Suicidality among clients in a network of coordinated specialty care (CSC) programs for first-episode psychosis: Rates, changes in rates, and their predictors

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ABSTRACT

Background: People experiencing their first episode of psychosis have high risk of suicide, and programs specializing in early psychosis have not always achieved reduced risk. The present study analyzes patterns of suicide ideation, self-harm, and suicide attempts within the Connection Learning Healthcare System of 23 early psychosis programs in Pennsylvania and Maryland that follow the Coordinated Specialty Care treatment model.
Method: People with first episode psychosis ($n = 1101$) were assessed at admission and every six months using a standardized battery that included self-reported past-month ideation and clinician-reported past-six-month ideation, self-harm, and suicide attempts.
Results: At admission, there were 28 % rates of self-reported past-month suicide ideation and 52 % rates clinician-reported past-six-month suicide ideation, 23 % rate of clinician-reported self-harm, and 15 % rate of attempts. After the first six months of treatment there were significantly lower rates of clinician-reported suicidality (with

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reductions of at least 77 %), and after the first year of treatment there was significantly lower self-reported ideation (with approximately 54 % reporting lower past-month ideation). Changes were not accounted for by differential early discharge. A range of psychosocial variables predicted within- and between-subject variability in suicidality. Social and role functioning, depressive symptom severity, and a sense of recovery were significant within-subject predictors of all four measures of suicidality.

Conclusions: Compared to admission, we observed substantially lower rates of suicidality within the first year of treatment for clients with first episode psychosis in Coordinated Specialty Care. Reductions were predicted by some of the variables targeted by the treatment model.

1. Introduction

Suicide is a disproportionately common cause of death for people with psychotic disorders (Bertolote and Fleischmann, 2002; Hor and Taylor, 2010; Palmer et al., 2005; *Suicide Worldwide in 2019: Global Health Estimates,* 2021). Suicide risk for people with psychosis is not uniformly distributed across the lifespan but instead peaks early, around the time of illness onset (Nordentoft et al., 2015; Palmer et al., 2005; Pompili et al., 2011). Thus, suicidality is a significant clinical concern for individuals undergoing treatment for first-episode psychosis (FEP). Treatment networks for FEP in Denmark and Canada found that approximately 1 % of clients had died by suicide within 4 years of starting treatment (Bertelsen et al., 2007; Sicotte et al., 2023); a center in Australia found that 3 % of clients died by suicide within 7.4 years (Robinson et al., 2009), and a network of specialty early psychosis clinics in Hong Kong found that 4.4 % of active treatment participants died by suicide within 12 years (Chan et al., 2018). Meanwhile, prevalence rates for suicidal ideation in people with FEP are estimated to be between 27 and 42 % (Chang et al., 2014; Martínez-Alés et al., 2023), while rates of non-lethal attempts are estimated to range between 11 and 26 % (Chang et al., 2014; Sicotte et al., 2021).

Given the increased risk for suicide during the period surrounding the first episode of psychosis, programs specializing in treating people with FEP have to address high rates of suicide. The gold-standard treatment model for FEP in the United States is Coordinated Specialty Care (CSC), which consists of team-based services including psychotherapy, medication management, case management, supported employment/education, family support, and peer support (Heinssen and Azrin, 2022).Within CSC programs, several studies indicate a high baseline rate of suicide ideation and behavior (Martínez-Alés et al., 2023; Paquin et al., 2023; Pompili et al., 2011). While CSC enhances clinical outcomes for individuals with FEP (Dixon et al., 2015; Kane et al., 2016), some programs have measured no significant treatment effect of specialty early psychosis care on suicidality as compared to non-specialty care (Anderson et al., 2018; Bertelsen et al., 2007). Standardized therapeutic approaches for suicidality specific to FEP have not been established and may warrant individualized approaches targeting domains that may be of particular relevance to this population, such as social functioning (Breitborde et al., 2021). Despite these initial findings, suicidality remains largely uncharacterized across early phases of psychotic disorders.

Since 2018, the National Institute of Mental Health has coordinated a network of first episode psychosis programs into a national learning healthcare system called the Early Psychosis Intervention Network (EPINET; Heinssen and Azrin, 2022). Given high rates of suicide and suicidal behavior in the target population, suicide prevention has been an explicit area of focus for EPINET (Heinssen and Azrin, 2022), providing an opportunity for further characterization of suicidality within an active learning healthcare framework.

In the present study, we examined data on suicidality (self-reported past-month ideation and clinician-reported past-6-month ideation, self-harm, attempts, and suicide death) from young people with FEP enrolled in CSC programs that form the Connection Learning Healthcare System (Connection LHS), a two-state regional hub representing 23 community treatment programs in Pennsylvania and Maryland that is part of EPINET. Using data collected within the context of EPINET as well as all available historical data from Pennsylvania programs (Westfall et al., 2021), we estimated rates and longitudinal changes in rates of suicidality. We also performed a sensitivity analysis to better understand the context of any observed decreases in suicidality (i.e., whether the decrease could be explained by treatment dropout). Finally, we examined between- and within-subject predictors of suicidality, focusing on variables that may be modifiable through treatment, such as symptom severity, recovery, social and role functioning.

