

Effectiveness of aftercare program for suicide ideators

Real-world evidence from National Suicide Surveillance System in Taiwan

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Abstract

Aftercare programs' effectiveness for suicide ideators has seldom been reported. This study assessed rates and factors related to the recurrence of suicide-related episodes after the index suicidal ideation episode, index cases, and family members receiving aftercare. This is a secondary data analysis of 1787 suicidal ideation episodes from 1557 individuals reported to the National Suicide Surveillance System in New Taipei City, Taiwan, from January 2012 to June 2013 and followed up until September 2013. Among 1787 index suicidal ideations, 19.1% had recurrences of suicide-related episodes, including suicidal ideation (11.9%), attempt (6.7%), and death (0.5%) within 2 years after index ideation. These recurrences were significantly reduced after the index cases received aftercare twice, three, and four or higher. Family members receiving aftercare twice or more were associated with reduced suicidality in the index cases. Receiving aftercare among index cases was associated with being a woman, suicide due to occupation/finance, and reporting from suicide hotlines. Receiving aftercare among family members was associated with the index cases aged ≤ 19 years old, suicide reasons related to school, occupation/finance, and reporting from schools and hospitals. Aftercare programs for suicide ideators and family members of adolescent suicide ideators (aged ≤ 19 years old) decreased subsequent episodes of suicidal behavior.

Abbreviations: NGOs = non-governmental organizations, NSSS = National Suicide Surveillance System, PHQ-9 = Patient Health Questionnaire-9, RCTs = randomized controlled trials.

Keywords: aftercare program, family member, recurrence, suicidal behavior, suicidal ideation, suicidality

1. Introduction

Suicide is one of the leading causes of death globally and has consistently been the top 12 leading causes of death in Taiwan from 1997 to 2020.^[1,2] Suicidal ideation is often a prerequisite for suicide attempts and death.^[3] However, many suicide attempts are impulsive without ideation beforehand.^[4] Although suicidal ideation is usually used as an initial evaluation of future suicide risk, suicidal ideation has a low positive predictive value for later suicide.^[4] This might be because of the heterogenous relationship between suicidal ideation and actual suicide.^[5] Notably, suicidal ideation varies in intensity,

duration, and character among different individuals and fluctuates across time with a broad spectrum of magnitude and characteristics.^[5] Therefore, accurately assessing the relationship between suicidal ideation and actual suicide is complicated. Nevertheless, suicidal ideation remains a crucial assessment for short-term suicide risk in clinical settings, highlighting the importance of the early detection of suicide ideators at the population level.

Aftercare programs and follow-ups for individuals at suicide risk are components of suicide prevention worldwide. In Taiwan, the National Suicide Surveillance System (NSSS) was established in 2006 to facilitate the early detection and treatment of suicide

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attempters.^{16,71} The NSSS includes an online reporting system for suicide attempts and suicide deaths and a structured aftercare program.^{16,71} The aftercare program of NSSS in New Taipei City, with a population of approximately 4 million, aimed to stop the transition from suicidal ideation to a suicide attempt and potentially suicide death by expanding its service to suicide ideators. Furthermore, most studies have focused on the effectiveness of aftercare programs for suicide attempters. However, few studies have examined the effectiveness of aftercare programs for suicide ideators. In randomized controlled trials (RCTs), receiving or not receiving the intervention was determined by randomization. In the real world, it is the choice of individuals who attempt suicide to receive aftercare services. Therefore, this study conducted secondary data analysis on those who reported to the NSSS in New Taipei City to assess the effectiveness of the aftercare program for suicide ideators. Additionally, we identified factors associated with receiving aftercare services for the index cases and their family members.

2. Materials and Methods

2.1. Study design, setting, and participants

We analyzed 1787 episodes of index suicidal ideation among 1557 individuals reported to the Suicide Surveillance System, New Taipei City, Taiwan, from January 2012 to June 2013. As a result, recurrences of suicidal ideation (213 of 1787, 11.9%), attempts (120 of 1787, 6.7%), and deaths (8 of 1787, 0.5%) among suicide ideators were identified through the linkage of the surveillance system and the national mortality database until September 2013.

In Taiwan, the NSSS covers suicide attempters only. However, the New Taipei City Government has extended the surveillance system to cover suicide ideators in its jurisdiction area. Non-governmental organizations (NGOs) and government agencies were invited to implement the program. NGOs included hospitals, schools, and suicide hotlines. The government agencies included the Department of Social Welfare, Department of Civil Affairs, Local district office, Bureau of Labour Insurance, Fire department/1999 (the 24-hour hotline of civil service), and Police department. Both NGOs and government agencies acted as reporting units in the NSSS. Once the reporting units had identified an episode of suicidal ideation, attempt, or other suicidal behaviors, hospital or public health officers completed the online registration for reporting. Other units faxed the relevant information (such as age, sex, presence of mental disorder, suicide reasons, and reporting unit) to the public health department. The public health department staff then completed the online reporting within 24 hours. Subsequently, the public health department assigned a suicide care manager for brief counseling, psychoeducation, and follow-up. The suicide care managers were specialized trained health care providers, including nurses and social workers. The index case was first followed up within three days of the index registration, and a minimum of two follow-ups per month for at least three months were required. Family members of the index case were also followed up, especially if the index case was not approached or was dependent. Follow-up frequency was based on the severity of depression assessed using the Patient Health Questionnaire-9 (PHQ-9). PHQ-9 measured the severity of depression from the previous two weeks. PHQ-9 was assessed regardless of whether depression was the cause of suicidality. The PHQ-9 can be categorized into five levels: minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27).¹⁸¹ According to the NSSS protocol, an individual with high risk would be referred for intensive psychiatric treatment; when the risk was moderate, the individual would be followed up once or twice per week; psychotherapy or counseling to the individual or family would be offered if needed. The suicide care manager recorded the PHQ-9 scores

and briefly described each follow-up online. The suicide care manager provided emotional support and referred suicide ideators to further psychiatric treatment or psychotherapy if needed. When the outreach service could not contact the suicide ideator, the suicide care manager provided psychoeducation and emotional support to the family to assist the family in helping the suicide ideator (Fig. 1).

