group membership and time, $F(1, 48) = 0.01$, $p = .935$, $\eta^2_p = 0.0001$, 95%CI (0, 0.04). The model accounted for about 47.3% of the variance in CCM-C KQ score change between baseline and follow-up, suggesting intervention efficacy on increasing self-directed violence knowledge.

Intent or actual use of training scale

The overall model presented good fit to the data, $F(60, 49) = 2.40$, $p = .001$, $\eta^2 = 0.75$, 95%CI (0.18, 0.60). There was a medium statistically significant effect of time on intent/actual use of training material, $F(1, 49) = 4.43$, $p = .041$, $\eta^2_p = 0.08$, 95%CI (0, 0.25), indicating an increase in intention scores from baseline to post-intervention for both training groups. Training group membership had no statistically significant influence on intention scores, $F(1, 49) = 0.35$, $p = .554$, $\eta^2_p = 0.006$, 95%CI (0, 0.10). There was no interaction between training group membership and time, $F(1, 49) = 0.04$, $p = .835$, $\eta^2_p = 0.001$, 95%CI (0, 0.07). The model accounted for about 43.6% of the variance in intention score change between baseline and follow-up, suggesting intervention efficacy on increasing use of CCM-C training content.

Aim 3: To explore short-term impacts on BHC compassion fatigue

Descriptive CF-SS scores can be found in Online Supplement Tables 4 and 5. Table 3 contains summary results from the repeated-measures ANOVA model. The overall model presented good fit to the data, $F(59, 49) = 10.11$, $p < .001$, $\eta^2 = 0.92$, 95%CI (0.74, 0.88). There was a statistically significant medium effect of time on CF-SS scores, $F(1, 49) = 5.30$, $p = .026$, $\eta^2_p = 0.10$, 95%CI (0, 0.27), indicating a decrease in CF-SS scores from baseline to post-intervention for both training groups. Training group membership had no statistically significant influence on CF-SS scores, $F(1, 49) = 0.10$, $p = .756$, $\eta^2_p = 0.002$, 95%CI (0, 0.08). There was no interaction between training group membership and time, $F(1, 49) = 0.44$, $p = .512$, $\eta^2_p = 0.009$, 95%CI (0, 0.12). The model accounted for about 83.3% of the variance in CF-SS score change between baseline and follow-up, suggesting intervention efficacy on decreasing compassion fatigue.

Discussion

This hybrid feasibility-effectiveness study assessed the CCM-C domains among correctional BHCs: (1) feasibility, appropriateness, accessibility, and usability; (2) self-directed violence prevention outcomes (i.e., knowledge, attitudes, intent to use content, perceived skill mastery); and (3) compassion fatigue. Answering RQ1, initial CCM-C evaluation outcomes were highly positive. Ratings of feasibility, acceptability, appropriateness, and usability were all high, complemented by a number of training strengths (e.g., inclusion of self-directed violence and corrections content). Answering RQ2, a number of recommendations for training improvement were offered, such as removing non-corrections content, enhancing opportunities for BHC participation and interaction, and creating participant handout packages. Hypotheses concerning self-directed violence outcomes were mostly supported. For example, CCM-C participation was associated with improved knowledge (H1), perceived skill mastery (H3), and intent to intervene and intent to use training content (H4). H2 was unsupported in that attitudes toward incarcerated people engaging in self-injury were unaffected by training. Finally, regarding RQ3, compassion fatigue decreased after participating in CCM-C.

