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ORIGINAL RESEARCH

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Management of suicidal risk in the emergency department: A clinical pathway using the computerized adaptive screen for suicidal youth

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Abstract

Objective: Given the critical need for efficient and tailored suicide screening for youth presenting in the emergency department (ED), this study establishes validated screening score thresholds for the Computerized Adaptive Screen for Suicidal Youth (CASSY) and presents an example of a suicide risk classification pathway.

Methods: Participants were primarily from the Study One derivation cohort of the Emergency Department Screen for Teens at Risk for Suicide (ED-STARS) enrolled in collaboration with Pediatric Emergency Care Applied Research Networks (PECARN). CASSY scores corresponded to the predicted probabilities of a suicide attempt in the next 3 months and risk thresholds were classified as minimal (<1%), low (1%–5%), moderate (5%–10%), and high (>10%). CASSY scores were compared to risk thresholds derived from clinical consensus and ED complaints and dispositions. CASSY risk thresholds were also examined as predictors of future suicide attempts in the Study Two validation cohort of ED-STARS.

Results: A total of 1452 teens were enrolled with a median age of 15.2 years, 59.5% were female, 55.6% were White, 22% were Black, 22.3% were Latinx, and 42.8% received public assistance. The clinical consensus suicide risk groups were strongly associated with the CASSY-predicted risk thresholds. Suicide attempts in the Study Two cohort occurred at a frequency consistent with the CASSY-predicted thresholds.

Conclusions: The CASSY can be a valuable tool in providing patient-specific risk probabilities for a suicide attempt at 3 months and tailor the threshold cutoffs based on the availability of local mental health resources. We give an example of a clinical risk

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pathway, which should include segmentation of the ED population by medical versus psychiatric chief complaint.

KEYWORDS
CASSY, suicide risk, suicide risk pathway

1 | INTRODUCTION

1.1 | Background

Suicide is the second leading cause of death for youths 12–17 years of age and has increased over the past two decades.[1] Rates of suicidal ideation (SI) and non-fatal suicide attempts (SA) among high-school students have increased, with rates up to 18.8% and 8.9%, respectively, in national studies.[2] Although the US Preventative Task Force states that there was not enough evidence to warrant universal suicide risk screening,[3] the Joint Commission recently clearly recommended that health systems implement universal suicide risk screening to identify youth for suicide risk.[4]

Emergency departments (EDs) serve an increasing number of youth seeking services for suicide risk and related mental health concerns,[5] and the ED is often one of the last points of clinical contact prior to suicide death among youth, making the ED an important setting for suicide screening and risk mitigation.[6,7] Screening tools have been developed for the ED, including the Ask Suicide Questionnaire (ASQ)[8] and the Columbia-Suicide Severity Rating Scale (C-SSRS).[9] While these measures have demonstrated acceptability and predictive validity for suicide-related outcomes,[10–13] they have limitations since they present the same set of questions to all youth despite heterogeneity of risk, and perform better for predicting SI, which is often concealed prior to suicidal behavior, therefore decreasing screening sensitivity for suicide risk.[14]

The recently validated Computerized Adaptive Screen for Suicidal Youth (CASSY)[15] provides a risk score that is a probability estimate for SA in the next 3 months from a brief, single administration (mean items: 11, range 5–21). In a multi-center cohort validation study, both the ASQ and the CASSY performed well in predicting SAs within the subsequent 3 months, but the CASSY outperformed the ASQ for those who presented with behavioral health complaints in addition to providing an individualized probability estimate for a SA in the next 3 months.[16] While there are some clinical guidelines developed for the ASQ and C-SSRS,[17,18] further guidance and triage recommendations are needed for the CASSY to delineate the steps an ED clinician should take in response to varying levels of risk.

1.2 | Importance

This study extends our prior work in developing and validating the CASSY screening tool by establishing validated screening score thresholds and an associated suicide risk classification system.

1.3 | Goals of this study

Our study aims are to (1) demonstrate the associations between the CASSY score thresholds (ie, probability of a SA in the next 3 months) and baseline risk classification (based on extant literature on risk for SAs), ED chief complaint, ED disposition, and future SAs; and (2) present an example of how the CASSY tool can be used in a clinical decision pathway in the ED for managing risk based on proposed CASSY score thresholds.