2.2. Measures

The study outcomes were as follows: recurrences of suicide-related episodes (including suicidal ideation, attempts, and deaths); and index cases and their family members receiving aftercare. Covariates were sex, age, self-reported mental disorder, frequency of receiving aftercare among index cases and their family members, reasons for suicide, PHQ-9 scores, and reporting unit. Age, sex, presence of mental disorder, reasons for suicide, and reporting unit were available when suicidal ideation was first reported to the online system. PHQ-9 scores measure participants' depressive state in the previous two weeks and are commonly used worldwide. We retrieved the records of suicide deaths by linking the index case to the NSSS and national mortality data.

2.3. Statistical analysis

In univariate analyses, we conducted a log-rank test to assess how the recurrences of suicide-related episodes varied with the covariates. Multiple comparisons were made for the significant covariates using the simple Bonferroni method to control the overall type I error (α). In the simple Bonferroni method, the α_i of each comparison i is reset as α/m , where m equals the number of multiple comparisons i within a covariate.¹⁹¹ Hence, the sum of all α_i equals α .¹⁹¹ When appropriate, we used the chi-square test, independent t test, and Fisher's exact test to assess the association between covariates and receiving the aftercare program. Moreover, we computed Pearson's correlation coefficient (r) to evaluate the linear relationship between the PHQ-9 scores at different follow-ups. In addition, we used Cox's proportional hazards model to identify factors associated with the recurrence of suicide-related episodes among the index suicide ideators in multivariate analyses. Finally, logistic regression was used to identify covariates associated with index suicide ideators and family members receiving the aftercare program. All analyses used SAS 9.4 (SAS Institute, Cary, NC), with the significance level (α) set at 0.05.

2.4. Ethics statement

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and the Helsinki Declaration of 1975, as revised in 2008. Furthermore, all procedures involving human subjects were approved by the Institutional Review Board (IRB) of the Chang Gung Medical Foundation (103-3543C) and the Department of Public Health, New Taipei City Government, Taiwan.

2.5. Consent statement

The Chang Gung Medical Foundation IRB waived the requirement for informed consent for the secondary data analysis of anonymized participants.

3. Results

3.1. Profile of suicide ideators

From January 2012 to June 2013, 1787 episodes (out of 1557 individuals) of suicidal ideation were reported to the Suicide