2. Materials and methods

2.1. Sample

The sample consisted of persons with FEP served by 23 CSC programs across Pennsylvania and Maryland. All programs offered services for at least 2 years. Some CSC programs were restricted to providing services to persons with a non-affective psychotic disorder (e.g., schizophrenia); others also provide services to persons with an affective disorder with psychosis (e.g., bipolar disorder with psychotic features).

2.2. Process of data collection

Data were collected between January 2017 and April 2023. Prior to 2021, sixteen CSC programs in Pennsylvania collected data as part of state-wide FEP program evaluation (PA-FEP-PE; see Westfall et al., 2020 and Dong et al., 2023 for a full description of the assessment battery and procedures for collecting it). Beginning in January 2021, CSC programs in Pennsylvania ($n = 19$ programs) and Maryland ($n = 5$ programs) formed Connection LHS as part of EPINET. However, one program in Pennsylvania closed, yielding a current total of 23 CSC programs across the two states. As an administrative dataset of existing programs, the sample does not always include all measurements and baseline measurements are sometimes missing.

As part of establishing Connection LHS, a Core Assessment Battery (CAB) was implemented at all programs that represented a harmonization of the PA-FEP-PE battery, the national EPINET battery, and additional measures in several domains of particular interest to Connection LHS investigators. The CAB consists of clinician-rated and client self-report measures that assess a range of domains including socio-demographics, pathways to care, psychiatric symptoms and diagnosis; psychosocial functioning and recovery; physical health; medication side-effects; school and work participation; and substance use. All measures reported in the current investigation were employed in both PA-FEP-PE and CLHS data collection, with the exceptions of the COMPASS-10, which was administered only after forming CLHS, and the BDI-7, which is only administered in Pennsylvania.

The CAB is completed at program admission and every six months thereafter for the duration of CSC enrollment. Data are collected using REDCap (Research Electronic Data Capture; Harris, et al., 2009; Harris, et al., 2019). Data are completely de-identified; local program staff assign a unique identifier and keep a local schedule of assessment due dates. Across sites, clinicians or other site staff complete specified measures; self-report surveys are completed by clients either in person or via an emailed REDCap survey link.

The University of Maryland Baltimore Institutional Review Board (IRB) designated CAB data collection by CSC sites as Not Human Subjects Research (HP-00093412). Creating a deidentified data set from the CAB data collection for research analysis was approved as Exempt (Category 4) by the University of Maryland Baltimore Institutional Review Board (HP-00092961). For this protocol, the IRB of Sheppard Pratt relied on the University of Maryland Baltimore IRB. The IRBs of the University of Pennsylvania, the University of Pittsburgh, Johns Hopkins University, and Children's Hospital of Philadelphia also approved as Exempt (Category 4) local institution protocols allowing use of CAB data for research purposes.

2.3. Assessment of suicidality

Suicide death was formally tracked by clinicians as a reason for discharge. Past six month ideation, self-harm, and attempts were reported by clinicians at each timepoint in answer to the following prompts: "Since the last assessment period (or past 6 months), has the client had suicidal ideation?"; "Since the last assessment period (or past 6 months), has the client had non-suicidal self-injurious behavior?"; "Since the last assessment period (or past 6 months), has the client had any suicide attempts?" For the subset of participants assessed after January 2021, self-reported ideation was also assessed at each timepoint using item 13 of the Colorado Symptom Index (CSI; Boothroyd and Chen, 2008) which poses the question "How often did you feel like hurting or killing yourself?" in the past month, and allows five possible Likert responses: 0 (Not at all), 1 (Once during the month), 2 (Several times during the month), 3 (Several times a week), or 4 (At least every day).

2.4. Predictor variables

2.4.1. Clinician-rated measures

Positive symptoms of psychosis were assessed with the Brief Psychiatric Rating Scale (BPRS) items of suspiciousness, unusual thought content, hallucinations, conceptual disorganization (delivered in the context of the COMPASS10 post-2021; Ventura et al., 2000) and negative symptoms were assessed using the COMPASS10 (avolition/apathy, asociality/low social drive; Robinson et al., 2021). For both measures, each item includes a description of the symptom being assessed, followed by suggested probe questions to obtain information about the symptom. Clinicians ask additional questions if the probe questions do not provide enough information to make a rating of symptom severity.

Functioning was measured with the Global Functioning Role and Social Scales (Cornblatt et al., 2007). The Global Function: Role Scale indexes functioning in the individual's primary role (school, work, or homemaking) on a scale of 1 (Extreme role dysfunction) to 10 (Superior role functioning). The Global Function: Social Scale reflects social and interpersonal functioning rated on a scale of 1 (Extreme social isolation) to 10 (Superior social/interpersonal functioning). The single summary ratings on each scale for the current month were used for the present analyses.