Overall, the training was well received, with participants consistently rating CCM-C content and implementation as appropriate and applicable to their work. Following recommended practices integrating mixed methods feasibility assessment [47], members of the statewide partnership also plan to update CCM-C materials following BHC narrative feedback. The resulting CCM-C training program provides an evidence-based structure to meet recommended guidelines for correctional self-directed violence prevention [15, 16]. Moreover, CCM-C integration of corrections-specific case studies, practice tools, and other resources addressed a significant gap in the literature, as general prevention training, such as QPR [20], often fails to meet required depth for BHCs nor adequately considers the complexities of correctional environments. One notable strength of the CCM-C training was its flexibility, a hallmark of

the original CCM which allows adaptation to specific populations and settings [25]. Participants particularly appreciated the tailored examples and resources provided during training. Some participants highlighted opportunities for further refinements, such as excluding assessments that are not relevant to correctional settings and addressing institutional constraints more directly. These findings underscore the importance of CCM training principles and iterative feedback in developing training programs for correctional settings.

The CCM-C training demonstrated significant improvements in participants' self-directed violence knowledge (large effect), perceived mastery of prevention skills (large effect), and intent to use training content (medium effect). Only the waitlist control group experienced significant gains in intention to intervene with a suicidal person (large effect). Our results mirror prior general CCM training research in community mental health and university settings [24, 25, 28, 29, 68]. CCM-C effectiveness findings are the first for a domain-specific adaptation of the CCM and are important for correctional practice. Namely, the CCM-C meets many recommended best practices for self-directed violence prevention in correctional settings. Cramer and colleagues [7] summarized best practices in the literature, including nature of training content (e.g., addressing assessment) and approaches (e.g., interactive), as well as social support (e.g., peer observation), risk assessment (e.g., assessing key risk factors), and risk management considerations (e.g., use of least restrictive environment). The CCM-C addresses quite a number of best practices in a compact, evidence-based manner.

The lack of significant improvement in attitudes towards incarcerated individuals s who self-harm, as measured by the APSH scale, warrants further comment. This finding contrasts with prior studies suggesting that the CCM training approach can reduce stigma and bolster positive suicide prevention attitudes among clinicians [25, 29]. It also contrasts general trends in the stigma reduction intervention literature that show a range of interventions (e.g., training, awareness campaigns) tend to reduce stigmatizing attitudes in the near-term [69]. In the current study, attitudes toward incarcerated individuals engaging in self-directed violence were measured via the APSH [53, 54] and demonstrated poor reliability ($\alpha = 0.68$) during the baseline assessment. Low internal consistency can restrict the ability to detect significant associations or change [70]. Prior psychometric evaluations of the APSH found total score internal consistency values > 0.70, but these studies featured samples of predominantly prison officers [53, 54], with the most recent evaluation comprised of only 14.5% of participants identifying as behavioral health professionals [53]. Therefore, the instrument may not be reliably used among BHCs.

On the other hand, non-significant findings may be due to poor content validity of the ASPH. Review of ASPH item content shows many of them to reflect day-to-day realities of working in correctional settings (e.g., interpersonal functions of self-injury) instead of stigma towards incarcerated persons. As such, the ASPH may assess the construct of treating self-injury in correctional settings. Future studies should focus on conducting a thorough psychometric evaluation of this scale used among BHCs working in correctional facilities. Additionally, researchers may focus on development of a scale to measure correctional BHCs' stigmatizing beliefs about incarcerated individuals with and without self-directed violence.

A third explanation for the lack of CCM-C training on impacts about attitudes toward incarcerated persons who engaged in self-directed violence concerns the brevity of modules addressing the topic. Competency 1 centers on recognizing and managing personal attitudes, overtly targeting attitudes related to self-directed violence in carceral settings. Online Supplement Table 1 outlines the full content of this module; inspection of the content shows that content addressing these specific attitudes represent just a small portion of an already brief module. Literature shows equivocal impacts of short-term stigma reduction interventions [69]. As such, the brevity of CCM-C addressing this specific stigma or attitude may explain the lack of findings.