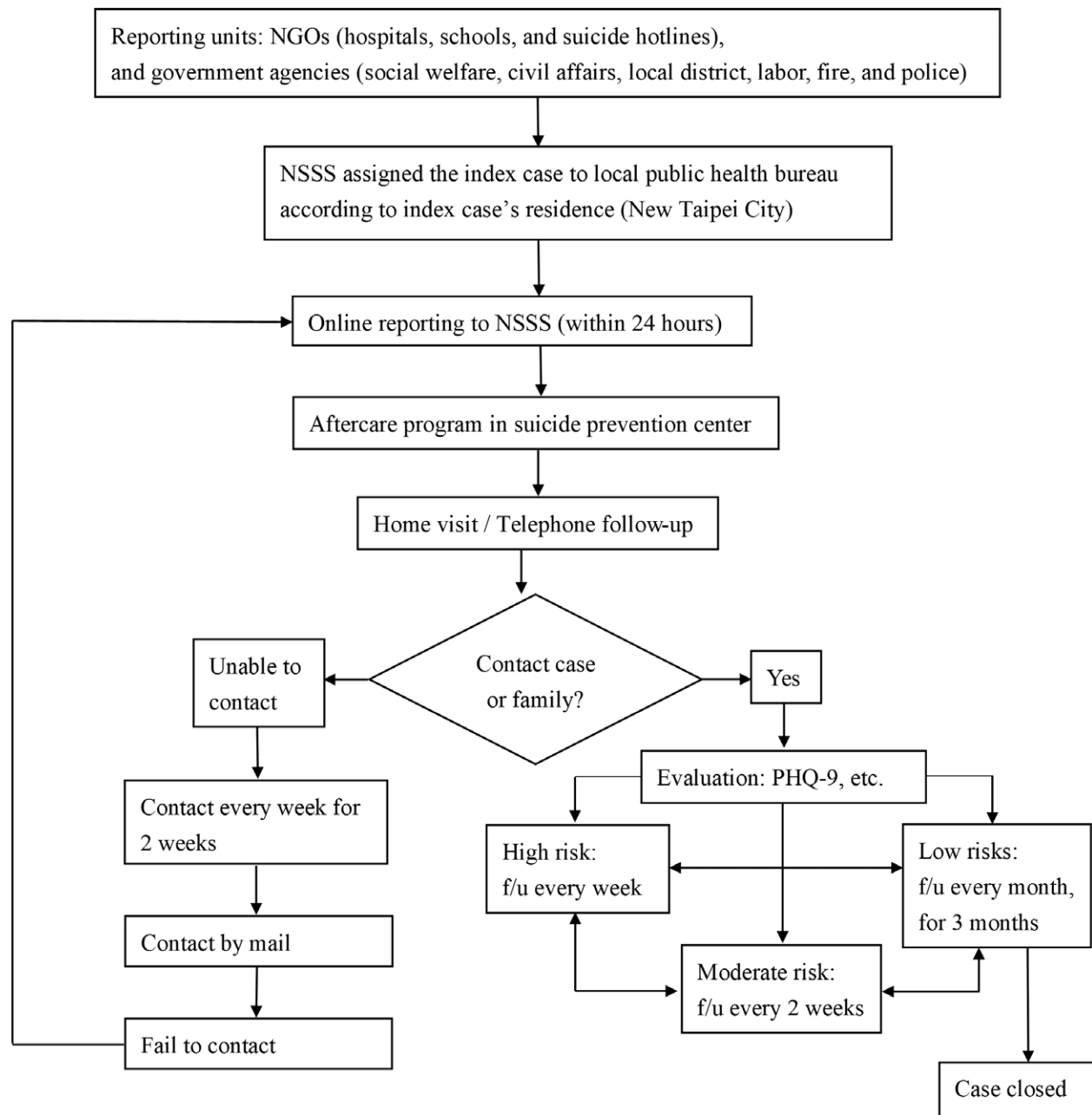


Figure 1. Case reporting and aftercare of the National Suicide Surveillance System (NSSS), Taiwan. NGOs = non-governmental organizations, PHQ-9 = Patient Health Questionnaire-9.

Surveillance System of New Taipei City. There were slightly more suicidal ideation episodes in women (952/1787, 53.3%) than men (835/1787, 46.7%). The adult group (20–64 years old) accounted for 70.7% of the suicidal ideation episodes, followed by the elderly (65+ years old, 8.1%), and the pediatric group (≤ 19 years old, 5.3%). A small proportion of episodes (306/1787, 17.1%) involved self-reported mental disorders. Regarding reporting units, government offices reported the highest number of episodes (820, 45.9%), followed by hospitals (591, 33.1%) and suicide hotlines (97, 5.4%) (Table 1).

Interpersonal relationships were the main reason for suicidal ideation (763, 42.7%), with the second and third being occupation/finance (492, 27.5%) and mental disorder (471, 26.4%), respectively (Table 2). Among the index episodes of suicidal ideation ($n = 1787$), 57.4% ($n = 1025$) and 49.8% ($n = 890$) did not have a PHQ-9 score at the first and last follow-up, respectively. The Pearson's correlation coefficient between PHQ-9

scores at the first and last follow-up was 0.59, and between mean PHQ-9 and PHQ-9 scores at the last follow-up was 0.92. Regarding the depression level at the last follow-up, 484 suicidal ideation episodes (27.1%) were minimal (PHQ-9 = 0–4), 320 (17.9%) were mild (PHQ-9 = 5–9), 79 (4.42%) were moderate (PHQ-9 = 10–14), and 14 (0.78%) were moderately severe or severe (PHQ-9 ≥ 15) (Table 3).

After reporting to the surveillance system, 1165 (65.2%) index cases and 478 (26.8%) family members of index cases received aftercare services. Among those who did not receive aftercare service, 26.7% had missing contact information, 33.3% declined to receive the service, and 40% were unable to reach. Among the index cases, 22.6% ($n = 404$) received aftercare services once, 16.7% ($n = 299$) received twice, 10.9% ($n = 195$) received three times, and 14.9% ($n = 267$) received four or more times. As for the family members, 12.5% ($n = 224$) received aftercare services once, and 14.2% ($n = 254$) received two or more (Table 3).

Table 1

Univariate analysis of the recurrences of suicide-related episodes* among suicide ideators reported during 2012 to June 2013, New Taipei City, Taiwan: by sex, age, presence of mental disorder, and reporting unit.

	Total (n = 1787)	Events (%)	<0.5 yr	0.5 to <1 yr	1–2 yr	P value
Sex						
Male	835	163 (19.5%)	138 (16.5%)	22 (2.6%)	3 (0.4%)	.5419
Female	952	178 (18.7%)	137 (14.4%)	35 (3.7%)	6 (0.6%)	
Age (yr)						<.0001
19 and below ^a	94	6 (6.4%)	4 (4.3%)	2 (2.1%)	0 (0.0%)	a vs b .0026
20–64 ^b	1264	237 (18.8%)	188 (14.9%)	42 (3.3%)	7 (3.0%)	a vs d < .0001
65+ ^c	145	18 (12.4%)	14 (9.7%)	4 (2.8%)	0 (0.0%)	b vs d < .0001
Unknown ^d	284	80 (28.2%)	69 (24.3%)	9 (3.2%)	2 (0.7%)	c vs d < .0001
Self-reported mental disorder						
No	1481	260 (17.6%)	213 (14.4%)	38 (2.6%)	9 (0.6%)	.0006
Yes	306	81 (26.5%)	62 (20.3%)	19 (6.2%)	0 (0.0%)	
Reporting unit						<.0001
School ^a	73	8 (11.0%)	6 (8.2%)	2 (2.7%)	0 (0.0%)	a vs b .0003
Suicide hotline ^b	97	34 (35.1%)	31 (32.0%)	1 (1.0%)	2 (2.1%)	b vs c .0006
Hospital ^c	591	121 (20.5%)	88 (14.9%)	29 (4.9%)	4 (0.7%)	b vs d < .0001
Gov't offices† ^d	820	135 (16.5%)	112 (13.7%)	20 (2.4%)	3 (0.4%)	
Other	206	43 (20.9%)	38 (18.4%)	5 (2.4%)	0 (0.0%)	

*Suicide-related episodes: suicidal ideation (213, 11.9%) and suicide attempt (120, 6.7%), and suicide death (8, 0.5%).

