Crisis Outreach, Treatment Engagement, and Outcomes after Suicide Risk Screenings in a Comprehensive Mental Health Platform

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Highlights:

- Tech-enabled crisis outreach within 24 hours of SI risk was linked to faster care initiation and stronger treatment retention.
- Outreach contact was associated with a 30% reduction in SI recurrence, even after adjusting for treatment engagement.
- Participants reached by care navigators showed steeper and sustained reductions in SI, depression, and anxiety symptoms over 6 months.
- Findings support proactive, platform-integrated crisis response as a scalable suicide prevention strategy.

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Abstract

Objective: To evaluate the short- and long-term outcomes of proactive crisis outreach within 24 hours of a suicidal ideation (SI) flag. Outcomes assessed via 6 months of follow-up data included treatment engagement indices and symptom trajectories (SI, depression, anxiety) following an SI flag.

Methods: Real-world data were drawn from 6,131 individuals aged 15 years or older enrolled in a comprehensive mental health platform (*Spring Health*) who flagged for SI and had not engaged in treatment in the prior 6 months (M_{age}=35.4, SD=11.5; 51.5% women). The primary exposure was successful care navigator contact within 24 hours of the SI event.

Results: Of the 6,131 participants with SI, 93.3% attended at least one therapy or medication management appointment within 6-months of SI flag. Successful crisis outreach was associated with greater odds of treatment initiation (OR=2.37 [1.99, 2.82]), 33% shorter time to first appointment (time ratio=0.67 [0.63, 0.72]), and greater odds of early care retention (OR=1.69 [1.51, 1.89]). Mediation analyses supported time to care as a key pathway linking outreach to both early retention and total utilization. Even after adjusting for treatment engagement, crisis contact was associated with 30% lower odds of SI recurrence (OR=0.70 [0.61, 0.80]) and steeper reductions in SI, depressive, and anxiety symptoms that were maintained over time.

Conclusions: Timely outreach following an SI screen was associated with improved treatment access, sustained treatment engagement, and symptom reduction. Results support tech-enabled crisis outreach within a comprehensive mental health platform as a scalable strategy for early suicide intervention and care continuity.

Keywords: Depression; Anxiety; Real-World Data; Employee Assistance Program; Spring Health.

Crisis Outreach, Treatment Engagement, and Outcomes after Suicide Risk Screenings in a Comprehensive Mental Health Platform

Suicidality is a global public health concern, resulting in over 700,000 deaths each year and countless non-fatal attempts.[1] In the U.S., nearly 50,000 lives are lost to suicide annually, making it a leading cause of preventable death.[2] Even non-fatal attempts have profound ripple effects across social networks, extending deeply into families and communities, often leaving long-term emotional and financial burdens.[3,4] Although suicide prevention is a policy priority, questions remain about how best to deliver rapid, scalable intervention. Notably, there remains a need for real-time crisis care approaches that not only proactively intervene during moments of acute risk, but also initiate a sustained crisis-to-care pathway.

Many individuals who present with suicidal ideation (SI)—even in clinical care settings—ultimately receive limited follow-up care with mental healthcare workforce shortages and referral delays.[5] Public-sector efforts like the 2020 National Suicide Hotline Designation Act, which established the 988 Suicide & Crisis Lifeline,[6] have expanded access to emergency support for those actively seeking help. Yet these resources focus on short term de-escalation rather than sustained care pathways, leaving many at-risk individuals without a clear plan for ongoing treatment.[7]

In recent years, tech-enabled mental health platforms have been rapidly adopted by employers and health plans to provide needed support.[8,9] These platforms improve access to both digital and in-person care while reducing costs across diverse populations.[10,11] These platforms integrate adaptive risk detection with protocol-driven follow-up, enabling structured crisis response and rapid connection to therapy, medication management, and care navigation. When paired with trained care teams, they allow for timely outreach following SI screens, including crisis planning and personalized engagement pathways. However, despite growing adoption,

real-world evidence remains limited on their specific impacts around suicide risk.

Timely outreach following an SI flag may interrupt acute risk, foster readiness to change, increase receptivity to support, and establish early therapeutic connection, all of which can accelerate entry into care.[12] By reaching individuals during a critical window of heightened risk and receptivity, rapid crisis response may shorten the time to care, which in turn promotes deeper and more sustained treatment involvement.[13] In this way, time to care may serve as a key mediator linking crisis intervention to broader patterns of care continuity. Moreover, if timely outreach has stabilizing or de-escalating effects during a crisis, it may directly reduce the likelihood of symptom persistence or SI recurrence, even when accounting for subsequent care.[14] Indeed, early connection may serve as a therapeutic turning point that conveys safety and instills hope, potentially improving future outcomes regardless of subsequent treatment.

Current Study

This study uses real-world data from a comprehensive mental health platform (*Spring Health*[15]) to examine the crisis-to-care pathway following a positive SI screen. The primary aim was to assess short- and long-term outcomes associated with successful crisis contact within 24 hours of a positive SI screen. Treatment engagement outcomes included any therapy or medication management appointment within 6-months of the SI flag, time to first appointment, early care retention (≥3 sessions within 90 days), and overall treatment utilization (total sessions). Clinical outcomes included SI recurrence (any additional SI flags within 6-months), SI severity[16], and depressive/anxiety symptoms.[17,18] Participants were followed for 6 months after the index SI event.

We hypothesized that successful crisis contact would be associated with increased odds of any appointment, shorter time to first appointment, greater odds of early care retention, and

higher overall treatment utilization. We also tested whether time to care mediated associations between crisis contact and care retention/utilization. For clinical outcomes, we expected successful contact to predict lower SI recurrence and greater symptom reduction over time (SI, depression, anxiety).

Method

This cohort study was deemed not human participant research by the Yale IRB and was exempt from approval and informed consent. This study followed the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) reporting guideline for observational studies.

Platform Overview

As described elsewhere,[9,15,19] *Spring Health* is a comprehensive, tech-enabled mental health platform offering measurement-based care from therapists (masters- or doctoral-level licenses), medication managers (MDs/DOs), and unlimited care navigation from masters degree–level mental health clinicians. Individuals can schedule a first appointment in under two days with 6–24 fully covered psychotherapy sessions annually and additional care available as an in-network benefit (i.e., co-pay). Providers use a shared electronic health record, enabling coordinated case management, supervision, and team-based care grounded in real-time data.

Individuals complete initial intake and regular follow-up assessments, including the PHQ-9.[17] Non-zero endorsement of PHQ-9 item nine ("Thoughts that you would be better off dead, or of hurting yourself in some way") triggers additional suicide risk questions from the Columbia-Suicide Severity Rating Scale (C-SSRS[16]), a validated approach for SI detection in digital mental health settings. Based on response acuity, individuals are categorized into Self-Harm Risk (no suicidal thoughts), Non-Immediate Risk (thoughts without intent, plan, or

behavior), or Immediate Risk (thoughts with intent, plan, or behavior). Only the latter two categories were treated as a positive SI flag in this study.