Data on past-month frequency of alcohol use and marijuana use were assessed with the following clinician-rated items: "In the past 30 days, about how often has the client used alcohol?" and "In the past 30 days, about how often has the client used marijuana?" with responses coded as (0) None, (1) Less than once a month, (2) Monthly, (3) Weekly, or (4) Daily.

2.4.2. Self-report measures

Self-reported PTSD symptom severity was assessed using the PTSD Symptom Scale (PSS; Foa et al., 1993), a 17-item self-report measure of traumatic stressor exposure and past two-week trauma symptom severity (total score ranging from 0 to 51). Clients also completed a 5-item version (Dong et al., 2023) of the Questionnaire about the Process of Recovery (QPR; Williams et al., 2015), which was developed collaboratively with service users and measures important aspects of recovery such as "I feel that my life has a purpose" and "I can take

control of aspects of my life"; items are rated on a 5-point scale from strongly disagree to strongly agree.

Clients at CSC programs in Pennsylvania provided self-reported ratings of depressive symptom severity via six Beck Depression Inventory items from the Beck Collection-9 (Dong et al., 2023), which includes the items from the Beck Depression Inventory-7 (BDI-7; Beck et al., 1997) except the suicidality item. Participants at CSC programs in Maryland did not complete the Beck measures and have missing data for these items.

2.5. Data analysis plan

2.5.1. Descriptive statistics

Because some client characteristics changed over time (e.g. age), we report the earliest measured demographic values for each client. We calculated and plotted raw rates of ideation, self-harm, and attempts at admission and at every subsequent six-month assessment timepoint, as well as raw Likert scale ideation self-report responses at each time point.

2.5.2. Estimating suicidality during treatment

We fit binary logistic regression models to estimate rates of clinician-reported ideation, self-harm, and attempts and changes in rates after accounting for nesting of observations within clients and of clients within site. Due to the apparent non-linear trajectory of change over time (see Fig. 1), we added separate varying intercepts for each timepoint.[1] We modeled self-reported past-month suicide ideation using the same set of predictors and multilevel structure (a non-linear trajectory for reduced suicidality was observed in the self-report data as well; see Fig. 2a) but used an ordinal model to respect the Likert scale format. There were varying degrees of missing data per person. Rather than restrict inclusion to clients with a minimum number of observations (which is likely to bias results) we used a multilevel model structure to estimate model coefficients using partial pooling, which allows for differing numbers of observations per person (Field and Wright, 2011).

2.5.3. Sensitivity analysis

We performed a sensitivity analysis to understand the extent to which reductions in clinician-reported suicidality might be due to suicidal clients leaving treatment earlier. We assessed this hypothesis by fitting survival curves to estimate whether suicidal clients left treatment earlier than non-suicidal clients. Specifically, separate cox regressions were fit for clinician-reported suicidal ideation, self-harm, and attempts, as well as self-reported ideation, using discharge (for any reason) as the endpoint event. When clients were still enrolled in treatment, they were coded as censored at their most recent assessment timepoint.

2.5.4. Psychosocial predictors of suicidality

To assess the relationship between psychosocial variables and suicidality, we fit multilevel regression models that included predictors as both between-subject variables (i.e., factors that distinguish people with higher rates of suicidality from people with lower rates of suicidality) and within-subject variables (i.e., factors that are predictive of change in suicidality during treatment). This was achieved by using each client's mean value to capture the between-subject effect, and using each client's deviation from their own mean value at each timepoint in order to capture the within-subjects effect (Lin et al., 2018). All predictors were

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[1] Mathematically, for each observation n, each outcome y was modeled as:

$$y_n \sim \mathrm{logit}\left(\alpha + \alpha_{participant[n]} + \alpha_{site[n]} + \alpha_{timepoint[n]} + \beta_1 timepoint_n + \beta_{site[n]} timepoint_n \right).$$