†Department of Social Welfare, Department of Civil Affairs, Local District Office, Bureau of Labour Insurance, Fire department/119/1999, Police.

abcdMultiple comparisons were made for the significant covariates using the simple Bonferroni method to control the overall type I error (α).

Table 2

Univariate analysis of the recurrences of suicide-related episodes* among suicide ideators reported during 2012 to June 2013, New Taipei City, Taiwan: by suicide reason.

	Total (n = 1787)	Events (%)	<0.5 yr	0.5 to <1 yr	1–2 yr	P value
Suicide reason						
Interpersonal relationship						
No	1024	199 (19.5%)	161 (15.8%)	32 (3.1%)	6 (0.6%)	.4632
Yes	763	142 (18.6%)	114 (14.9%)	25 (3.3%)	3 (0.4%)	
Occupation/financial						.0009
No	1295	221 (17.1%)	172 (13.3%)	41 (3.2%)	8 (0.6%)	
Yes	492	120 (24.4%)	103 (20.9%)	16 (3.3%)	1 (0.2%)	
Mental disorder						.7385
No	1316	250 (19.0%)	194 (14.7%)	47 (3.6%)	9 (0.7%)	
Yes	471	91 (19.3%)	81 (17.2%)	10 (2.1%)	0 (0.0%)	
Disease						.4266
No	1573	303 (19.3%)	247 (15.7%)	48 (3.1%)	8 (0.5%)	
Yes	214	38 (17.8%)	28 (13.1%)	9 (4.2%)	1 (0.5%)	
Substance use						.3610
No	1693	320 (19.9%)	260 (15.4%)	53 (3.1%)	7 (0.4%)	
Yes	94	21 (22.3%)	15 (16.0%)	4 (4.3%)	2 (2.1%)	
School						.1452
No	1763	339 (19.2%)	275 (15.6%)	55 (3.1%)	9 (0.5%)	
Yes	24	2 (8.3%)	0 (0.0%)	2 (8.3%)	0 (0.0%)	
Military						.9317
No	1783	340 (19.0%)	275 (15.4%)	56 (3.1%)	9 (0.5%)	
Yes	4	1 (25.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)	
Other						.6419
No	1704	325 (19.0%)	261 (15.3%)	55 (3.2%)	9 (0.5%)	
Yes	83	16 (19.3%)	14 (16.9%)	2 (2.4%)	0 (0.0%)	
Unknown						.1623
No	1406	278 (19.7%)	225 (16.0%)	47 (3.3%)	6 (0.4%)	
Yes	381	63 (16.5%)	50 (13.1%)	10 (2.6%)	3 (0.8%)	

*Suicide-related episodes: suicidal ideation (213, 11.9%) and suicide attempt (120, 6.7%), and suicide death (8, 0.5%).

3.2. Recurrences of suicide-related episodes

There were 341 (19.1%) recurrences of suicide-related episodes. Among these 341 individuals, 62.5% (n = 213) had suicidal ideation, 35.2% (n = 120) had suicide attempts, and 2.3% (n = 8) were dead due to suicide. Generally, the recurrence rate among suicide ideators was the highest within the

first six months after reporting and dropped gradually afterward (Tables 1–3).

Univariate analysis revealed that factors significantly associated with the recurrence of suicide-related episodes included age, self-reported mental disorder, reported by suicide hotline, suicide due to occupation/financial reasons, frequency of receiving aftercare services for both index cases and family members,

Table 3

Univariate analysis of the recurrences of suicide-related episodes* among suicide ideators reported during 2012 to June 2013, New Taipei City, Taiwan: by PHQ-9 scores, frequency of receiving aftercare among index cases and family members.

	Total (n = 1787)	Events (%)	<0.5 yr	0.5 to <1 yr	1–2 yr	P value
PHQ-9 at first follow-up						.0004
Minimal (0–4) ^a	197	26 (13.2%)	20 (10.2%)	5 (2.5%)	1 (0.5%)	a vs c .0007
Mild (5–9) ^b	389	68 (17.5%)	57 (14.7%)	10 (2.6%)	1 (0.3%)	a vs d .0002
Moderate (10–14) ^c	141	41 (29.1%)	29 (20.6%)	10 (7.1%)	2 (1.4%)	b vs d .0020
Severe (≥15) ^d	35	13 (37.1%)	11 (31.4%)	2 (5.7%)	0 (0.0%)	
Unknown ^e	1025	193 (18.8%)	158 (15.4%)	30 (2.9%)	5 (0.5%)	
PHQ-9 at last follow-up						<.0001
Minimal (0–4) ^a	484	41 (8.5%)	24 (5.0%)	14 (2.9%)	3 (0.6%)	a vs b <.0001
Mild (5–9) ^b	320	80 (25.0%)	65 (20.3%)	14 (4.4%)	1 (0.3%)	a vs c <.0001
Moderate (10–14) ^c	79	30 (38.0%)	27 (34.2%)	3 (3.8%)	0 (0.0%)	a vs d <.0001
Severe (≥15) ^d	14	6 (42.9%)	6 (42.9%)	0 (0.0%)	0 (0.0%)	a vs e <.0001
Unknown ^e	890	184 (20.7%)	153 (17.2%)	26 (2.9%)	5 (0.6%)	c vs e .0015
Frequency of receiving aftercare (index case)						<.001
0 ^a	622	132 (21.2%)	115 (18.5%)	15 (2.5%)	1 (0.2%)	a vs e <.0001
1 ^b	404	108 (26.7%)	95 (23.5%)	10 (2.5%)	3 (0.7%)	b vs c .0007
2 ^c	299	50 (16.7%)	38 (12.7%)	10 (3.3%)	2 (0.7%)	b vs d .0005
3 ^d	195	28 (14.3%)	17 (8.7%)	9 (4.6%)	2 (1.0%)	b vs e <.0001
4+ ^e	267	23 (8.6%)	10 (3.7%)	12 (4.5%)	1 (0.4%)	
Frequency of receiving aftercare (family member)						<.0001
0 ^a	1309	282 (21.5%)	229 (17.5%)	45 (3.4%)	8 (0.6%)	a vs c <.0001
1 ^b	224	40 (17.8%)	35 (15.6%)	5 (2.2%)	0 (0.0%)	b vs c .0010
2+ ^c	254	19 (7.5%)	11 (4.3%)	7 (2.8%)	1 (0.4%)	

PHQ-9 = Patient Health Questionnaire-9.