A 24/7 crisis team of masters-level licensed care navigators (e.g. LCSW, LMHC) reaches out to all SI-flagged cases as soon as possible with priority given to immediate risk cases. Most cases are reached in less than 30min from flag generation and all are outreached multiple times within the first 24 hours. Outreach includes multiple phone, voicemail, and email attempts, and is documented in the individual's case history to support follow-up care and safety planning. Employers cannot see who uses *Spring Health* services or access any personal information, including SI flags. Individuals voluntarily consent to clinical escalation protocols when needed (e.g., contacting emergency services). Full details of the risk-tiers and outreach protocols are provided in Supplemental Materials A.

Participants and Procedures

Participants included individuals from 339 employers or health plans across 50 countries. The study period spanned February 2024 to March 2025, with individuals tracked for 6 months following a positive SI screen (index event). To ensure time for a full 6-months of follow-up, only individuals with an SI index event ≥6 months prior to data analysis were eligible for study inclusion. A 6-month washout was applied to include only individuals starting a new care episode.

SI prevalence was estimated among all platform-registered individuals with at least one assessment between February and September 2024 (N=270,678). The analytic sample for follow-up outcomes was restricted to the 6,131 individuals flagged for Immediate or Non-Immediate SI risk (67% were active employees enrolled in the EAP, 24% were covered dependents, and 9% accessed *Spring Health* through an affiliated health plan). These individuals ranged in age from

15 to 91 years (*M*=35.4, *SD*=11.5); 51.5% identified as women, 32.0% as men, and 16.4% as another or undisclosed gender; 10.2% had prior *Spring Health* treatment. Additional clinical characteristics are shown in Table S1.

Analyses

Measures are described in Supplemental Materials B. Intraclass correlation coefficients (ICCs) indicated that 2–12% of outcome variability was attributable to employer/payer clustering, supporting the use of mixed-effects models with random intercepts for group. To evaluate potential selection bias, a logistic generalized linear mixed model (GLMM) predicted successful crisis contact as a function of index SI risk category, treatment optimism, prior platform-based care, depressive/anxiety symptoms at index, age, and gender.

Models used maximum likelihood estimation to accommodate unbalanced follow-up and retain all individuals, even those with only baseline data, consistent with intent-to-treat principles and minimizing listwise exclusion bias. All models adjusted for treatment optimism, index SI risk, age, and gender, and were conducted using the '*glmmTMB*' package in R.[20]

Treatment Engagement Models. Binary outcomes (i.e., any treatment and early care retention) were estimated using logistic GLMMs with crisis contact as the primary covariate. Time to first appointment was positively skewed and modeled using a Gamma distribution with a log link, yielding time ratios. Overall care utilization was estimated both in the full sample and among the subset with ≥1 appointment to model continued care once treatment began.

Mediation Models. Two mediation models assessed indirect associations of time to first appointment on treatment engagement outcomes among those with ≥1 appointment. These tested the crisis-to-care hypothesis that crisis contact facilitates earlier treatment initiation, which in turn promotes deeper/sustained engagement. Analyses were conducted using the '*mediation*'

package in R.[21] Indirect, direct, and total associations were estimated using nonparametric bootstrapping with 1,000 simulations.

Clinical Outcomes Models. SI recurrence was modeled using a logistic GLMM. Symptom trajectories (i.e., SI, depression, anxiety) were modeled with GLMMs using random intercepts and flexible/natural spline terms to capture nonlinear change over time. Interaction terms assessed whether symptom change differed by crisis contact status. Distributions and link functions were selected based on outcome characteristics (e.g., negative binomial for overdispersed count data). All models adjusted for baseline covariates and post-index treatment exposure. Full model specifications are described in Supplemental Materials C.

Results

Descriptive Results

Of all participants with one or more assessments during the study period, 15.9% flagged at least once for any SI risk. Specifically, 9.6% flagged for self-harm risk, 3.6% flagged for Non-Immediate risk, and 1.7% flagged for Immediate risk. The analytic sample included only those with Non-Immediate (n=4,241) or Immediate (n=1,890) risk flags, as these groups were eligible for structured crisis outreach.

Individuals in the Immediate risk group were more likely to be reached within 24 hours of SI flag (71%) compared to the Non-immediate group (39%). Overall, 49% of individuals were successfully reached within 24 hours, and among those reached, 97% were within 10 hours, indicating successful outreach typically occurred soon after the SI flag. However, even unsuccessful outreach attempts may function as behavioral nudges, as 32% of Non-Immediate and 13% of Immediate risk individuals who were not successfully reached still booked an appointment within 72 hours.

Correlates of Successful Crisis Contact

The preliminary model assessing factors associated with successful crisis contact (Supplemental Table S2) indicated that Immediate risk participants were four times more likely to be successfully reached than those flagged as Non-Immediate (OR=4.02 [3.55, 4.55]). Higher treatment optimism at intake was also associated with increased odds of contact, with each one-point increase on the 0–10 scale corresponding to a 5% increase in odds (OR=1.05 [1.03, 1.07]). As such, treatment optimism was included in all models to reduce potential biases. Neither prior platform-based care nor depressive/anxiety symptom severity at the index event were associated with crisis contact. Women had 19% lower odds of being reached compared to men (OR=0.81 [0.72, 0.92]).

Treatment Engagement Results

Any Appointment. Most individuals with an SI flag (93.3%) attended a mental health appointment during the 6-month follow-up. Successful crisis contact was associated with significantly higher model-predicted probabilities of any appointment (Table 1; Figure S1a). Those successfully contacted were more than twice as likely to have at least one mental health appointment in the following six months (OR=2.37 [1.99, 2.82]).

Time to First Appointment. Among participants with any appointment, the median time to first appointment was 6.9 days following an SI flag (Immediate Risk=5.7 days; Non-Immediate Risk=7.2 days). Successful contact was associated with shorter time to care (Table 1). A time ratio of 0.67 indicates that, on average, those reached attended their first appointment 33% sooner than those not reached. This corresponds to an average difference of approximately seven days, as illustrated in the model-predicted estimates in Figure S1b.

Early Care Retention. Among the full sample, 68.4% had early care retention

(Immediate Risk=70.4%; Non-Immediate Risk=67.4%). Those successfully contacted had 69% higher odds of early care retention (OR=1.69 [1.51, 1.89]), which corresponds to a model-predicted increase from 59.4% in the not reached subgroup to 71.2% in the reached subgroup (Figure S1c).

Overall Care Utilization. In the full sample, including participants with no appointments, successful contact was associated with 25% more mental health appointments over the 6-month follow-up (Table 2). When restricted to participants with at least one appointment, successful contact was still associated with 9% greater total appointments. This suggests that successful contact promotes deeper engagement even among the subgroup who enter care (Figure S1d).

Mediation Models. The crisis-to-care pathways are shown in Supplemental Figures S2 and S3. Time to first appointment significantly mediated the association between crisis contact and early care retention. The indirect association was significant, while the direct association was not, supporting a fully mediated pathway. Notably, 83.3% ($p<.001$) of the total association was attributable to the indirect pathway via earlier care.