2 | METHODS

2.1 | Sample and setting

We primarily used data from the Emergency Department Screen for Teens at Risk for Suicide (ED-STARS) Study One derivation cohort, which developed a continuous risk score for the likelihood of an SA within 3 months. We used the Study Two validation cohort, which prospectively validated the CASSY in an independent sample to demonstrate the frequency of future SAs within each CASSY probability threshold level. In Study One, we recruited from 13 Pediatric Emergency Care Applied Research Networks (PECARN) EDs, and in Study Two, from 14 PECARN EDs and one Indian Health Services ED.[16] Youth were excluded if they were wards of the state, non-English speaking, medically unstable, cognitively impaired, or had already enrolled in the study. Participants and legal guardians used computers to complete self-report measures assessing demographic and suicide risk factors; follow-up interviews were conducted with both youth and guardians by telephone. Written informed consent from parent/guardian and adolescent assent were obtained. Institutional Review Board approval was obtained for all participating sites.

Participants' baseline risk classifications based on expert clinical consensus were originally part of the risk stratification process designed to enrich the follow-up sample in Study One of ED-STARS. All participants were classified at baseline into three subsets of risk groups based on their endorsement of established suicide risk factors.[19] The three baseline risk classifications were defined as follows: (1) high risk for an SA (defined by SI with intent/plan, history of SA, non-suicidal self-injury [NSSI] 5 or more times in past year, or homicidal ideation with intent/plan); (2) moderate risk for an SA (defined by an endorsement of SI or homicidal ideation alone, or by two or more other risk factors, such as current SI without a plan, alcohol/substance abuse, impulsive aggression, depression); and (3) low risk for an SA (defined as 0 or 1 endorsed risk factor).

2.2 | Measures

The CASSY was developed using model-based measurement (multidimensional Item Response Theory) and included a pool of 72 suicide risk and protective factors.[15] Youth in the Study One Derivation Cohort did not complete the actual CASSY but had the CASSY algorithms applied to their responses to the complete set of 72 CASSY items. CASSY risk threshold levels were informed by previous computerized adaptive tests for suicidal behavior in youth and young adults nationally,[20,21] and in consultation with ED-STARS co-investigators. Four threshold levels for CASSY predicted suicide risk were chosen: (1) minimal risk (≤1%), (2) low risk (>1% to ≤5%), (3) moderate risk (>5% to ≤10%), and (4) high risk (>10%). Youth in the Study Two validation cohort completed the actual CASSY (mean items: 11, range 5–21)[15] to compare probability scores to actual attempts. Since outcome data from the Study One cohort was used to develop the predictive probabilities on the CASSY, data from the Study Two cohort was used to independently demonstrate the frequency of SAs within each CASSY probability threshold level.

The Bottom Line

Suicide is a leading cause of death for youths aged 12–24 years and emergency departments serve an increasing number of patients seeking mental health services. This study established a validated screening score threshold for the Computerized Adaptive Screen for Suicidal Youth (CASSY), providing patient-specific risk probabilities for a suicide attempt at 3 months. This study presents a suicide risk classification pathway for emergency department adoption, allowing mental health resources to be tailored based on threshold cutoffs; therefore, offering the ability to allocate locally available resources to those most at risk.

2.3 | Analysis

Differences between categorical variables were tested using the chi-squared test or the Fisher's exact test (Monte Carlo approximation) when expected sample sizes were small. In Table 1, "left against medical advice" and "other" ED disposition categories were omitted due to small sample size. Because continuous and ordinal variable distributions were skewed, differences across groups were tested using the Wilcoxon rank sum test and Kruskal–Wallis test. Continuous variables were summarized using the median, first and third quartiles. The data in Table 2 are collected from Study Two cohort.

3 | RESULTS

3.1 | Youth characteristics

Of 10,664 youths approached to participate in Study One, 6641 completed baseline assessments; of which, 6448 had sufficient data for

TABLE 1 Baseline risk classification, chief complaint, and disposition by Computerized Adaptive Screen for Suicidal Youth (CASSY) predicted risk thresholds (Study One cohort).