*Suicide-related episodes: suicidal ideation (213, 11.9%) and suicide attempt (120, 6.7%), and suicide death (8, 0.5%).

abcdeMultiple comparisons were made for the significant covariates using the simple Bonferroni method to control the overall type I error (α).

and PHQ-9 scores at the first and last follow-up (Tables 1–3). The PHQ-9 scores at the first and last follow-up were highly correlated ($R = 0.59$). Hence, the PHQ-9 score at the last follow-up was included in the final Cox's model, but not the PHQ-9 score at the first follow-up. We noted that the recurrence of suicide-related episodes among the index cases received only once was higher than among those who did not receive any aftercare service, but the difference was not statistically significant. However, as the index cases received aftercare services twice or more, the recurrence of suicide-related episodes became significantly lower compared with those who did not receive any aftercare services. Among the family members of suicide ideators, the recurrences were highest in those whose family members did not receive aftercare. The family members who received aftercare services twice or more had the lowest recurrences of suicidality in the index cases than those who received aftercare once (Tables 1–3, Fig. 2).

In the Cox proportional hazards model, the recurrences decreased as the aftercare frequency increased among the index cases and family members. The adjusted hazard ratios (aHRs) of the index cases who received aftercare twice, three times, and four times or more were 0.64 (95% CI: 0.43–0.96), 0.57 (0.35–0.94), and 0.34 (0.20–0.57), respectively. The family members who received aftercare twice or more had reduced recurrence of suicidality in the index cases (the aHR of 0.32, 95% CI: 0.20–0.52). As for self-reported mental disorders and reporting from the suicide hotline, the aHRs were 1.61 (1.23–2.11) and 2.33 (1.58–3.42), respectively. In the PHQ-9 results at the last follow-up, the recurrences increased as depression became more severe since the aHRs of categories mild, moderate, moderately severe, and severe were 2.92 (2.00–4.28), 4.37 (2.72–7.04), and 7.81 (3.25–18.76), respectively (Table 4).

Apart from reducing the overall recurrences of suicide-related episodes by event type, it is unknown whether aftercare services reduce both the recurrences of suicidal ideation and suicide actions (i.e., suicide attempts and suicide deaths). When looking at the recurrence of suicidal ideation, the sample size became 1659 after excluding those with the recurrence of suicide actions (including suicide attempts and suicide deaths). The results of

the univariate analysis and multivariate analysis (Supplemental Table S1, <http://links.lww.com/MD/H652>) were similar to the main results. The aHRs of the index cases who received aftercare twice, three times, and four times or more were 0.51 (95% CI: 0.30–0.88), 0.58 (95% CI: 0.32–1.05), and 0.25 (95% CI: 0.13–0.50), respectively. The aHRs of the family members receiving aftercare once and twice or more were 0.49 (95% CI: 0.29–0.83) and 0.37 (95% CI: 0.21–0.65), respectively (Supplemental Figure S1, <http://links.lww.com/MD/H654>).

When looking at the recurrence of suicide actions (including suicide attempts and suicide deaths), the sample size became 1574 after excluding those with the recurrence of suicidal ideation. The results of the univariate and multivariate analysis (Supplemental Table S2, <http://links.lww.com/MD/H653>) were similar to the main results, except for the association with the frequency of the index cases receiving aftercare. The recurrence of suicide actions among the index cases who received aftercare once was significantly higher than those not receiving the aftercare service. The index cases receiving aftercare service three times and four times or more had a borderline reduced risk of the recurrence of suicide action than those not receiving the aftercare service (aHRs: 0.42 [95% CI: 0.16–1.08], 0.47 [95% CI: 0.22–1.04]), respectively. The aHRs of the family members receiving aftercare twice or more was 0.21 (95% CI: 0.08–0.51) (Supplemental Figure S2, <http://links.lww.com/MD/H655>).

3.3. Associations with receiving aftercare service

We explored the factors associated with receiving aftercare services among the index cases and their family members. In the univariate analysis of the index cases, the factors significantly associated with receiving aftercare services were sex, age, self-reported mental disorder, suicide due to mental disorder/substance use, occupation/finance, unknown reasons, and reporting unit. In the univariate analysis of their family members, the factors significantly associated with receiving aftercare services were age, suicide due to occupation/finance and school, and reporting unit (Table 5).