This study also explored the impact of CCM-C training on compassion fatigue, revealing a significant reduction in compassion fatigue levels post-training. This was facilitated by the creation of a "judgement free zone" and use of an open dialogue format encouraged BHCs to share their experiences. This finding is particularly important given the well-documented mental health challenges faced by BHCs working with people experiencing self-directed violence [71]. The importance extends equally to BHCs working with incarcerated persons as a whole. To our knowledge, no previous training for BHCs addressed compassion fatigue as an outcome. As such, the positive impact on compassion fatigue is a new finding, yet not entirely surprising. For example, by incorporating clinician self-management strategies into the training (e.g., mindfulness, attitude self-assessment tools), CCM-C addressed an often-overlooked aspect of self-directed violence prevention: the well-being of the clinician. Healthcare providers require individual and organizational approaches to address their well-being [72]. Mindfulness interventions show promise for individual level clinician wellness [73, 74]. Moreover, CCM-C provides one training tool and a technical package of resources to ameliorate compassion fatigue in an otherwise challenging work setting. By including self-care and debriefing

practices within the training, CCM-C aligns with broader CCM emphasis on clinician self-management. Clinical care skills content may also be relevant to reducing compassion fatigue. Compassion fatigue among BHCs is influenced, in part, by over extension of empathic responding and trauma history [75]. CCM-C integrates the idea of therapeutic detachment [76] as an alternative way to respond to challenges such as persons experiencing self-directed violence. Exposure to this content and associated resources may be an important first step in mitigating compassion fatigue for correctional BHCs.

Implications for correctional self-directed violence prevention theory, practice, and research

Regarding theory, this hybrid trial acts as a partial test of an adaptation of the social-cognitive model of suicide prevention training [22]. Specifically, CCM-C is based on a training model in which training impacts self-directed violence intervention practices through enhanced knowledge, attitudes, skill self-efficacy, and intention, while accounting for individual and contextual factors [21]. Offering partial support of the link between training and social-cognitive outcomes, our findings suggest that engagement in the CCM-C training program results in increases in BHCs' self-directed violence knowledge and prevention skill mastery, confirming these tenets of the CCM-C adapted social cognitive model [21]. However, our results contradict the model's assertion that participation in the CCM-C training would reduce BHCs' stigmatization towards self-directed violence and incarcerated persons. Finally, our findings extended the CCM-C social cognitive model [21], as our results suggest that participation in the CCM-C training decreases compassion fatigue among BHCs. Future studies should more fully test this model by evaluating mediating pathways (e.g., self-directed violence prevention knowledge) in other correctional facilities to ascertain impacts on long-term skill usage and ultimately outcomes for incarcerated persons.

In terms of practice implications, the findings of this study contribute to the growing body of literature on self-directed violence prevention best practices in corrections [2, 7, 77]. Self-directed violence prevention practices in the United States are generally inadequate to date despite existing guidelines [15, 16]. For example, a review of state and federal prison suicide prevention policies concluded that nearly half of recommended practices were absent [77]. Lack of best practices are complicated by systemic barriers to self-directed violence prevention such as staffing shortages and limited access to care exacerbate the risk of self-directed violence in these settings [2, 3]. CCM-C addresses these shortages by espousing evidence-based practices in an organized training framework. Speaking to the need for self-directed violence prevention reform, the United States Department of Justice [78] recently released a report enumerating recommendations for prison system improvements to respond to prison self-directed violence. CCM-C training and its associated assets (e.g., SIRAP-C) [17] address a number of these recommendations, such as developing suicide risk and prevention training and resources, enhancing peer-based and safety planning intervention usage, and conducting research on validation of self-directed violence risk assessment tools.

The evaluation of the CCM-C training program highlights several critical implications for the training and practice of BHCs in correctional settings. One of the primary goals of training programs like CCM-C is to bridge the gap between research and practice by equipping clinicians with evidence-based tools and strategies to address self-directed violence. By providing targeted education on self-directed violence prevention, the CCM-C training fosters clinicians' ability to integrate evidence-based practices into their daily work with incarcerated individuals, ultimately improving care quality and outcomes. Addressing the science to practice gap remains a significant challenge in corrections. The CCM-C training and the forthcoming toolkit disseminate best practices directly to frontline BHCs, thereby overcoming the research to practice gap. These best practices include psychometrically sound self-assessment tools, research-supported risk assessment approaches, evidence-based safety and therapeutic interventions, social support enhancement strategies, and clinical documentation standards.