Time to first appointment partially mediated the relationship between crisis contact and overall care utilization as both the direct and indirect associations were significant. The proportion mediated was 42.3% ($p<.001$), suggesting that a substantial share of the total association between crisis contact and care utilization operated through accelerated treatment initiation.

Clinical Outcomes

SI Recurrence. As shown in Supplemental Table S3, successful crisis contact corresponded to 30% lower odds of SI recurrence in the following 6-months, relative to those

who were unreached (OR=0.70 [0.61, 0.80]). Model-predicted probabilities reflected the magnitude of this difference: 17.0% recurrence for those successfully contacted versus 22.6% for those not reached (Figure 1a).

SI Symptom Severity Trajectories. The natural spline model examining SI symptom trajectories by crisis contact status (Table 3) revealed significantly steeper reductions within the first two segments (days 0–6 and 7–46) among those successfully contacted. No significant differences were observed during the third segment (days 47–180). Taken together, those reached within 24 hours of SI flag experienced early relative improvements in SI severity that were largely sustained over the 6-month follow-up period (Figure 1b).

Depressive Symptom Trajectories. Depressive symptoms declined more steeply among the reached group during the first (days 0–6) and second (days 7–46) spline segments, with no group differences observed in the third segment (Table 3). These early reductions resulted in a sustained separation between groups across the 6-month follow-up (Figure 1c).

Anxiety Symptom Trajectories. No significant group difference in anxiety symptom trajectories were observed during the first segment (days 0–6); however, those with successful contact exhibited significantly steeper reductions during the second segment (days 7–46). No differences were observed in the third segment as trajectories remained largely parallel (Figure 1d).

Supporting Analyses

Several sensitivity checks supported the robustness of results. Findings were consistent after excluding those whose platform eligibility/coverage was terminated at some point during follow-up (~5%), and after redefining successful crisis contact using a 48-hour window. Including prior care as a covariate, despite its lack of association with successful contact, did not

change interpretation.

Discussion

In this study, successful care navigator crisis contact within 24 hours of an SI flag was associated with faster care entry, greater treatment engagement, and sustained reductions in SI, depression, and anxiety symptoms even after adjusting for treatment. These findings support tech-enabled crisis outreach within mental health platforms as a promising avenue for scalable suicide prevention.

Although crisis hotlines remain a vital public health resource, this study highlights distinct advantages of platform-based outreach over traditional hotlines. The first key advantage is proactive detection and structured outreach; individuals are flagged through routine assessments and contacted directly, rather than needing to seek help themselves. This lowers the activation barrier compared to calling a crisis hotline, a step often taken only in moments of acute distress. Often, only minutes separate the decision to attempt suicide from the act itself, emphasizing the critical importance of earlier detection and preemptive contact.[22] Notably, individuals flagged as Immediate Risk had greater odds of outreach contact compared to those at Non-Immediate Risk. This may reflect the more intensive protocol for Immediate Risk cases, including multiple follow-ups and the possibility of clinical escalation (e.g., calling emergency contact). Individuals experiencing more severe SI may be more receptive to receiving help when proactively contacted, further supporting the value of differentiated crisis protocols. Conversely, those with lower SI severity may not perceive their ideation as serious enough to warrant immediate support, which could explain lower outreach response rates.

Second, this approach is uniquely positioned to connect at-risk individuals directly to treatment. Those successfully contacted had a median time to first appointment of just 6.9 days

from SI flag. This is rarely achievable via crisis hotlines, which typically lack integrated referral systems.[23] In contrast, the centralized platform infrastructure enables coordinated case management, clinical oversight, and rapid linkage to treatment across providers. Just as crucial is the platform's ability to offer nationwide appointments within two days, enabling crisis outreach to be followed quickly by treatment. Consequently, 94% of reached individuals in this study had a mental health appointment within six months, far surpassing estimates of 42% referral follow-through rates for traditional crisis hotlines.[24] Additionally, 71% of contacted individuals achieved early care retention, indicating not only rapid access but sustained engagement during the critical post-crisis window where most dropout occurs.[25] Mediation analyses further supported this crisis-to-care pathway; successful outreach predicted shorter time to first appointment, which in turn predicted both early retention and greater overall utilization, reinforcing time to care as a key driver of sustained engagement.

Third, findings point to a direct therapeutic benefit of crisis outreach on symptom trajectories, independent of care engagement. Crisis contact was associated with immediate and sustained reductions in SI, depressive, and anxiety symptoms above and beyond the effect of treatment engagement. While further mechanistic work is warranted, these associations may stem from perceived support, reductions in isolation, and enhanced sense of hope. Such outreach is powerful; previous research found 91% of individuals with SI reported that check-ins helped keep them safe, and 80% said check-ins prevented further suicide attempts.[26]

Finally, this outreach model may help reach populations historically less likely to self-initiate help-seeking. Whereas crisis hotlines are more commonly used by women,[27] our findings showed men had greater odds of being reached, suggesting this type of support may resonate with historically harder-to-reach groups.

As Miller and colleagues[23] noted in the context of crisis hotlines, future work should examine the content and quality of outreach interactions, including elements like therapeutic alliance and which outreach behaviors are most impactful. A deeper understanding of what occurs during outreach and what aspects drive symptom relief could further improve protocols.

Limitations

The real-world, non-randomized design limits causal inference and introduces the possibility of unmeasured confounding beyond best efforts to adjust for key covariates and conducting sensitivity analyses. Because many individuals classified as "unreached" still booked an appointment within 72 hours of SI flag, our models may underestimate the full impact of care navigation. These individuals may have benefited from unmeasurable behavioral nudges triggered by the outreach attempts, even if contact was unsuccessful. Despite adjusting for treatment optimism, other unmeasured self-selection biases may have influenced individuals' willingness to engage with outreach attempts. Similarly, while the platform delivers proactive outreach following SI-flagged assessments, individuals who complete assessments more regularly may already be inclined toward care. Even so, outreach appears to help people move from intention to action, propelling them over the final hurdle into treatment. Moreover, because SI detection requires assessment completion, the sample may exclude individuals who bypass digital platforms and seek help through other resources, potentially underrepresenting higher-acuity cases. Race/ethnicity were not available for most individuals, limiting our ability to explore possible disparities. Lastly, mortality and suicide attempt data were not available, though reductions in SI and improved care engagement are key upstream indices of risk mitigation, even in a sample of predominantly employed individuals with historically lower risk for mental health[28] and suicidality concerns.[29]

Conclusions

Findings support the value of timely crisis outreach as a scalable approach to suicide intervention. Proactive outreach within 24 hours of an SI flag was associated with faster access to care, deeper treatment engagement, and meaningful symptom improvement. Importantly, proactive outreach may ease the burden on individuals in crisis by helping them navigate into care more quickly, highlighting the value and growing role of comprehensive mental health platforms in suicide prevention.