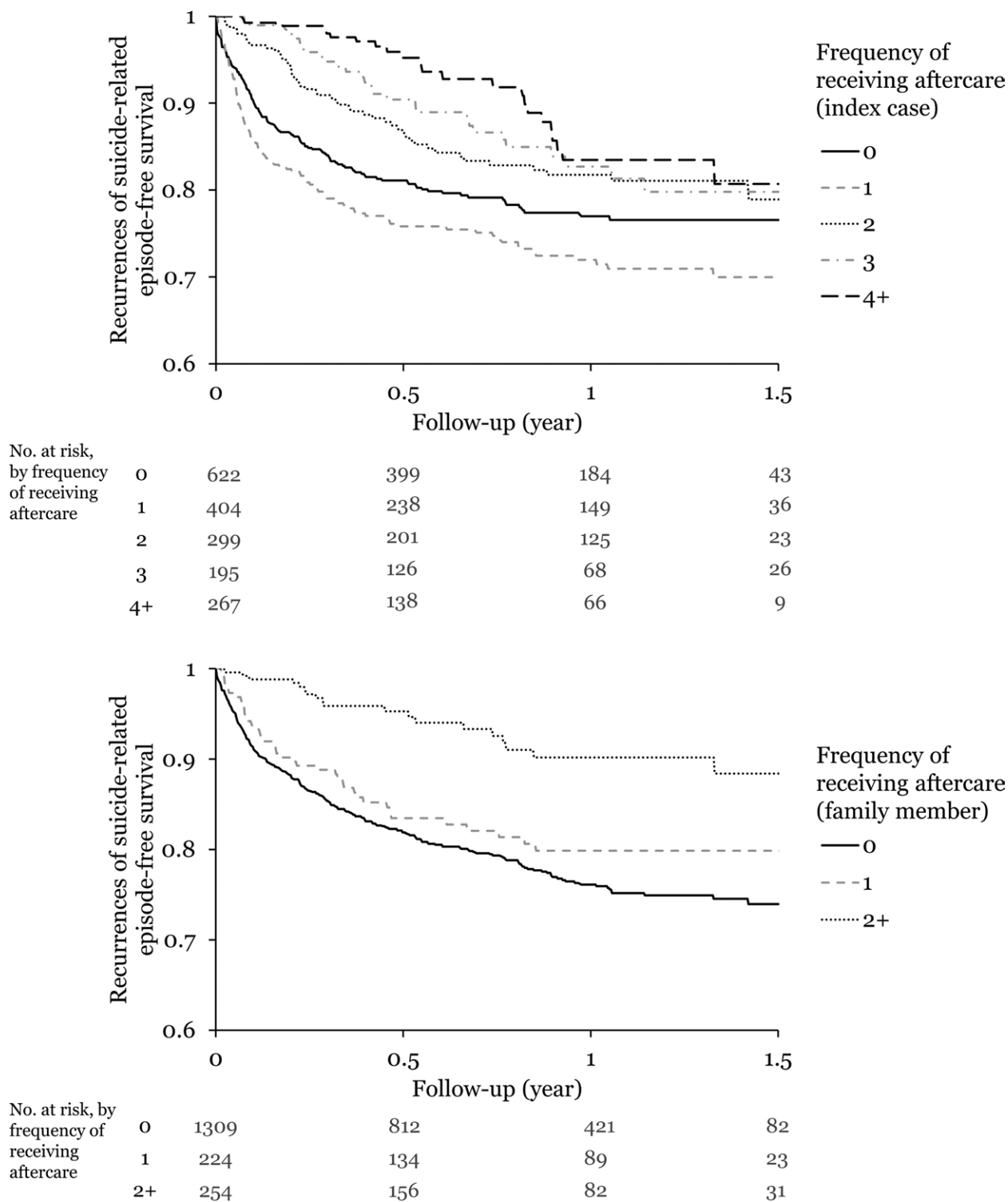


Figure 2. Recurrence-free rates of suicide-related episode* among suicide ideators reported during 2012 to June 2013, New Taipei City, Taiwan, by frequency of receiving aftercare service among index cases and family members. *Suicide-related episodes include suicidal ideation, suicide attempt, and suicide death.

In the multivariate analysis, for index suicide ideators, factors that were significantly related to receiving aftercare services were being a woman (AOR: 1.38, 95% CI: 1.13–1.67), suicide due to occupation/finance (1.52, 1.21–1.91), and reporting from suicide hotlines (2.23, 1.43–3.49). As for family members, significant associations included those aged < 19 years (3.14, 1.85–5.37), suicide due to occupation/finance (0.45, 0.30–0.67), school (3.35, 1.80–6.25), and reporting from school (3.35, 1.80–6.25) and hospital (1.49, 1.09–2.04) (Table 5).

4. Discussion

4.1. Main findings

To the best of our knowledge, this is the first study to demonstrate the effectiveness of an aftercare program for suicidal ideators using real-world evidence based on a large population-based sample (1787 suicidal ideation episodes from 1557 suicide ideators). Our main findings were that either suicide ideators or family members who received aftercare twice or

Table 4
Multivariate analysis of the recurrences of suicide-related episodes† among suicide ideators reported during 2012 to June 2013, New Taipei City, Taiwan.

	Total (n = 1787)	Adjusted HR	95% CI
PHQ-9 at last follow-up			
Minimal (0–4)	484	1.00	Reference
Mild (5–9)	320	2.92*	2.00–4.28
Moderate (10–14)	79	4.37*	2.72–7.04
Moderately severe and severe (≥15)	14	7.81*	3.25–18.76
Unknown	890	2.29*	1.52–3.45
Age (yr)			
19 and below	94	0.49	0.20–1.16
20–64	1264	1.00	Reference
65+	145	0.71	0.44–1.16
Unknown	284	1.77*	1.36–2.32
Frequency of receiving aftercare (index case)			
0	622	1.00	Reference
1	404	1.36	0.97–1.90
2	299	0.64*	0.43–0.96
3	195	0.57*	0.35–0.94
4+	267	0.34*	0.20–0.57
Frequency of receiving aftercare (family member)			
0	1309	1.00	Reference
1	224	0.77	0.55–1.08
2+	254	0.32*	0.20–0.52
Self-reported mental disorder			
No	1481	1.00	Reference
Yes	306	1.61*	1.23–2.11
Reporting unit			
School	73	0.96	0.45–2.05
Suicide hotline	97	2.33*	1.58–3.42
Hospital	591	1.11	0.85–1.44
Gov't offices‡	820	1.00	Reference
Other	206	1.29	0.91–1.83

We calculated adjusted HR and 95% CI from Cox proportional hazard model.