	CASSY predicted suicide risk thresholds			
	Minimal risk, ≤1% (*N* = 774)	Low risk, >1% to ≤5% (*N* = 190)	Moderate risk, >5% to ≤10% (*N* = 228)	High risk, >10% (*N* = 260)
Baseline clinical consensus suicide risk classification[a]				
Low risk for attempt	345 (99.7%)	1 (0.3%)	0 (0.0%)	0 (0.0%)
Moderate risk for attempt	379 (73.4%)	103 (20.0%)	30 (5.8%)	4 (0.8%)
High risk for attempt	50 (8.5%)	86 (14.6%)	198 (33.6%)	256 (43.4%)
Chief complaint[b]				
Medical complaint, unintentional injury	735 (64.5%)	169 (14.8%)	157 (13.8%)	78 (6.8%)
NSSI or psychiatric	34 (38.6%)	11 (12.5%)	21 (23.9%)	22 (25.0%)
Suicidal ideation or attempt	5 (2.2%)	10 (4.4%)	50 (22.2%)	160 (71.1%)
ED disposition[c]				
Admitted for psych reasons	11 (5.6%)	9 (4.6%)	37 (18.9%)	139 (70.9%)
Admitted for non-psych reasons	121 (64.4%)	31 (16.5%)	30 (16.0%)	6 (3.2%)
Discharged	642 (60.4%)	150 (14.1%)	160 (15.1%)	111 (10.4%)

Note: Chi-squared test of differences in categorical variables across CASSY predicted suicide risk threshold categories.
Abbreviations: ED, emergency department; NSSI, non-suicidal self-injury.
[a] $\chi^2(6, N = 1452) = 1031.23, p < 0.0001$.
[b] $\chi^2(6, N = 1452) = 604.60, p < 0.0001$.
[c] $\chi^2(6, N = 1447) = 480.24, p < 0.0001$.

TABLE 2 Computerized Adaptive Screen for Suicidal Youth (CASSY) probability thresholds as predictors of future suicide attempts (Study Two validation cohort).

	CASSY predicted suicide risk threshold					
	Minimal risk, ≤1% (*N* = 1144)	Low risk, >1% to 5% (*N* = 605)	Moderate risk, >5% to 10% (*N* = 374)	High risk, >10% (*N* = 631)	Total sample (*N* = 2754)	*p*-Value
CASSY score: min, Q1, median, Q3, max	0.1%, 0.3%, 0.3%, 0.4% 1.0%	1.0%, 2.3%, 3.0%, 3.9%, 5.0%	5.0%, 6.4%, 7.1%, 8.2%, 10.0%	10.0%, 13.3%, 15.4%, 21.9%, 74.3%	0.1%, 0.4%, 2.7%, 8.9%, 74.3%	
3-Month suicide attempt						<0.001[a]
No	1142 (99.8%)	592 (97.9%)	349 (93.3%)	506 (80.2%)	2589 (94.0%)	
Yes	2 (0.2%)	13 (2.1%)	25 (6.7%)	125 (19.8%)	165(6.0%)	

[a]Chi-squared test of differences in categorical variables across CASSY predicted suicide risk threshold categories: $\chi^2(3, N = 2754) = 298.82$.