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Tables and Figures

Table 1. Generalized linear mixed models estimating associations between crisis call contact and treatment engagement outcomes in the 6-months following the SI index event

	Model 1: Any Appointment		**Model 2: Time to First Appointment**		**Model 3: Early Care Retention (3+ Appts in first 90 days)**	
Covariate	Odds Ratio	95% CI	Time Ratio	95% CI	Odds Ratio	95% CI
(Intercept)	6.39	[4.41, 9.27] ***	31.20	[26.61, 36.59] ***	1.16	[0.91, 1.49]
Successful Crisis Call Contact (≤24 hours)	2.37	[1.99, 2.82] ***	0.67	[0.63, 0.72] ***	1.69	[1.51, 1.89] ***
Immediate SI Risk (relative to Non-Immediate)	0.72	[0.60, 0.86] ***	0.94	[0.87, 1.01]	0.96	[0.85, 1.09]
Treatment Optimism at Intake	1.10	[1.06, 1.13] ***	0.96	[0.95, 0.98] ***	1.08	[1.05, 1.10] ***
Member Age	0.99	[0.98, 0.99] ***	0.99	[0.99, 1.00] ***	0.99	[0.99, 1.00] *
Gender (Referent = Man)						
Woman	0.86	[0.72, 1.03]	1.09	[1.01, 1.18] *	0.89	[0.79, 1.00]
Other Gender	0.69	[0.22, 2.15]	1.09	[0.62, 1.93]	1.00	[0.40, 2.47]
Unknown Gender	1.50	[1.13, 1.98] ***	0.90	[0.81, 0.99] *	1.17	[0.98, 1.39]

Note: Models 1 and 3: *N* = 6111, reflecting that 0.5% of participants had missing treatment optimism scores from intake. Model 2: N = 5351, reflecting that the model only includes participants who received any mental health treatment during the 6-month follow-up period (i.e., *n* = 87.5% of full sample). Model was specified with a Gamma distribution and log link to accommodate skew in time to appointment. *p<.05, **p<.01, ***p<.001.

Table 2. Generalized linear mixed model estimating associations between crisis call contact and overall care utilization (total MH appointments in the 6-months post-SI flag)

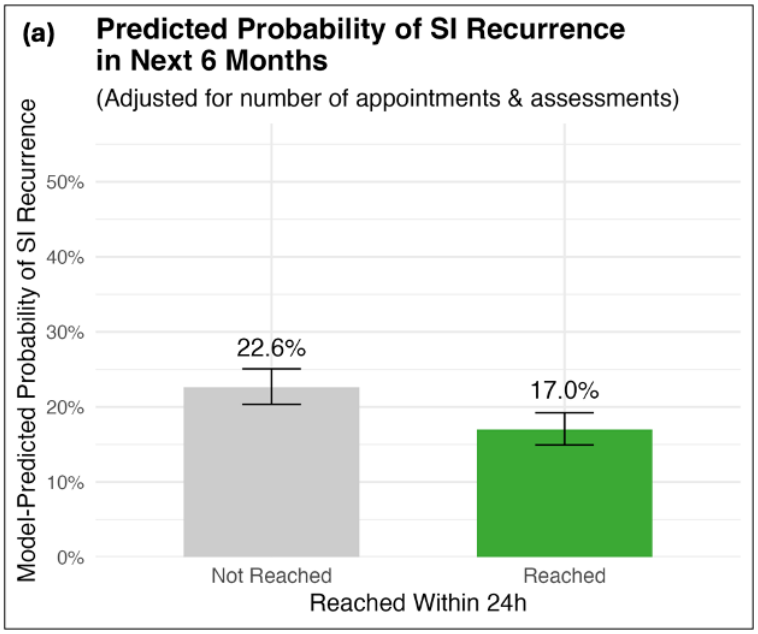
Covariate	Model 1: All Participants		Model 2: Participants with 1+ Appt.	
	Rate Ratio	[95% CI]	Rate Ratio	[95% CI]
(Intercept)	4.92	[4.45, 5.45]***	5.86	[5.38, 6.38]***
Successful Crisis Call Contact (≤24 hours)	1.25	[1.19, 1.30]***	1.09	[1.05, 1.13]***
Immediate SI Risk (relative to Non-Immediate)	0.95	[0.91, 1.00]*	1.01	[0.97, 1.05]
Treatment Optimism at Intake	1.03	[1.02, 1.04]***	1.01	[1.01, 1.02]***
Member Age	1.00	[0.99, 1.00]***	1.00	[1.00, 1.00]
Gender (Referent = Man)				
Woman	0.95	[0.91, 0.99]*	0.97	[0.93, 1.01]
Other Gender	1.06	[0.75, 1.50]	1.16	[0.87, 1.54]
Unknown Gender	1.04	[0.98, 1.11]	0.98	[0.93, 1.03]

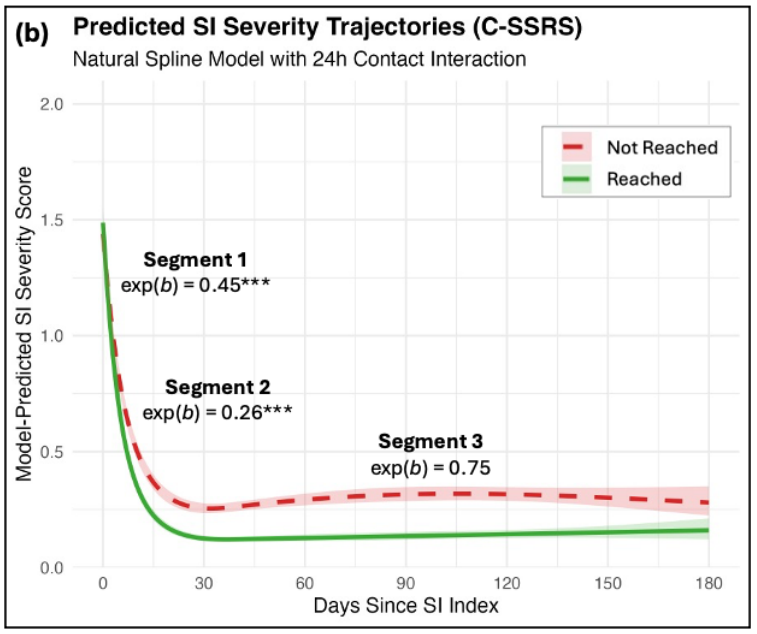
Note: Model 1 *N* =6111 ; Model 2 *N* = 5351, reflecting the removal of those with no follow-up appointments during the study period.
*p<.05, **p<.01, ***p<.001.