Adjusted HR = adjusted hazard ratio, 95% CI = 95% confidence interval, PHQ-9 = Patient Health Questionnaire-9.

†Suicide-related episodes: ideation (213, 11.9%) and suicide attempt (120, 6.7%), and suicide death (8, 0.5%).

‡Department of Social Welfare, Department of Civil Affairs, Local District Office, Bureau of Labour Insurance, Fire department/119/1999, Police.

* $P < .05$.

more significantly reduced the recurrence of index cases' suicide-related episodes (including ideation, attempt, and death). Furthermore, the recurrences were related to self-reported mental disorders, mild to severe levels of depression, and reporting from the suicide hotline. Additionally, we found that receiving aftercare among the index cases was associated with being a woman, suicide due to occupation/finance, and reporting from suicide hotlines. Receiving aftercare among family members was related to index cases aged ≤ 19 years, suicide due to school problems, and reporting from schools and hospitals.

4.2. Factors associated with recurrences of suicide-related episodes

The presence of self-reported mental disorder, mild to severe depression, and reporting from the suicide hotline were all statistically significantly associated with subsequent suicide-related episodes among suicide ideators (Table 4). This finding suggests that depression levels at the last follow-up and other mental disorders are related to suicidal ideation and behaviors, consistent with the current literature.^[10,11] Regarding the positive association between reporting from a suicide hotline and recurrence, participants who reported from the suicide hotline might have been more willing to seek help in times of distress and, therefore, more likely to be

identified as having recurring suicide-related episodes. Conversely, their episodes might have been severe enough to warrant attention. Therefore, they were more likely to be reported from the suicide hotline and have recurrences of suicide-related episodes.

4.3. Effectiveness of aftercare for suicide ideators

Interestingly, patients who received aftercare once were more likely to have recurrences of suicide-related episodes than those who did not. A systematic review and meta-analysis also revealed that the risk of recurrences of suicide-related episodes was the highest among suicidal patients newly discharged from mental healthcare facilities during the initial weeks.^[12] Therefore, more effort is needed to identify and encourage suicide ideators who receive aftercare once to have long-term access to aftercare services, as highlighted by our findings in Figure 2.

Our data showed that the rates of subsequent suicide-related episodes decreased significantly as the index suicide ideators or family members received more aftercare services (i.e., contact frequency > 2) (Table 4, Fig. 2). We found that single aftercare follow-up contact was insufficient to reduce subsequent suicide-related episodes. In multiple follow-up contacts, we hypothesized that the aftercare manager assessed suicidal thoughts regularly and encouraged adherence to psychiatric treatment. We speculated that regular follow-ups also allowed the early detection of repetition of suicidal ideation and suicide attempts to implement timely interventions to avoid suicide deaths. It might also be possible that follow-ups reduced loneliness or made some suicide ideators feel guilty about committing suicide because it would cause moral injury to the person following up. Nevertheless, we were unsure whether the same aftercare manager was responsible for the follow-up. Notably, among individuals at suicide risk, brief suicide interventions in acute care settings were associated with reduced subsequent suicide attempts and an increased likelihood of attending at least one follow-up care session.^[13] Moreover, our findings were similar to those based on suicide attempters, demonstrating that aftercare programs for suicide attempters decreased subsequent suicide rates.^[7,14,15] Therefore, based on our data, we believe effective suicide prevention interventions should facilitate the attendance of subsequent follow-up care among suicide ideators and their family members.

When looking at the recurrences of suicidal ideation and suicide action separately, we noted that aftercare generally reduced suicidal ideation recurrences but the reduction was not noticeable in suicide action recurrences (including suicide attempts and deaths) (Supplemental Tables S1–S2, <http://links.lww.com/MD/H652>; <http://links.lww.com/MD/H653> and Supplemental Figures S1–S2, <http://links.lww.com/MD/H654>; <http://links.lww.com/MD/H655>). Among those with recurrences of suicide-related episodes, two-thirds were suicidal ideation ($n = 213$), and one-third were suicidal action ($n = 128$). It is reasonable to observe similar univariate and multivariate results between the overall recurrences of suicide-related episodes and the recurrence of suicidal ideation, and the borderline effect of the index cases receiving aftercare service three and four times on reducing the recurrence of suicide action.

Interestingly, receiving aftercare once increased the risk of suicide action recurrence among index cases. This finding supports the notion that suicidal patients recently discharged from mental health facilities generally have an enduring elevated risk of recurrences of suicide actions.^[12] We also speculated that suicide ideators who later experienced recurrences of suicide actions tended to have higher depression severity. Therefore, these suicide ideators might be more refractory to subsequent aftercare treatment. This might also explain our finding that adjusted HRs of suicidal ideation and suicide action recurrences increased with increasing PHQ-9 scores.