Varying intercepts $\alpha_{participant}$, α_{site}, $\alpha_{timepoint}$, and varying coefficients β_{site} were themselves modeled as drawn from normal distributions with standard deviations estimated from the data. For example (as we did for this study), one can use the rstanarm package in R to fit such a model using the following command: stan_glmer(y ~ 1 + timepoint + (1|participant) + (1|timepoint) + (1 + timepoint|site), family = binomial).
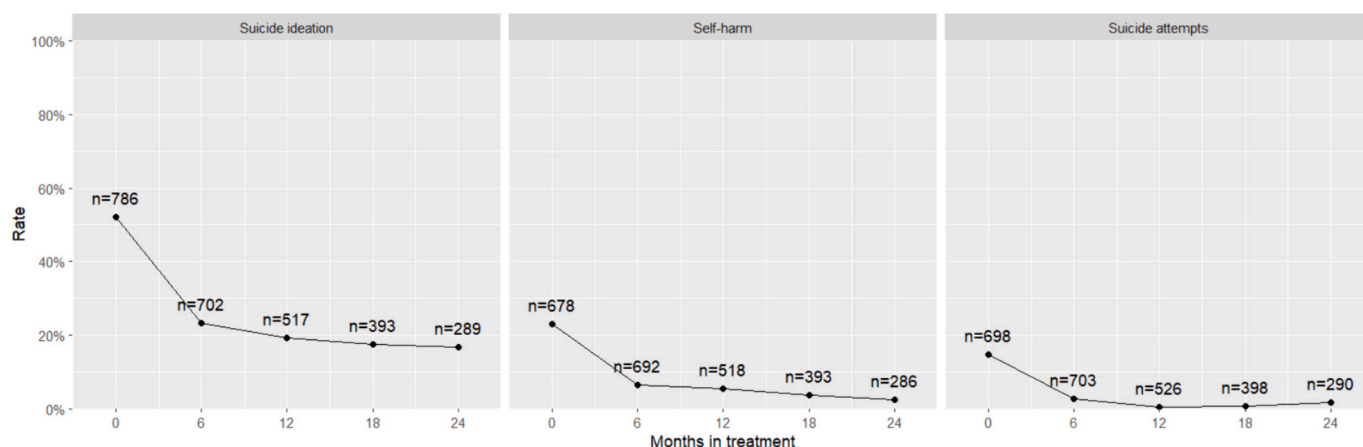
Fig. 1. Raw rates of clinician-reported past-six-month suicide ideation, self-harm, and suicide attempts, by number of months in treatment. The total number of assessed clients at each timepoint is indicated above each point.
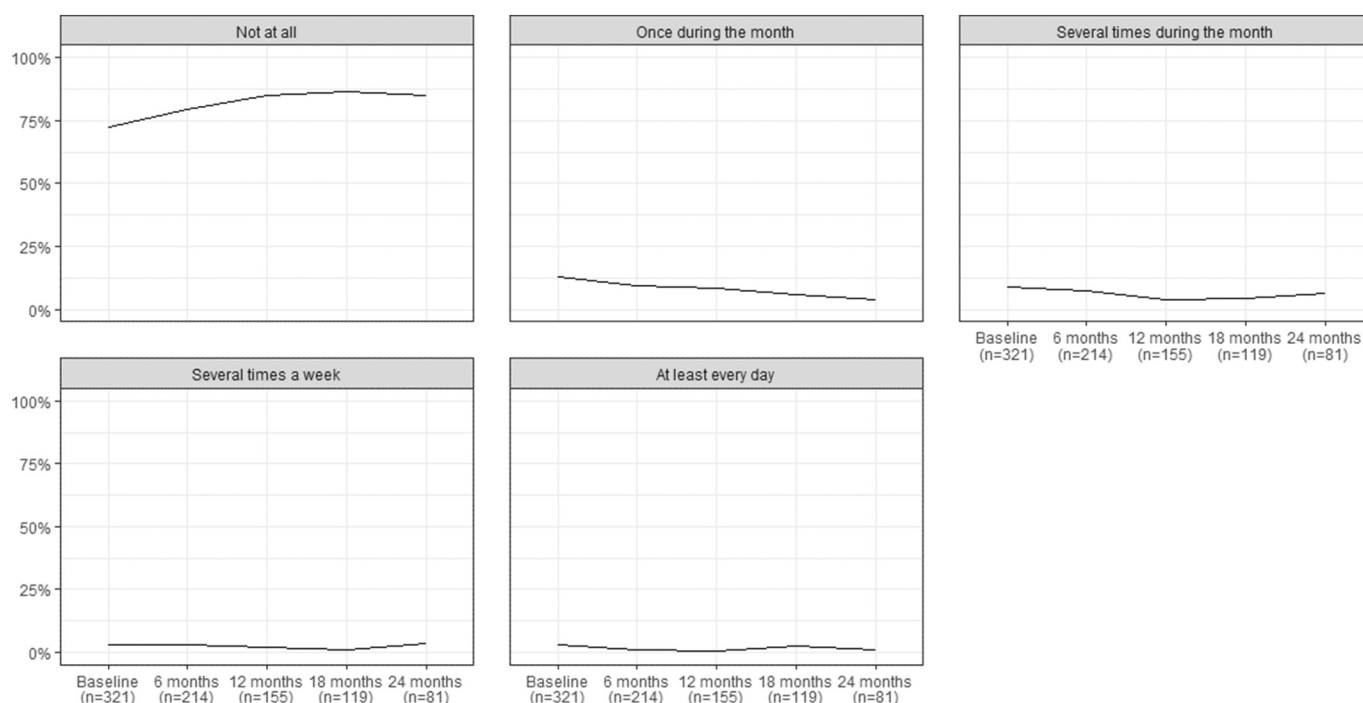