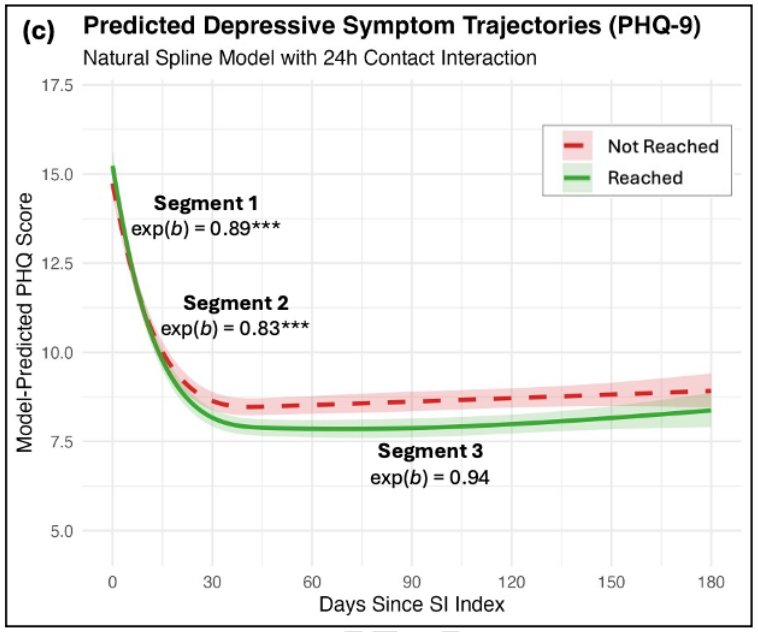
Table 3. Generalized linear mixed models with natural spline terms and interaction effects estimating differences in trajectories of clinical mental health symptomology by crisis call contact (reached vs. unreached) in 6-months post-SI flag

	SI Symptoms		Depressive Symptoms		Anxiety Symptoms	
Covariate	exp(*b*)	[95% C.I.]	exp(*b*)	[95% C.I.]	exp(*b*)	[95% C.I.]
(Intercept)	1.69	[1.57, 1.82]***	17.37	[16.57, 18.22]***	13.24	[12.49, 14.04]***
Spline Segment 1 (days 0 to 6)	0.50	[0.40, 0.64]***	0.71	[0.67, 0.75]***	0.74	[0.69, 0.78]***
Spline Segment 2 (days 7 to 45)	0.05	[0.04, 0.05] ***	0.37	[0.36, 0.39]***	0.57	[0.55, 0.60]***
Spline Segment 3 (days 46 to 180)	0.46	[0.37, 0.57] ***	0.79	[0.75, 0.82]***	0.85	[0.80, 0.89]***
Successful Crisis Call Contact (≤24 hours)	1.03	[1.00, 1.07]	1.03	[1.01, 1.06]**	1.04	[1.01, 1.07]**
Immediate SI Risk (relative to Non-Immediate)	2.75	[2.66, 2.85] ***	1.08	[1.05, 1.10]***	1.04	[1.01, 1.07]*
Treatment Optimism at Intake	0.97	[0.97, 0.98] ***	0.98	[0.98, 0.98]***	0.99	[0.98, 0.99]***
Member Age	1.00	[1.00, 1.00]	1.00	[1.00, 1.00]***	1.00	[0.99, 1.00]***
Gender (Referent = Man)						
Woman	0.99	[0.96, 1.03]	1.08	[1.06, 1.11]***	1.09	[1.06, 1.12]***
Other Gender	1.01	[0.77, 1.32]	1.16	[0.99, 1.35]	1.17	[0.96, 1.42]
Unknown Gender	0.96	[0.92, 1.01]	1.00	[0.97, 1.03]	1.01	[0.97, 1.05]
Total MH Appointments Post-SI Flag	1.01	[1.00, 1.01]***	1.01	[1.00, 1.01]***	1.00	[1.00, 1.01]***
Total Assessments Completed	0.98	[0.97, 0.99]***	0.98	[0.98, 0.99]***	0.98	[0.98, 0.99]***
Spline Segment 1 × Successful Crisis Call Contact	0.45	[0.31, 0.65]***	0.89	[0.82, 0.96]**	0.96	[0.89, 1.05]
Spline Segment 2 × Successful Crisis Call Contact	0.26	[0.21, 0.32]***	0.83	[0.79, 0.88]***	0.84	[0.79, 0.89]***
Spline Segment 3 × Successful Crisis Call Contact	0.75	[0.54, 1.06]	0.94	[0.88, 1.01]	0.96	[0.89, 1.03]

Note: Because each of these outcomes was scored as an integer, with positive skew, models were fit to a negative binomial distribution with a log link; coefficients are exponentiated to reflect multiplicative effects on the outcome. Values < 1 indicate lower symptom severity; values > 1 indicate higher severity. Main effects of spline segments reflect the change in symptom severity over time for the reference group (not contacted within 24h). The main effect of crisis call contact represents the group difference at the initial SI index assessment (Day 0). Interaction terms reflect how the trajectory of symptoms differs between groups during each spline segment. For example, an exp(β) of 0.90 would indicate a 10% steeper (i.e., faster) reduction in symptom severity for the contacted group, relative to non-contacted, within that segment. N = 6111 for SI and depressive symptom models; N = 5851 for the anxiety symptoms model as GAD is not always assessed due to adaptive survey logic. *p<.05, **p<.01, ***p<.001.


(a)
Predicted Probability of SI Recurrence in Next 6 Months
(Adjusted for number of appointments & assessments)
Model-Predicted Probability of SI Recurrence
50%
40%
30%
20%
10%
0%
22.6%
17.0%
Not Reached
Reached
Reached Within 24h


(b)
Predicted SI Severity Trajectories (C-SSRS)
Natural Spline Model with 24h Contact Interaction
Model-Predicted SI Severity Score
2.0
1.5
1.0
0.5
0.0
Not Reached
Reached
Segment 1
exp(b) = 0.45***
Segment 2
exp(b) = 0.26***
Segment 3
exp(b) = 0.75
0
30
60
90
120
150
180
Days Since SI Index


(c)
Predicted Depressive Symptom Trajectories (PHQ-9)
Natural Spline Model with 24h Contact Interaction
Model-Predicted PHQ Score
17.5
15.0
12.5
10.0
7.5
5.0
Not Reached
Reached
Segment 1
exp(b) = 0.89***
Segment 2
exp(b) = 0.83***
Segment 3
exp(b) = 0.94
0
30
60
90
120
150
180
Days Since SI Index

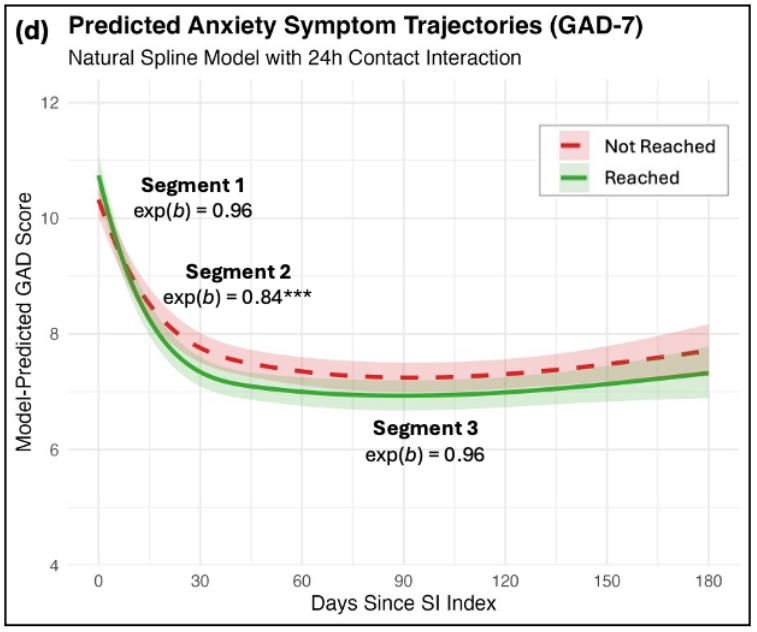

(d)
Predicted Anxiety Symptom Trajectories (GAD-7)
Natural Spline Model with 24h Contact Interaction
Model-Predicted GAD Score
12
10
8
6
4
Not Reached
Reached
Segment 1
exp(b) = 0.96
Segment 2
exp(b) = 0.84***
Segment 3
exp(b) = 0.96
0
30
60
90
120
150
180
Days Since SI Index