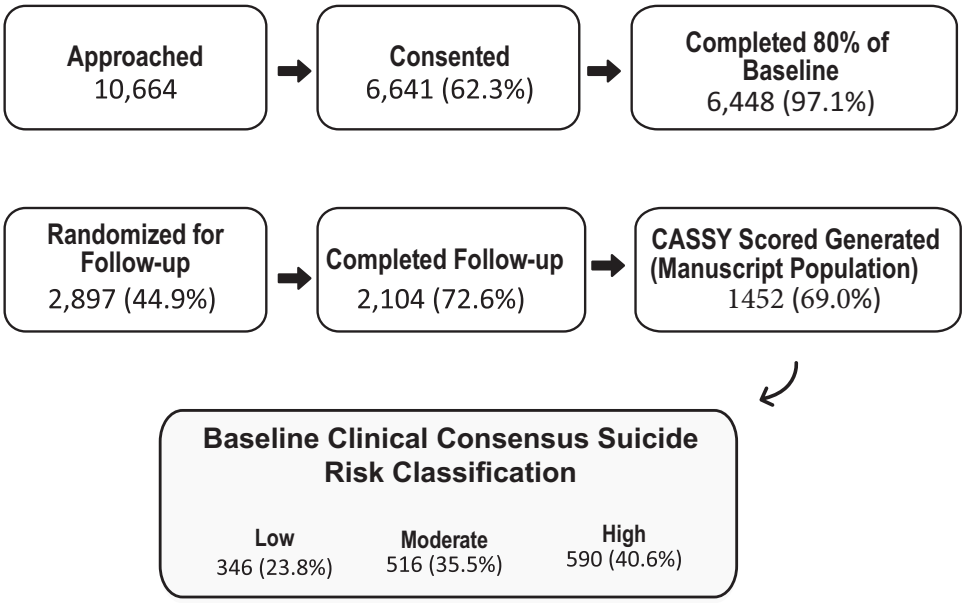

FIGURE 1 Flow diagram of Study One participation.

study inclusion (80% complete). A subset of youth (n = 2897), stratified by suicide risk classification to maximize follow-up SA outcomes, was randomly assigned to a follow-up assessment at 3 months. A total of 2104 completed the follow-up assessment and 1452 had sufficient data (i.e., 100% of survey questions used as inputs to generate CASSY algorithm were complete) for analysis (see Figure 1).

As presented in Table 3, the 1452 adolescents analyzed had a median age of 15.2 years. Of these, 40.5% of participants were male, 55.6% were White, 22% were Black, 5.6% were multi-racial, 1.5% were Asian, Hawai'ian, or Pacific Islander, 7.6% were of unknown race, and 22.3% were Latinx; and 42.8% of patients' families received public assistance. Those who had a CASSY score derived were similar to those not retained in the study with respect to sociodemographic characteristics, although there were some statistically significant differences in the retention analysis due to the large sample size. Specifically, females were less likely to have a CASSY score (60% with vs. 70% without) compared to males (30% with and 40.5% without), and those retained were more likely to be White (55.6% vs. 47.5%), and less likely to have parents that reported graduation from high school or less (Appendix 1).

3.2 | Suicide risk thresholds and comparators

The Study One *baseline* clinical consensus suicide risk groups, chief complaints, and disposition by CASSY predicted risk thresholds are presented in Table 1. The baseline clinical consensus risk stratifications were strongly associated with the CASSY *predicted* suicide risk thresholds ($\chi^2[6, N = 1452] = 1031.23$, $p < 0.0001$). All but one youth from the baseline clinical consensus low-risk classification group had CASSY scores that placed them in the CASSY minimal risk (<1%) threshold category for SA at 3 months. Furthermore, most (73%) of the youth in the baseline clinical consensus moderate-risk group actually fell into the CASSY minimal risk (<1%) category, and only 20% were in the CASSY predicted low-risk (1%–5%) category. About 77% of youth initially

TABLE 3 Computerized Adaptive Screen for Suicidal Youth (CASSY) threshold categories and demographic characteristics (Study One derivation cohort).