Fig. 2a. Self-reported past-month suicide ideation. Proportion of participants endorsing each Likert category at each timepoint.

normalized through z-scoring before being entered into the regression. Thus, estimated between-subject effects can be thought of as the odds ratio of suicidality (on average) for a person being one standard deviation higher than the average client in the sample, whereas the within-subject effect can be thought of as the odds ratio of suicidality for each standard deviation *change* from the client's own average score. In the case of self-reported ideation, for which we used an ordinal model, the reported odds ratios are the odds of a client being one category higher on the Likert scale (e.g., odds of increasing from "Not at all" to "Once During the Month"). We chose variables that have the potential to be targeted and improved through treatment: positive symptom severity (BPRS/COMPASS10) and negative symptom severity (COMPASS10), Global Functioning Role and Social (GF Scales), past-month frequency of alcohol use and marijuana use, PTSD symptom severity (PSS), a rating of personal recovery (QPR), and the six Beck Depression Inventory items from the BDI-7.

3. Results

As of the end of the data collection period (April 2023) there were 1296 clients with at least one assessment timepoint. Of these, 1101 had at least one non-missing suicidality ratings for at least one timepoint. Thus, the total analytic sample consisted of 1101 clients. Demographic information is presented in Table 1. Approximately two-thirds of clients identified as male and a nearly equal number of clients identified as Black and White. Fewer than 10 % identified as Hispanic or Latinx. The plurality was diagnosed with Other Specified/Unspecified Schizophrenia Spectrum and Other Psychotic Disorder (i.e., Psychotic Disorder - Not Otherwise Specified.)

Patients were assessed on suicidality an average of 2.4 times each (range:1 to 5). Fig. 1 displays raw rates of clinician-reported past 6-month suicidality (ideation, self-harm, and attempts). Fig. 2a and Fig. 2b displays raw self-report responses about past-month suicide

Table 1
Demographics of the sample at earliest timepoint. Total $N = 1101$.

Variable	N	%
Gender		
Male	691	62.76
Female	353	32.06
Trans male	7	0.64
Trans female	2	0.18
Non-binary	19	1.73
Other or missing	29	2.63
Race		
White	460	41.78
Black	471	42.78
Asian	64	5.81
Pacific Islander	1	0.09
Multiracial	28	2.54
Other or did not answer	77	7
Ethnicity		
Hispanic/Latino	90	8.2
Not Hispanic/Latino	960	87.2
Unanswered or missing	51	4.6
Diagnosis		
Schizophrenia	154	14
Schizoaffective	108	9.8
Schizophreniform	56	5.1
Mood disorder	132	12
Psychosis NOS	534	48.5
Brief Psychotic Disorder	30	2.7
Other	59	5.4
Missing	28	2.5
	Mean	**Standard Deviation**
Age	20.7	4.2
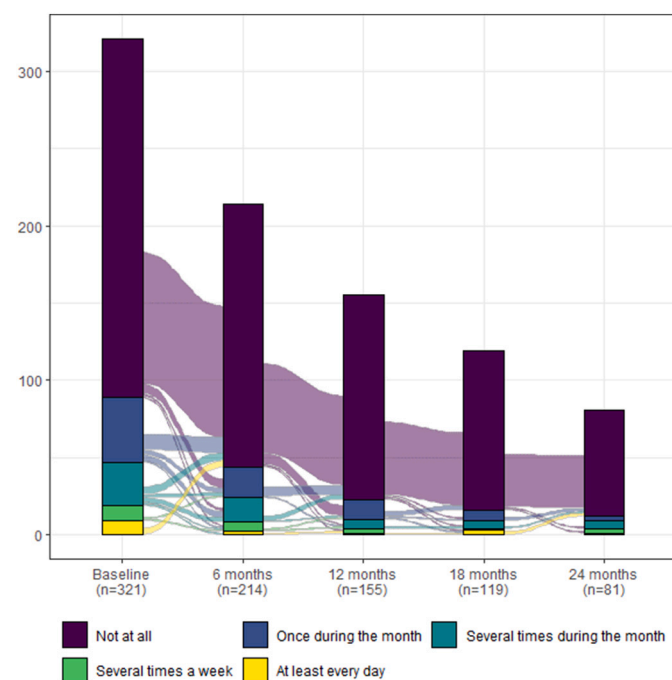
Fig. 2b. Sankey plot illustrating how specific participant responses to self-reported past-month suicide ideation changed over time.

ideation at each time point. The number of non-missing observations for each outcome measure at each timepoint is indicated on each Figure.