Figure 1. Model-predicted estimates from clinical outcomes models. In the natural spline models, knots were placed based on the distribution of follow-up time and were not informed by the outcome. This data-driven approach enabled a common temporal structure across models while minimizing the risk of outcome-specific overfitting.

Supplemental Materials

Crisis Outreach, Treatment Engagement, and Outcomes after Suicide Risk Screenings in a Comprehensive Mental Health Platform

Supplemental Material A - Detailed Suicidal Ideation Protocol.

Responses to item 9 of the PHQ-9 serve as the initial screening mechanism. A non-zero score triggers follow-up questions from the Columbia-Suicide Severity Rating Scale (C-SSRS), which assess ideation severity, presence of intent or plan, and any suicidal behavior. These responses determine the individual's SI risk tier. *Self-Harm Risk* is assigned for a positive score on the PHQ-9 gate item (i.e., item #9), but no active SI based on the C-SSRS items. *Non-Immediate Risk* is assigned for those who indicate suicidal ideation without a clear plan or intent and, finally, *Immediate Risk* is assigned to those with active SI and a plan, intent, or behavior (i.e., based on C-SSRS items).

All individuals who trigger the SI protocol are provided with immediate digital pop-up information regarding how to access immediate support, including a clickable phone number to the platform crisis line. Individuals in the Non-Immediate Risk group are further informed that care navigators will reach out by phone in the next 24 hours to check-in and provide support. If the individual does not answer the phone, a voicemail is left and an email is sent encouraging individuals to call the crisis line and a second call may be made if prior patient history indicates suicide risk. The Immediate Risk group is similarly informed about an outreach, but within the next two hours, and that if they are unable to connect and do not hear back within an hour of outreach that they may coordinate emergency services to their location. If they do not answer the initial call, a voicemail is left, an email is sent, and a second call is made within 10-50 minutes. If still not contacted, an outreach attempt is made to the individuals' emergency contact on file and if unsuccessful (or indicates imminent risk) then emergency services are contacted for emergent cases (i.e., welfare check).

Care navigators are trained mental health professionals who follow structured protocols to support consistent crisis documentation, escalation, and care planning. When individuals in the Immediate and Non-Immediate Risk groups *are* contacted, care navigators work with the individual to create a safety plan, connect into platform-based care, and/or engage in emergency service protocols as needed. In some cases, a welfare check is initiated while the care navigator remains on the phone with the individual. For individuals with an existing/established provider, the provider receives a notification about the SI event. For all individuals, the event details are added into the member dashboard/profile to facilitate adaptive measurement-based care at the next appointment. All documentation is recorded in the platform's centralized electronic health record system and accessible to both care navigators and treating providers.

Together, these procedures aim to ensure timely crisis response, mitigate acute risk, and establish a clear pathway to ongoing care through coordinated follow-up and shared documentation.

Supplemental Materials B – Description of Measures

Crisis Contact. Successful crisis contact was operationalized as direct communication with a care navigator within 24 hours of the index SI event. This 24-hour threshold captured most successful contact: for example, of those reached within 48 hours, 97.7% were already reached by the 24-hour mark.

Treatment Engagement. *Any appointment* was operationalized as any treatment (psychotherapy or medication management) within 6 months post-index. *Time to care* was days to first appointment from index. *Early care retention* was defined as three or more appointments within 90 days of SI index, consistent with prior findings that ~50% of patients with depression discontinue after one or two sessions, and >70% of all mental health treatment dropout occurs before the third visit.[1,2] *Overall care utilization* was total appointments within 6 months following SI index.

Clinical Outcomes. *SI recurrence* was defined as any additional SI flag (Non-Immediate or Immediate risk) within 6 months. *SI severity* was based on the most severe C-SSRS[3] item endorsed, which ranged from 0 (no ideation) to 5 (active ideation with SI-related behavior). In follow-up assessments, C-SSRS was not always administered when participants responded '0' on item nine of the PHQ-9[4] and, in these cases, they were assigned a severity score of 0. *Depressive symptoms* and *anxiety symptoms* were assessed using the PHQ-9[4] (range 0–27) and GAD-7[5] (range 0–21), respectively.

Treatment Optimism. On the initial intake survey, individuals were asked "How confident are you that treatment can help you feel better?" Response options ranged from 0 (Not confident) to 10 (Very Confident).

Supplemental Materials C - Detailed Clinical Outcomes Model Specifications

Symptom trajectories were modeled separately using generalized linear mixed models (GLMMs), with natural splines for time and interaction terms for crisis contact (Time×Crisis Contact). Splines were defined using three data-driven segments (days 0–6, 7–45, 46–180) to flexibly capture nonlinear patterns. Crisis contact interactions reflect group differences in change rate across each segment; however, estimates are shaped by the full spline function and are not fully independent. Models used negative binomial distributions with log links to accommodate skew and overdispersion. Random intercepts accounted for repeated measures nested within participants, and participants nested within employers/payers. All coefficients were exponentiated for interpretability.

In addition to the covariates listed in the main text, spline models adjusted for the total number of follow-up assessments and mental health appointments completed in the six months post-index. Adjusting for treatment intensity isolates the unique contribution of successful crisis contact on symptom change, controlling for differences in treatment exposure.

Supplemental References

1. Olfson M, Mojtabai R, Sampson NA, et al. Dropout From Outpatient Mental Health Care in the United States. *Psychiatr Serv*. 2009;60(7):898-907. doi:10.1176/ps.2009.60.7.898

2. Barrett MS, Chua WJ, Crits-Christoph P, Gibbons MB, Thompson D. Early withdrawal from mental health treatment: Implications for psychotherapy practice. *Psychother Theory Res Pract Train*. 2008;45(2):247-267. doi:10.1037/0033-3204.45.2.247

3. Posner K, Brown GK, Stanley B, et al. The Columbia–Suicide Severity Rating Scale: Initial Validity and Internal Consistency Findings From Three Multisite Studies With Adolescents and Adults. *Am J Psychiatry*. 2011;168(12):1266-1277. doi:10.1176/appi.ajp.2011.10111704

4. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a brief depression severity scale. *J Gen Intern Med*. 2001;16:606-613.

5. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: The GAD-7. *Arch Intern Med*. 2006;166:1092-1097. doi:10.1001/archinte.166.10.1092

Supplemental Tables and Figures

Table S1. Intake clinical characteristics of participants with suicidal ideation.

Clinical Characteristic at Intake	Estimate (%)	95% C.I.
Alcohol Use	8.8	[8.1, 9.6]
Drug Use	4.7	[4.2, 5.3]
Smoking, Vaping, or Chewing Tobacco	8.8	[8.1, 9.6]
Anger or Irritability	49.1	[47.8, 50.4]
Eating or Body Image	38.8	[37.6, 40.1]
Poor Concentration	47.6	[46.3, 48.9]
Family or Relationships	64.0	[62.8, 65.3]
Grief or Bereavement	25.3	[24.2, 26.5]
Panic Attacks	41.1	[39.9, 42.4]
Postpartum Concerns	4.9	[4.4, 5.5]
Sad, Down, or Depressed	91.3	[90.5, 92.0]
Trouble Sleeping	40.4	[39.2, 41.7]
Feeling Stressed Out	74.7	[73.5, 75.8]
Excessive Worrying	80.2	[79.2, 81.3]
Problems at Work	24.8	[23.6, 26.0]

Note: When participants completed their initial intake assessment they were asked a series of check-all-that-apply questions about why they were using *Spring Health*, what they would like support with, and what issues were bothering them.

Table S2. Generalized linear mixed model to identify correlates of successful crisis call contact within 24 hours of SI flag

Covariate	Adjusted OR	95% CI
(Intercept)	0.39	[0.28, 0.52]***
Immediate SI Risk (relative to Non-Immediate)	4.02	[3.55, 4.55] ***
Treatment Optimism at Intake	1.05	[1.03, 1.07] ***
Prior Spring Care Appointment (No/Yes)	0.87	[0.73, 1.05]
PHQ-9 Score at Index Event	1.01	[1.00, 1.02]
GAD-7 Score at Index Event	1.01	[0.99, 1.02]
Member Age	1.00	[1.00, 1.01]
Gender (Referent = Man)		
Woman	0.81	[0.72, 0.92] ***
Other Gender	0.91	[0.37, 2.23]
Unknown Gender	0.96	[0.81, 1.13]

Note: *N* = 5804, reflecting that 5% of participants had missingness on the GAD items due to adaptive survey logic. *p<.05, **p<.01, ***p<.001.

Table S3. Generalized linear mixed model estimating associations between crisis call contact and any SI recurrence in 6-months post-SI flag

Covariate	Odds Ratio	95% CI
(Intercept)	0.52	[0.39, 0.69]***
Successful Crisis Call Contact (≤24 hours)	0.70	[0.61, 0.80]***
Immediate SI Risk (relative to Non-Immediate)	1.59	[1.39, 1.82]***
Treatment Optimism at Intake	0.91	[0.89, 0.93]***
Member Age	0.99	[0.99, 1.00] **
Gender (Referent = Man)		
Woman	0.98	[0.85, 1.12]
Other Gender	1.40	[0.56, 3.48]
Unknown Gender	0.93	[0.77, 1.11]
Total MH Appointments Post-SI Flag	1.02	[1.01, 1.03]***
Total Assessments Completed	1.19	[1.15, 1.24]***

Note: *N* = 5538, reflecting the inclusion of only participants who had at least one follow-up assessment. *p<.05, **p<.01, ***p<.001.

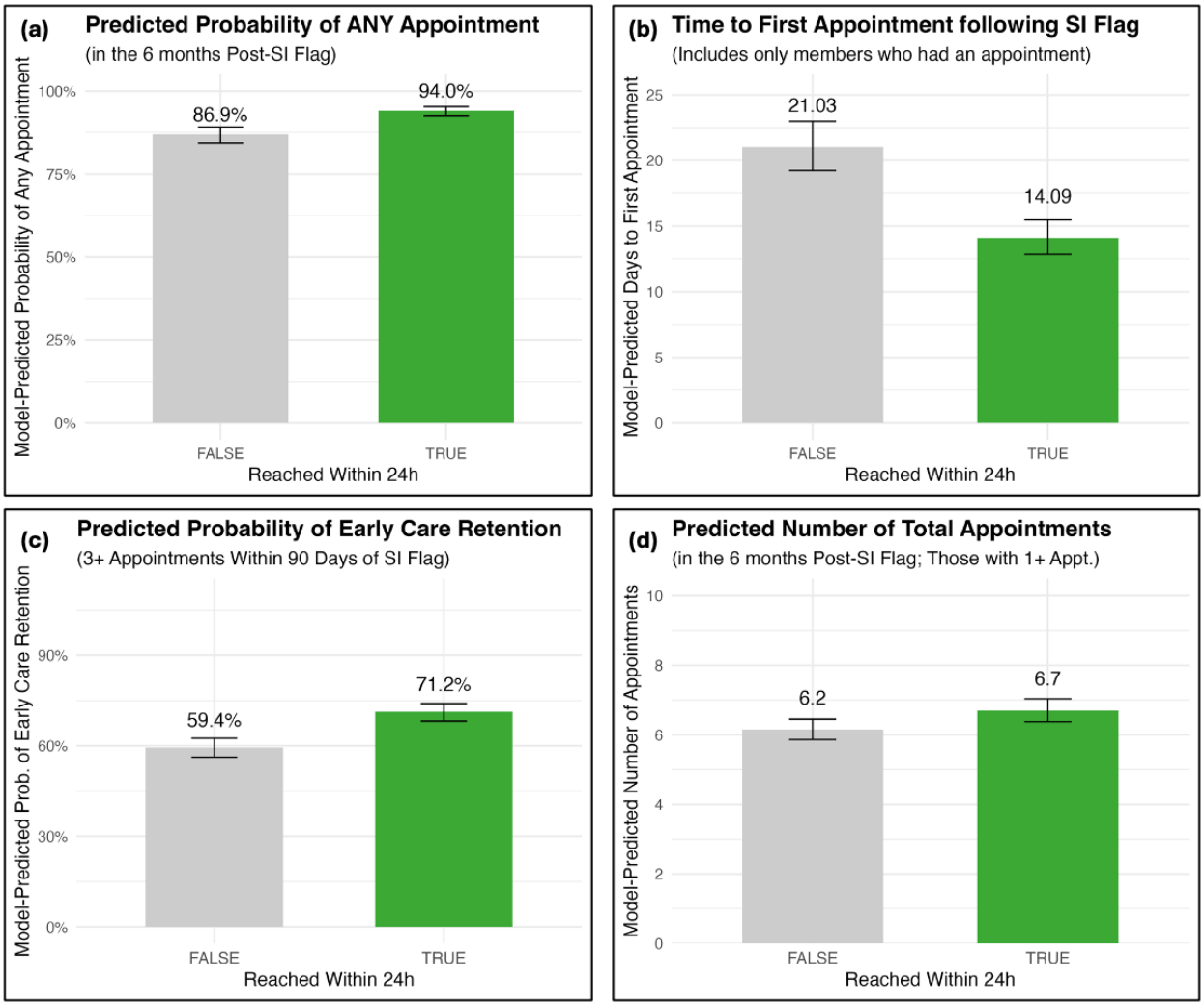


Figure S1. Model-predicted estimates from GLMMs shown in Table 1.