Moving forward, a key component of continued CCM-C research and training concerns development of the *CCM-C Toolkit* tailored for BHCs in correctional settings. This toolkit will include practical training materials (e.g., training slides, handouts), practice resources (e.g., SIRAP-C worksheet) [17], evaluation tools (e.g., feasibility and outcome assessment questionnaires), an implementation guide, and train-the-trainer materials. The Toolkit, available in consultation with authors RJC and LJP, can facilitate further CCM-C implementation and evaluation. For example, future CCM-C research should compare the training approach to a true control group or other training intervention in larger randomized controlled trials. Moreover, use of secondary clinical data in our statewide partnership may offer the opportunity to examine CCM-C outcomes beyond short-term training impacts. CCM-C training is also ripe for extension to other justice settings, such as jails and juvenile detention centers. Finally, the SIRAP-C, although developed specifically on prison risk assessment data, should be exposed to further field use and psychometric assessment.

The value of CCM-C extends beyond practice to ethics and law. For example, ethical guidelines such as the

American Psychological Association's [79] and the National Association of Social Workers' [80] codes underscore the need to pursue ongoing professional development to ensure competent, effective care. From an ethical standpoint, self-directed violence prevention has been argued as an essential skill all BHCs should maintain competence in [81, 82]. By participating in CCM-C, BHCs not only fulfill this ethical obligation, but also contribute to advancing the standard of care for incarcerated individuals, a population that is often underserved and stigmatized. In terms of correctional standards, National Commission on Correctional Health Care [15] and American Correctional Association [16] established correctional facility guidelines on mental health assessment (including self-directed violence screening) during intake, correctional staff recognition and response to warning signs of suicide, access to mental health care, and how to minimize future instances of self-directed violence within these settings. The CCM-C training not only meets these National Commission on Correctional Health Care and American Correctional Association standards, but goes beyond them to aid BHCs' self-management and clinical care self-directed violence skills.

Limitations

The present study possesses several limitations requiring attention. First, available public data informing the data may be outdated. For instance, Bureau of Justice Statistics last assessment of self-directed violence rates in carceral settings took place in 2019 [1]. Our more recent state-level data [23] was therefore used in CCM-C training.

We deviated from the original protocol for CCM-C evaluation in several ways [30]. We planned to conduct a series of interrupted time series analyses because it allows assessment of trends over time for better estimation of the intervention effect [83]. Moreover, our intention was to utilize factored regression for missing data [65] before running the interrupted time series analyses. However, there was a large amount of missing data in the assessments collected at follow-up time-points such that whole measures (e.g., SCAF, AIBS) were missing, not simply items within measures. Additionally, preliminary analyses revealed that data was not missing at random. Since this was the case, we decided not to use factored regression in accordance with guidelines from Enders [65]. The inability to employ factored regression contributed to not being able to reliably run the interrupted time series analysis. As such, we cannot speak to whether CCM-C training participation results in changes that are sustained over time. Finally, we planned to use a combination of content and thematic analyses. However, narrative survey responses were too brief to employ thematic analysis, so we stopped at identification of specific codes [59].

Procedurally, one potential cause of the large amount of missing data may have been confusion regarding completing assessments. After participating in the CCM-C training, BHCs were asked to complete the corresponding study assessments. However, they were also asked by the state correctional organization (not the study team) to complete a brief survey in relation to receiving continuing education credits. It is possible that BHCs thought they completed the study assessment when they only completed the continuing education form. Regardless of the reason, this type of attrition is common in studies that collect data at multiple time-points [84].