3.1. Suicidality during treatment

3.1.1. Clinician-reported

No clients were recorded as dying by suicide during treatment. On admission, clinicians reported that 52 % of individuals had past-six-month suicide ideation, 23 % had past-six-month self-harm, and 15 % had a past-six-month suicide attempt. Multilevel modeling suggested substantial and statistically significant reductions in clinician-reported suicidality for people in treatment during the study period, with most change occurring within the first six months. Specifically, after accounting for the multilevel structure of the data (e.g., site- and client-specific effects), the first six months of treatment were associated with an estimated 83 % (95%CI: 77 %–88 %) reduction in past-six-month suicide ideation, an 89 % (95%CI: 81 %–94 %) reduction in past-six-month self-harm, and an 88 % (95%CI: 78 %–94 %) reduction in past-6-month suicide attempts (see Fig. 1 for raw rates). For self-harm, the continuous effect of time was also statistically significant, suggesting continued measurable improvements after the first six months of treatment.

3.1.2. Self-reported

Self-reported past-month suicide ideation was common for people entering treatment, with 28 % reporting any past-month ideation at baseline. However, self-reported ideation decreased substantially during treatment, with significantly lower suicide ideation at 12 months than at baseline (OR = 0.46, 0.22–0.86). The linear effect of time over the 24-month period was not significant, suggesting that improvements were not continuous but mostly occurred during the first year of treatment. See Fig. 2a and Fig. 2b for raw responses to this Likert scale measure.

3.2. Sensitivity analysis

Fig. 3 presents survival curves illustrating time to discharge for people with versus without a history of each type of clinician-reported suicidality. Cox regressions suggested no statistically significant relationship between earlier discharge from treatment and clinician-reported suicide ideation ($p = 0.64$), self-harm ($p = 0.67$), or suicide attempt ($p = 0.32$). We also used Cox regression to test whether self-reported past-month suicide ideation predicted earlier discharge and found no statistically significant effect ($p = 0.76$; survival curves not plotted because the predictor was multinomial).

3.3. Psychosocial predictors of suicidality

Please see Table 2 for a full list of coefficients with confidence intervals detailing all between- and within-subject effect estimates. Between-subjects analyses suggested that people with indicators of suicidality tended to have systematically different characteristics from people without these indicators. Specifically, people with all forms of suicidality (clinician-reported ideation, self-harm, and suicide attempts, as well as self-reported ideation) tended to have lower self-perceived recovery and more severe positive symptoms of psychosis, and more severe trauma symptoms. Depressive symptoms tended to be higher among people with all indicators of suicidality except clinician-reported suicide attempts. Both clinician- and self-reported suicide ideation were associated with lower social functioning and greater negative symptoms. Marijuana use was associated only with clinician-rated ideation, and alcohol use showed no statistical association with any suicidality indicator.

Within-subjects analyses suggested a range of factors associated with changes in suicidality over time. For all indicators of suicidality (clinician-reported ideation, self-harm, attempts, and self-reported ideation), worsening suicidality tended to track deteriorations in social and role functioning, self-perceived recovery, and exacerbations of depressive symptom severity. Increasing positive symptom severity predicted increases on all three clinician-reported suicidality indicators, but not self-reported ideation. Increases in negative symptom severity were associated with worsening clinician- and self-reported ideation, but not clinician-reported suicidal behavior. Increases in trauma symptom were associated with all indicators of suicidality except suicide attempts. Finally, increased alcohol use was associated with clinician-reported ideation only, whereas changes in marijuana use did not significantly track changes on any suicidality indicator.
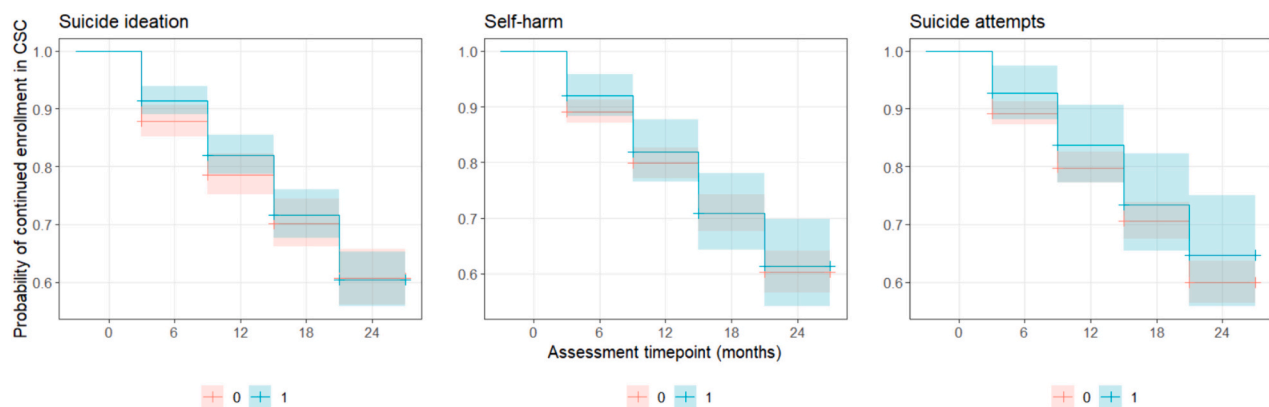
Fig. 3. Survival curves illustrating the relationship between suicidality and early discharge from CSC. Program completions are coded as censoring points rather than discharges. There were no significant differences in time to discharge by ideation, self-harm, or suicide attempts.