	CASSY predicted suicide risk threshold					
	Minimal risk, ≤1% (*N* = 774)	Low risk, >1% to 5% (*N* = 190)	Moderate risk, >5% to 10% (*N* = 228)	High risk, >10% (*N* = 260)	Total sample (*N* = 1452)	*p*-Value
Age (years): min, Q1, median, Q3, max	12.0, 13.4, 14.8, 16.3, 17.9	12.1, 14.3, 15.3, 16.4, 17.9	12.1, 14.3, 15.7, 16.8, 17.9	12.1, 14.1, 15.3, 16.4, 17.9	12.0, 13.8, 15.2, 16.5, 17.9	<0.001[a]
Gender						<0.001[b]
Male	377 (48.7%)	80 (42.1%)	76 (33.3%)	55 (21.2%)	588 (40.5%)	
Female	397 (51.3%)	110 (57.9%)	152 (66.7%)	205 (78.8%)	864 (59.5%)	
Race						<0.001[c]
American Indian or Alaska Native	14 (1.8%)	2 (1.1%)	3 (1.3%)	2 (0.8%)	21 (1.4%)	
Asian	10 (1.3%)	0 (0.0%)	1 (0.4%)	3 (1.2%)	14 (1.0%)	
Black or African American	192 (24.8%)	38 (20.0%)	52 (22.8%)	37 (14.2%)	319 (22.0%)	
Native Hawaiian or other Pacific Islander	4 (0.5%)	2 (1.1%)	0 (0.0%)	1 (0.4%)	7 (0.5%)	
White	392 (50.6%)	118 (62.1%)	134 (58.8%)	164 (63.1%)	808 (55.6%)	
Multi-racial	38 (4.9%)	14 (7.4%)	8 (3.5%)	25 (9.6%)	85 (5.9%)	
Unknown	71 (9.2%)	11 (5.8%)	18 (7.9%)	10 (3.8%)	110 (7.6%)	
Missing	53 (6.8%)	5 (2.6%)	12 (5.3%)	18 (6.9%)	88 (6.1%)	
Ethnicity						<0.001[b]
Hispanic or Latino	205 (26.5%)	27 (14.2%)	41 (18.0%)	51 (19.6%)	324 (22.3%)	
Not Hispanic or Latino	485 (62.7%)	137 (72.1%)	171 (75.0%)	177 (68.1%)	970 (66.8%)	
Unknown or unavailable	84 (10.9%)	26 (13.7%)	16 (7.0%)	32 (12.3%)	158 (10.9%)	
Child's grade in school						<0.001[c]
5th–8th grade	306 (39.5%)	52 (27.4%)	62 (27.2%)	79 (30.4%)	499 (34.4%)	
9th grade to high school graduate	435 (56.2%)	134 (70.5%)	157 (68.9%)	172 (66.2%)	898 (61.8%)	
Child does not attend school	3 (0.4%)	2 (1.1%)	2 (0.9%)	0 (0.0%)	7 (0.5%)	
Missing	30 (3.9%)	2 (1.1%)	7 (3.1%)	9 (3.5%)	48 (3.3%)	
Mother's education[d]						0.010[b]
High school graduate or less	240 (31.0%)	36 (18.9%)	64 (28.1%)	59 (22.7%)	399 (27.5%)	
Some college/technical	199 (25.7%)	69 (36.3%)	68 (29.8%)	79 (30.4%)	415 (28.6%)	
College graduate/professional	284 (36.7%)	81 (42.6%)	86 (37.7%)	107 (41.2%)	558 (38.4%)	
Do not know/not applicable	20 (2.6%)	2 (1.1%)	3 (1.3%)	6 (2.3%)	31 (2.1%)	
Missing	31 (4.0%)	2 (1.1%)	7 (3.1%)	9 (3.5%)	49 (3.4%)	
Father's education[d]						0.020[b]
High school graduate or less	304 (39.3%)	62 (32.6%)	84 (36.8%)	86 (33.1%)	536 (36.9%)	
Some college/technical	142 (18.3%)	42 (22.1%)	48 (21.1%)	49 (18.8%)	281 (19.4%)	
College graduate/professional	215 (27.8%)	75 (39.5%)	66 (28.9%)	94 (36.2%)	450 (31.0%)	
Do not know/not applicable	79 (10.2%)	9 (4.7%)	23 (10.1%)	20 (7.7%)	131 (9.0%)	
Missing	34 (4.4%)	2 (1.1%)	7 (3.1%)	11 (4.2%)	54 (3.7%)	
Public aid						0.043[b]
No	393 (50.8%)	120 (63.2%)	123 (53.9%)	140 (53.8%)	776 (53.4%)	
Yes	349 (45.1%)	66 (34.7%)	98 (43.0%)	108 (41.5%)	621 (42.8%)	
Missing	32 (4.1%)	4 (2.1%)	7 (3.1%)	12 (4.6%)	55 (3.8%)	

[a]Kruskal–Wallis test of differences in continuous or ordinal variables across CASSY predicted suicide risk threshold categories.
[b]Chi-squared test of differences in categorical variables across CASSY predicted suicide risk threshold categories.
[c]Fisher's exact test of differences in categorical variables across CASSY predicted suicide risk threshold categories (Monte Carlo approximation) for categories with small expected sample sizes.
[d]Includes step mother/father.

placed in the baseline clinical consensus high-risk group for attempt fell into the moderate and high CASSY suicide risk threshold categories (>5% likelihood of a SA at 3 months).