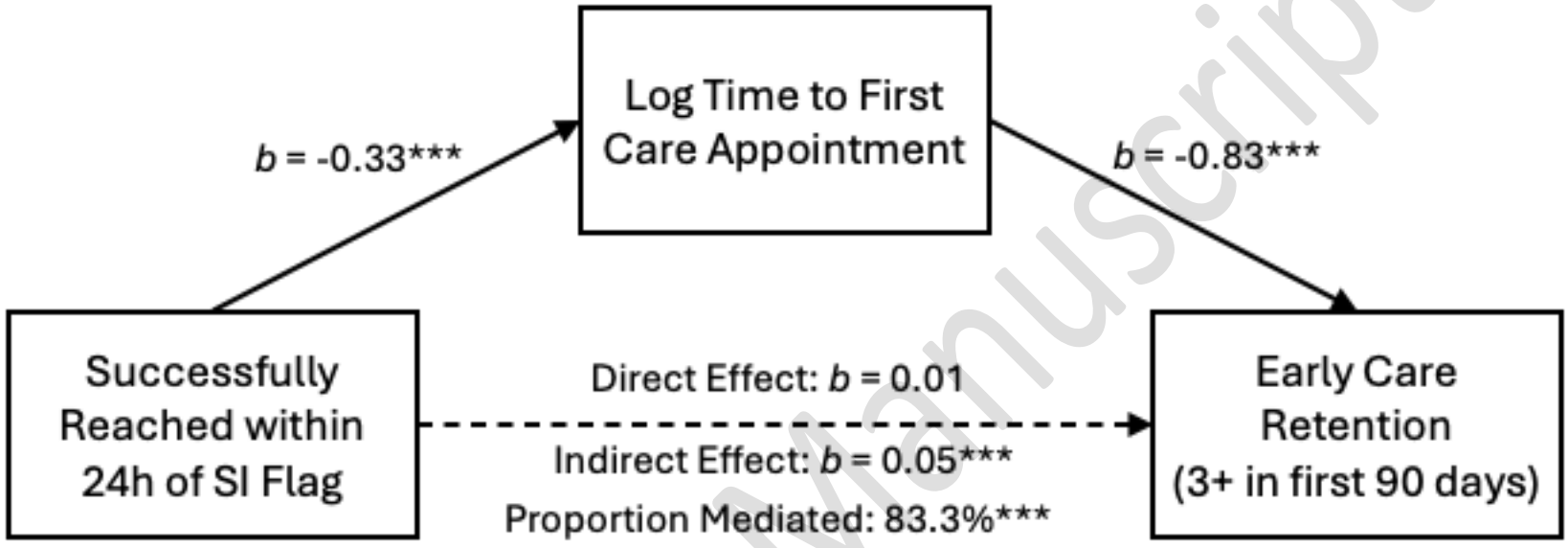


Figure S2. Mediation model estimating the indirect effect of successful crisis contact on early care retention, via time to first appointment, among members with at least one appointment. Solid arrows represent regression-based effects: the 'a' path reflects a regression-based effect on the log scale, and the 'b' path reflects a logistic regression estimate. Direct and indirect effects were estimated using quasi-Bayesian Monte Carlo simulation and reflect average changes in predicted probability of early retention. The proportion mediated reflects the share of the total effect explained by the indirect pathway through time to care.

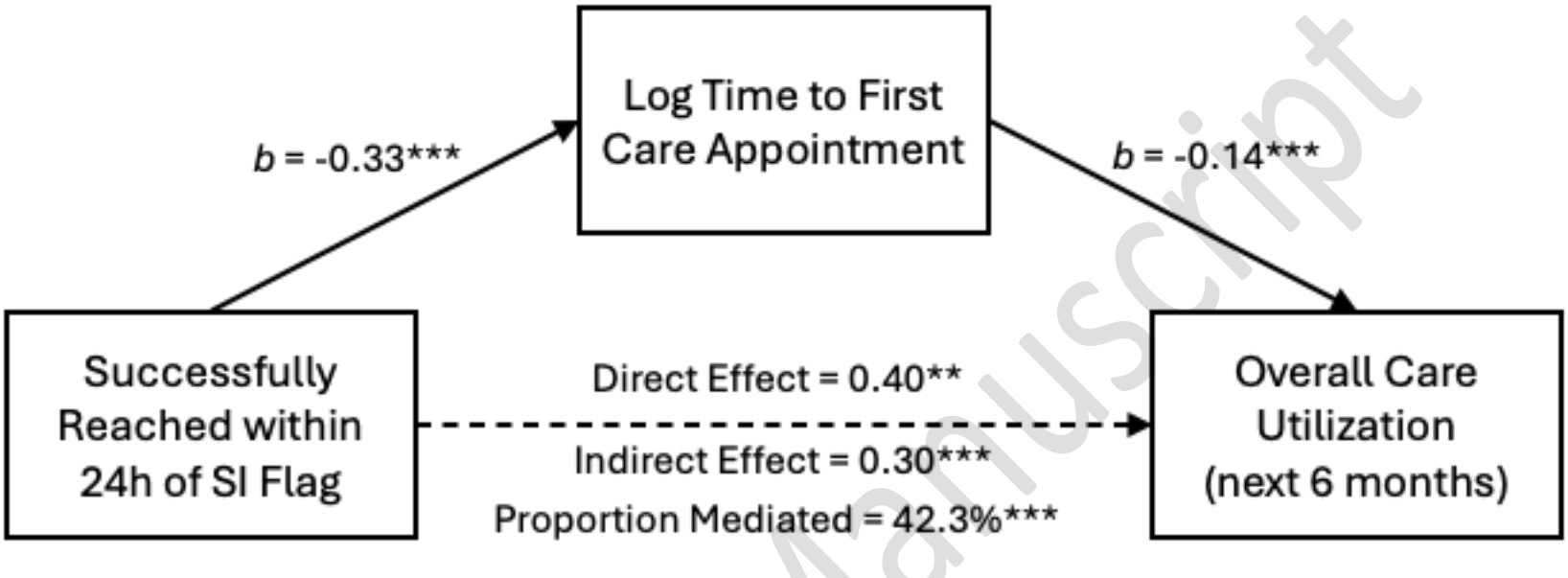


Figure S3. Mediation model estimating the indirect effect of successful crisis contact on overall care utilization, via time to first appointment, among participants with at least one appointment. The 'a' and 'b' paths (solid arrows) reflect regression-based effects on the log scale, while the direct and indirect effects were estimated using quasi-Bayesian Monte Carlo simulation and represent average differences in expected number of appointments. The proportion mediated reflects the share of the total effect explained by the indirect pathway through time to care.