Table 2
Predictors of suicidality.

Source for outcome	Outcome	Predictor	Between			Within		
			Odds ratio	95 % lower	95 % upper	Odds ratio	95 % lower	95 % upper
Clinician-report	**Past 6 month ideation**	Role functioning	0.88	0.75	1.04	**0.57**	**0.49**	**0.65**
		Social Functioning	**0.84**	**0.72**	**0.98**	**0.67**	**0.59**	**0.76**
		Recovery	**0.56**	**0.46**	**0.67**	**0.75**	**0.65**	**0.85**
		Depressive symptom severity	**2.02**	**1.68**	**2.48**	**1.56**	**1.35**	**1.85**
		Positive symptom severity	**1.69**	**1.43**	**2**	**1.81**	**1.59**	**2.1**
		Negative symptom severity	**1.34**	**1.14**	**1.71**	**1.24**	**1.07**	**1.44**
		Trauma symptom severity	**2.06**	**1.64**	**2.72**	**1.57**	**1.3**	**1.95**
		Alcohol use (past 6 months)	1.18	0.96	1.48	**1.2**	**1.01**	**1.43**
		Marijuana use (past 6 months)	**1.34**	**1.07**	**1.70**	1.03	0.89	1.19
	Past 6 month self-harm	Role functioning	**0.77**	**0.6**	**0.99**	**0.69**	**0.54**	**0.86**
		Social Functioning	0.56	0.61	1.01	**0.56**	**0.44**	**0.69**
		Recovery	**0.55**	**0.42**	**0.69**	**0.79**	**0.64**	**0.97**
		Depressive symptom severity	**1.91**	**1.46**	**2.62**	**1.26**	**1.02**	**1.56**
		Positive symptom severity	**1.78**	**1.41**	**2.27**	**1.69**	**1.36**	**2.12**
		Negative symptom severity	1.23	0.91	1.65	1.19	0.95	1.53
		Trauma symptom severity	**1.65**	**1.23**	**2.39**	**1.36**	**1.05**	**1.78**
		Alcohol use (past 6 months)	0.95	0.66	1.34	0.87	0.65	1.14
		Marijuana use (past 6 months)	1.14	0.78	1.27	0.99	0.78	1.27
	Past 6 month suicide attempts	Role functioning	0.94	0.76	1.19	**0.7**	**0.56**	**0.88**
		Social Functioning	1.01	0.82	1.27	**0.75**	**0.61**	**0.92**
		Recovery	**0.77**	**0.59**	**0.99**	**0.73**	**0.58**	**0.93**
		Depressive symptom severity	1.25	0.95	1.62	**1.31**	**1.04**	**1.64**
		Positive symptom severity	**1.32**	**1.06**	**1.64**	**1.69**	**1.36**	**2.1**
		Negative symptom severity	1.12	0.82	1.49	1.24	0.95	1.61
		Trauma symptom severity	**1.65**	**1.14**	**2.36**	1.32	0.96	1.78
		Alcohol use (past 6 months)	0.86	0.57	1.24	0.91	0.67	1.24
		Marijuana use (past 6 months)	1.16	0.58	1.01	0.77	0.58	1.02
Self-report	**Past-month Ideation**	Role functioning	0.86	0.64	1.14	**0.69**	**0.52**	**0.89**
		Social Functioning	**0.75**	**0.57**	**0.98**	**0.69**	**0.55**	**0.88**
		Recovery	**0.33**	**0.25**	**0.43**	**0.78**	**0.63**	**0.95**
		Depressive symptom severity	**3.85**	**2.78**	**5.66**	**2.00**	**1.56**	**2.64**
		Positive symptom severity	**1.88**	**1.14**	**2.49**	1.22	0.93	1.60
		Negative symptom severity	**1.5**	**1.12**	**2.12**	**1.31**	**1.07**	**1.62**
		Trauma symptom severity	**2.55**	**1.82**	**3.82**	**1.59**	**1.2**	**2.15**
		Alcohol use (past 6 months)	1.13	0.83	1.55	0.93	0.71	1.22
		Marijuana use (past 6 months)	1.07	0.79	1.48	0.94	0.73	1.12

Note. All predictors z-scored before being entered into the model. Role and social functioning were measured using the Cornblatt's Global Functioning scales. Depressive symptoms were measured using the BDI-7 (Beck et al., 1997) with the suicidality item dropped. Positive and negative symptoms were assessed by clinicians using the COMPASS-10. Trauma symptom severity was assessed using the PSS. Recovery was measured with the QPR. Marijuana use and alcohol use were assessed as single items delivered by clinicians. Coefficients significantly different from 1 at $p < 0.05$ are bolded.