3.3 | ED variables

Chief complaint was strongly associated with CASSY risk thresholds ($\chi^2[6, N = 1452] = 604.60, p < 0.0001$). The majority (79.4%) of youths presenting with medical complaints fell into the minimal (≤1%) and low (>1% to ≤5%) CASSY predicted risk threshold categories. Youth presenting with NSSI or psychiatric chief complaints (not SA or SI) were more evenly distributed across CASSY predicted risk thresholds. Most youths presenting with SI or attempt scored in the moderate (22.2%) or high (71.1%) CASSY predicted risk threshold categories (Table 1).

ED disposition was strongly associated with the CASSY risk thresholds ($\chi^2[6, N = 1447] = 480.24, p < 0.0001$). The majority of youth admitted for medical reasons or who were discharged home from the ED were in the minimal or low CASSY predicted risk threshold categories (80.9% and 74.5%). Almost 90% of youth admitted for psychiatric reasons scored in the moderate or high CASSY predicted risk threshold categories (18.9%, 70.9%) (Table 1).

Prospective associations between the CASSY score and SAs were conducted with participants from the Study Two validation cohort ($N = 2754$, mean age = 15.0, 64% female—for full sample description, please see King et al.).[15] The overall number of SAs at 3 months for each risk group was consistent with the predicted CASSY risk thresholds. For example, among the 605 youth who received a CASSY predicted probability score between 1% and 5% (i.e., low risk), 13 (2.1%) made a SA (Table 2).

4 | LIMITATIONS

There are several limitations that should be considered. CASSY thresholds were based on expert consensus of the larger study co-investigators, including pediatric psychiatrists, psychologists, and emergency medicine physicians, which did not include a formal Delphi approach. In order to generate a CASSY score, all items needed to be completed during the initial survey, and the exclusion of individuals with some degree of missing data may have introduced a potential source of bias for the final sample. In addition, the study was performed in urban children's hospital EDs and therefore may not be generalizable to EDs in other geographic and clinical settings. However, we believe this tool would work well in many settings and using standardized cutoffs may help to mitigate implicit bias in decision making, although this will need further evaluation. Finally, due to the complexity of the assessments, non-English speaking youths were excluded. It will be important to include this important group in future work.

5 | DISCUSSION

In this study, we validated the CASSY's stratification of youth into four levels of predicted suicide risk and demonstrated how scores from the CASSY can be used to stratify youth presenting to the ED into risk groups based on the probability of a SA in the next 3 months. We validated four risk levels—minimal (≤1%), low (1% to ≤5%), moderate (>5% to ≤10%), and high (>10%)—using four criteria: baseline risk classification based on empirically established risk factors, presenting chief complaints, ED disposition, and future SAs.

The ability to estimate patient risk for SA with reasonable accuracy and to triage patients based on this risk are central to the care of youth presenting in the ED setting even for medical patients not presenting for psychiatric care. Clinician estimates of the risk for a SA in patients seen in the ED are often little better than chance, and much less accurate than predictions based on self-report.[22] Unfortunately, this risk estimate is often accomplished by the clinician's clinical experience and judgment, also known as "gestalt."[23,24] Because clinical gestalt has a wide variation and often includes implicit bias, a large number of patients at lower risk for adverse outcomes are deemed to need further evaluation or admission resulting in the "overevaluation" of the patient population. This is amplified with certain populations (e.g., children) or presentations (e.g., suicidal risk) that are particularly perplexing to clinicians and result in significant costs to the health care system. Alternatively, patients may be sent home inappropriately without risk evaluation or follow-up at a significant safety cost.