Our results raise possible variation in differences between training groups. Specifically, there was a significant group difference in attitudes towards intervening with a suicidal person, such that those in the waitlist control displayed a statistically significant improvement in this score while those in first training group did not. Possible explanations for this group difference include demographic differences of the training groups or early exposure of materials to members of the second training group resulting in contamination. While we initially planned to stratify random sampling by geographic region to reduce risk of contamination [30], we needed to deviate from this strategy due to low BHC cell counts in some geographic regions (after eliminating contractors from the pool of possible participants for administrative reasons).

In terms of measurement, the CCM-C KQ displayed poor reliability (assessed via KR20) during each assessment period. However, we still found significant differences in BHCs CCM-C knowledge. These findings are still believed to be a good indicator of CCM-C training effectiveness at increasing suicide prevention knowledge among BHCs. While poor reliability indicates poor internal consistency and has the potential to obscure significant results, it does not erroneously generate significant test results [70]. While the current study's findings are believed to be indicative of BHCs' knowledge gains, the CCM-C KQ should be psychometrically evaluated in future investigations.

Conclusion

CCM-C is a promising approach to self-directed violence prevention training for correctional BHCs. Initial findings highlighted several implementation improvements that will inform the final publicly available CCM-C Toolkit. Training effectiveness is reflected by improvement in several theoretically-supported BHC outcomes. Findings should be interpreted with methodological limitations in mind. Next steps include rolling out and evaluating CCM-C training in new carceral systems.

Abbreviations

BHC	Behavioral health clinician
CCM-C	Core Competency Model for Corrections
ANOVA	Analysis of Variance
SIRAP-C	Self-Injury Risk Assessment Protocol for Corrections
CCM	Core Competency Model
SCAF	Suicide Competency Assessment Form
RQ	Research question
H	Hypothesis
NC DAC	North Carolina Department of Adult Correction
CAP	Correctional advisory panel
UNC	University of North Carolina
CAPTCHA	Completely Automated Public Turing Test to tell Computers and Humans Apart
FIM	Feasibility of Intervention Measure
AIM	Acceptability of Intervention Measure
IAM	Intervention Appropriateness Measure
UIM	Usability of Intervention Measure
AIBS	Attitudes about Intervening with a Suicidal Person
APSH	Attitudes toward Prisoners who Self-Harm
CCM-C KQ	Core Competency Model for Corrections Knowledge Quiz
KR20	Kuder-Richardson 20 formula
CF-SS	Compassion Fatigue-Short Scale
BCBT	Brief Cognitive Behavioral Therapy for Suicide
DSHI-S	Deliberate Self-Harm Inventory-Short Version
QPR	Question Persuade Refer

Supplementary Information

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Supplementary Material 1.

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Authors' contributions

Conceptualization: RC, LJP; Data curation: SC, JM, SP, AP; Formal analysis: SC, JM, AP, SP; Funding acquisition: RC, LJP; Investigation: SC, RC, JM, SP, MB; Methodology: LJP, RC, AC, AP; Project administration: RC, LJP, AC, MB; Resources: RC, LJP, AC, AP, SP; Software: SC, SP; Supervision: RC, LJP, SC, JM; Validation: SC, SP; Visualization: SP; Writing: RC, JM, AC, SC, AP, SP; Editing: All. All the authors participated in the review and revision of the manuscript and approved the final manuscript to be published.

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Data availability

Data are not publicly available because they are regulated by NC Department of Adult Correction Research Committee policy.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the UNC Charlotte Institutional Review Board (IRB) in compliance with the Declaration of Helsinki and with all applicable Federal regulations governing the protection of human subjects. All participants affirmed consent via the IRB-approved e-informed consent form prior to participation in the study. Current protocol version and approval date: IRB-24-0209, amendment 2 (January 4, 2024).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]University of North Carolina at Charlotte, 9201 University City Blvd, Charlotte, NC 28223, USA
[2]NC Department of Adult Correction, 831 W. Morgan Street, Raleigh, NC 27699, USA
[3]Department of Epidemiology and Community Health, UNC Charlotte, 9201 University City Blvd., Charlotte, NC 28227, USA

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