4. Discussion

The present study assessed self-reported past-month suicide ideation and clinician-reported past-six-month suicidality as well as changes in these outcomes for clients in the Connection LHS two-state network of early psychosis programs. We found that rates of clinician-reported past-

six-month suicidality were high for clients entering the program (52 % were reported to have suicidal ideation, 23 % self-harm, 15 % suicide attempts), and that rates decreased substantially (by no less than 77 % on all clinician-reported outcomes) during the first six months of treatment, and these improvements were sustained or, in the case of self-harm, continued to improvement. The picture was similar for past-

month self-reported suicide ideation, where we found significant reductions in ideation within the first 12 months of treatment. No clients were recorded as dying by suicide during treatment.

While we are unable to evaluate the degree to which these improvements may be due to factors related to treatment (e.g., level of engagement, medication, adherence, skill acquisition) or unrelated to treatment (such as regression to the mean), we were able to rule out the likelihood that such decreases were due to people with suicidality leaving treatment earlier than people without suicidality.

Among the between-subjects factors assessed in the present study, lower sense of recovery (e.g., "I feel that my life has a purpose" and "I can take control of aspects of my life") and higher trauma symptom severity were associated with every measure of suicidality. The concept of personal recovery—characterized by hope and empowerment—has emerged as a critically important treatment goal that is distinct from clinical and functional recovery (Best et al., 2020). Our results further emphasize this idea, highlighting that a person's sense of recovery is an important factor linked to lower suicide risk. Regarding trauma and early psychosis, the association with suicidality has been less well-studied but has received some support in prior studies of first episode psychosis (Grattan et al., 2019; Tarrier et al., 2007), with some research suggesting that the relationship between trauma and suicidality in FEP is partially mediated by negative schemas (Cui et al., 2020).

Encouragingly, we found that a range of factors targeted in treatment by the CSC model (viz., social and role functioning, depressive symptom severity, and a sense of recovery) were significant within-subject predictors of all measures of suicidality, suggesting the possibility that targeting these domains in treatment may lead to reductions in suicidality. These findings suggest that clients in the CSC programs in this region experience reductions in suicidality on average over the course of treatment, and that interventions targeting specific domains (e.g., bolstering functioning, self-efficacy, hope, and purpose) may be particularly beneficial with respect to suicide risk. Of course, these findings also imply that decreases in suicidality are likely dependent to some extent upon treatment response.

There were several methodological limitations of the present study. First, the lack of a control group makes it difficult to assess causality or contextualize these findings. Population studies of suicidality suggest that our observed rates of suicidality toward the end of the treatment period may be similar to rates observed among similarly aged people in the general population (Czeisler et al., 2020; Twenge et al., 2019). However, the present sample was *not* selected from the general population, e.g., the plurality of clients identified as Black, a cohort that in the United States tends to have lower rates of suicide (Ramchand et al., 2021; although rates in this group have increased in recent years; Stone, 2023). There are innumerable other measured and unmeasured factors that may additionally characterize the sample that are difficult to account for without a randomized control (e.g., time, neighborhood factors, cultural context, etc.). Secondly, this study only covered observations made during treatment. It is unknown whether people who left treatment (either through early discharge or treatment completion) later suffered adverse outcomes, such as worsening suicidality or even death by suicide. Research is needed to evaluate outcomes of people after they leave CSC treatment, such as by linking treatment records with health services or mortality datasets. Other limitations of the study include the self- and clinician-report methodology, which risks under-reporting, as well as the ambiguous wording of items related to self-harm: neither the clinician-report item referring to "self-harm" nor the self-report item referring to "hurting" oneself specify whether these actions should be specifically related to suicide. Additionally, our analyses of predictors of suicidality considered one psychosocial variable at a time, whereas it is most likely that many or all of these variables are interrelated. Finally, particularly in the case of death by suicide, the baseline probability of the event is so low that it is difficult to estimate its likelihood or changes in its likelihood within a sample of the size available for this study.

Overall, the present findings provide an estimate of the rates of suicidality that clinicians in our region observe among clients in CSC programs. Rates tend to be high among people entering treatment—with the majority of clients experiencing suicide ideation in the past six months per clinician reports—but rates of ideation, self-harm, and attempts tend to decrease on average for people who remain in the program. Such improvements are to some extent tracked by variables targeted in the CSC model: particularly social and role functioning, sense of recovery, and depressive symptom severity. Additional research is needed to determine whether observed improvements in suicidality are greater than those that would be observed among people who do not receive services or who leave the program early, and whether these improvements are sustained after people leave specialized early psychosis treatment.

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Declaration of competing interest

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