Decision support tools that incorporate self-report and/or data from electronic health records can help clinicians improve the accuracy of their predictions.[25–27] For youth presenting to the ED, particularly those presenting with medical chief complaints, uncovering unrecognized suicide risk in the ED is very important, as the ED visit may provide their only opportunity for interaction with health care providers. For these youth, the CASSY can help uncover unrecognized risk, and trigger mitigation strategies based on the severity of risk. Even more beneficial than a standard static screening tool, the adaptive structure of the CASSY allows for the detection of potential suicide risk even when SI is not present, or disclosed, by the youth, providing a significant advantage over alternative screening methods that do require SI to flag a youth for further assessment. Furthermore, for all patients, including youth presenting with psychiatric chief complaints, the CASSY can augment the evaluation by providing additional information regarding the patient-specific risk of a SA at 3 months.

5.1 | Clinical decision pathway demonstration

Fundamental to the implementation of suicide screening is linking risk to clinical pathways for risk mitigation since screening alone without linkage has not been shown to decrease suicidal behavior.[28] Suicide risk clinical pathways, such as the one developed for the ASQ, can guide healthcare providers and hospitals on the best approach for patients who screen positive for suicide risk.[29] We propose the following application of CASSY thresholds for clinical decision making based on four distinct thresholds of risk (Figure 2). Youth scoring at or below 1% on the CASSY (minimal risk; 65% of youth with medical complaints in our study, approximately 84% of youth with medical complaints in un-enriched population) may receive usual ED discharge

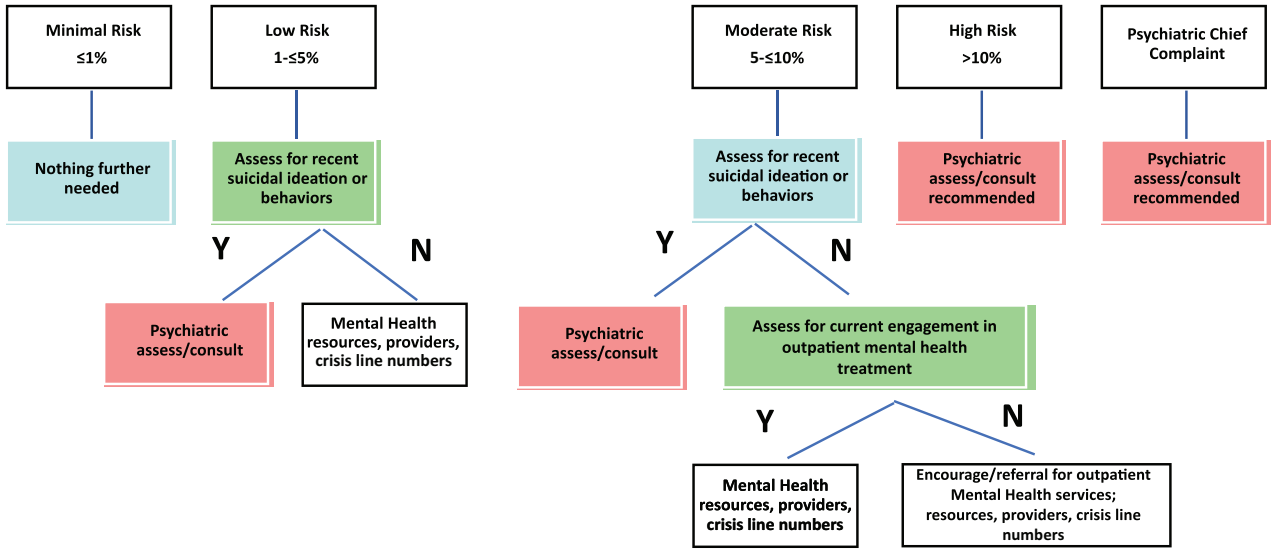

FIGURE 2 Computerized Adaptive Screen for Suicidal Youth (CASSY) clinical pathway.

education. Youth with CASSY scores of >1% to 5% (low risk; 15% in our study, approximately 7% in un-enriched sample) should be assessed by ED staff for recent suicidal thoughts or behaviors. Those endorsing recent SI should receive a full psychiatric assessment, and those without SI should receive a handout with mental health and crisis resources. Those with CASSY scores of >5% to 10% (moderate risk; 14% of our sample, 6% in an un-enriched sample) should also be assessed for recent suicidal thoughts and behaviors and referred for a psychiatric assessment if endorsed. Those in this risk category denying SI should be assessed for participation in outpatient mental health care and encouraged/referred for services if they are not. Mental health and crisis resources should be provided to all youth in this risk group, regardless of outpatient treatment status. For all those presenting with medical chief complaints and who scored >10% on the CASSY (high risk; 7% of our sample; 3% in an unenriched population), a psychiatric assessment is recommended. Particularly, elevated CASSY scores (>20) within the high-risk category may warrant consideration in the context of dispositional decisions, but remain secondary to content of the full psychiatric assessment.

Youth presenting with psychiatric chief complaints are isolated in our clinical pathway recommendation since this group is already segmented upon presentation to the ED. Among those presenting with a psychiatric chief complaint, low CASSY scores should not be used to rule out a full suicide risk evaluation—we recommend that all these patients receive an assessment by a mental health specialist or consult service in the ED. However, the CASSY can augment the evaluation of patients with psychiatric chief complaints by providing a patient-specific risk estimate of a SA at 3 months.

Due to high acuity and limited resources in the ED, existing screens have often utilized a two-phase suicide screening strategy that begins with brief self-report screeners followed by a more in-depth evaluation for youths who screen positive, with clinicians simply receiving classification as a negative/low risk, moderate, or high/imminent risk.[29] However, these classifications have not been fully empirically guided in quantifiable differences in risk for future behavior since each cutoff does not allow for differentiation within each group, such that the highest risk group could have a 10% or 50% likelihood of a future attempt. An advantage of the CASSY is its dimensional risk score, which provides the possibility to map recommendations for clinical decision making—next steps to take in response to a positive screen—onto screening score thresholds. This titrated approach may increase the feasibility of screening in EDs with limited resources, allowing them to choose a positive screen threshold that balances sensitivity and specificity with their capacity for mental health evaluation and follow-up.

In summary, the CASSY has the potential to add to the toolbox of existing suicide screens and support clinician decision making by providing patient-specific risk probabilities for an SA in the next 3 months and tailor the threshold cutoffs based on the availability of local mental health resources. From this percentage risk of attempt, cutoffs can be derived to suggest a therapeutic course of action tailored to the environment: for example, those who need to be admitted, those who can be followed up closely as an outpatient or those who can be discharged with no mental health follow-up. A suicide risk algorithm should include segmentation by medical versus psychiatric chief complaints allowing for the more robust mental health evaluation that routinely occurs in youths presenting with psychiatric chief complaints and may be tailored based on hospital resources. This approach allows an individualized, and objective means to stratify risk thus informing a clinicians' treatment plan while minimizing implicit bias. The CASSY may lead to more accurate prediction of suicide risk and better guiding resources for further assessment and disposition. Further studies are needed to empirically study and validate the outcomes of these recommendations.

AUTHOR CONTRIBUTIONS

Charlie Casper and Michael Webb had full access to all of the data in the study and take responsibility for the integrity of the

data and the accuracy of the data analysis. *Concept and design*: Jacqueline Grupp-Phelan, Adam Horwitz, Cheryl King, David Brent, and Charlie Casper. *Acquisition, analysis, or interpretation of data*: all authors. *Drafting of the manuscript*: Jacqueline Grupp-Phelan, Adam Horwitz, Cheryl King, David Brent, Charlie Casper, and Michael Webb. *Critical revision of the manuscript for important intellectual content*: Jacqueline Grupp-Phelan, Adam Horwitz, Cheryl King, David Brent, Charlie Casper, Michael Webb, Lauren Chernick, and Rohit Shenoi. *Statistical analysis*: Charlie Casper, Page, Wang, and Gibbons. *Obtained funding*: Cheryl King, David Brent, Jacqueline Grupp-Phelan, and Charlie Casper. *Administrative, technical, or material support*: Jacqueline Grupp-Phelan, Adam Horwitz, Cheryl King, David Brent, Lauren Chernick, Rohit Shenoi, and Michael Webb. *Supervision*: Jacqueline Grupp-Phelan, Cheryl King, David Brent, Charlie Casper, and Adam Horwitz.

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CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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