Our findings reflect the effectiveness of aftercare services for suicide ideators in real life. Our study has several advantages over RCTs of suicide prevention interventions based on

Table 5**Univariate and multivariate analysis for factors associated with receiving aftercare service among suicide ideators reported during 2012 to June 2013, New Taipei City, Taiwan,**

	Total (n = 1787)	Univariate analysis				Multivariate analysis					
		Index cases receiving aftercare		Family members receiving aftercare		Index cases receiving aftercare			Family members receiving aftercare		
		n = 761 (42.6%)	P value	n = 254 (14.2%)	P value	Adjusted OR	95% CI	P value	Adjusted OR	95% CI	P value
Sex											
Male	835	332 (39.8%)	.0237†	127 (15.2%)	.2589†	Reference					
Female	952	429 (45.1%)		127 (13.3%)		1.38	1.13–1.67	.0013*			
Age (yr)											
19 and below	94	26 (27.7%)	0.0245†	46 (48.9%)	<.0001†				3.14	1.83–5.37	<.0001*
20–64	1264	554 (43.8%)		160 (12.7%)					Reference		
65+	145	61 (42.1%)		26 (17.9%)					1.34	0.84–2.13	.2162
Unknown	284	120 (42.3%)		22 (7.8%)					0.58	0.36–0.93	.0228*
Mean ± SD	44.0 ± 15.7	45.7 ± 14.8	.0002‡	40.0 ± 18.6	.0003‡						
Self-reported mental disorder											
No	1481	611 (41.3%)	.0124†	203 (13.7%)	.1771†						
Yes	306	150 (49.0%)		51 (16.7%)							
Suicide reasons (multiple choice)											
Interpersonal relationship	763	336 (44.0%)	.2841†	109 (14.3%)	.9401†						
Occupation/finance	492	261 (53.1%)	<.0001†	33 (6.7%)	<.0001†	1.52	1.21–1.91	.0004*	0.45	0.30–0.67	<.0001*
Mental disorder	471	224 (47.6%)	.0110†	84 (17.8%)	.0087†						
Disease	214	97 (45.3%)	.3873†	38 (17.8%)	.1136†						
Substance use	94	43 (45.7%)	.5245†	7 (7.5%)	.0536†						
School	24	9 (37.5%)	.6120†	15 (62.5%)	<.0001§				3.04	1.07–8.62	.0362*
Military	4	2 (50.0%)	1.0000§	0 (0%)	1.0000§						
Other	83	35 (42.2%)	.9373†	7 (8.4%)	.1225†						
Unknown	381	117 (30.7%)	<.0001†	53 (13.9%)	.8486†	0.63	0.48–0.82	.0006*			
Reporting unit											
School	73	24 (32.9%)	<.0001†	36 (49.3%)	<.0001†	0.72	0.43–1.20	.2081	3.35	1.80–6.25	.0001*
Suicide hotline	97	61 (62.9%)		9 (9.3%)		2.23	1.43–3.49	.0004*	1.07	0.51–2.24	.8636
Hospital	591	252 (42.6%)		97 (16.4%)		1.09	0.87–1.37	.4372	1.49	1.09–2.04	.0125*
Gov't offices¶	820	320 (39.0%)		93 (11.3%)		Reference			Reference		
Other	206	104 (50.5%)		19 (9.2%)		1.33	0.97–1.82	.0791	0.94	0.55–1.59	.8025

Adjusted OR = adjusted odds ratio, CI = confidence interval.

†Chi-square test.

‡Independent *t* test.

§Fisher's exact test.

¶Department of Social Welfare, Department of Civil Affairs, Local district office, Bureau of Labour Insurance, Fire department/119/1999, Police.

**P* < .05.

real-world evidence. In real-world practice, suicide ideators decide whether they would continue to receive aftercare. This characteristic of real-world studies allowed us to overcome the two main obstacles common in RCTs. First, the difficulty in identifying subjects with a high risk of suicidal ideation and suicidal behaviors in clinical trials; second, the potential bias due to loss of follow-up, as those who withdrew from RCTs might be more likely to die by suicide than those who remain in the trials.

4.4. Factors associated with receiving aftercare service

The index cases who participated in the aftercare program were more likely to be women, have suicide-related episodes because of occupation/finance, and be reported by the suicide hotline (Table 5). This was probably because women were more likely to express suicidal thoughts than men.^[16] Suicide-related episodes reported by the suicide hotline were more likely from those willing to seek help actively and, therefore, were more likely to receive medical referrals and treatment.^[17] Moreover, problems related to occupation/finance were less likely to be stigmatized and more likely to be perceived as solvable problems (such as obtaining new jobs and changing the workplace) than suicide-related episodes due to mental disorder/substance use. Consequently, we speculate that these patients tended to have better social support systems. Therefore, they were more likely to receive aftercare follow-ups.^[18]

Among the family members of index cases who received aftercare services, index cases were likely to be ≤19 years old, due to problems in school, and were reported by hospitals and schools (Table 5). These findings suggest that adolescent index cases were likely to have family members receiving aftercare services and that suicide-related episodes were associated with school problems instead of occupation/finance. Furthermore, since most patients aged ≤19 years were enrolled in schools, hospitals and schools tended to report most suicidal incidents among adolescents who participated in aftercare programs. Thus, collectively, these findings highlight that family support is instrumental in receiving aftercare services among adolescents, demonstrating the essential roles of family support systems as a protective factor against suicide^[18] and facilitating aftercare engagement.

4.5. Limitations

Our study had several limitations. First, we could not sub-analyze subjects with active suicidal ideation (i.e., current painful thoughts of ending one's life) and passive suicidal ideation (i.e., desire to take one's life or better off dead).^[11] Hence, we could not estimate the proportion of passive suicide ideators included in our study who had a lower risk of suicide attempts than those with active ideation,^[11] leading to bias. Second, the data were obtained from 2012 to June 2013, which were not up-to-date and had a relatively

short follow-up period (1.5 years). Third, we could not identify the underlying psychiatric disorders, ways of self-harm, family history of suicide (e.g., biological and genetic factors), environmental factors (e.g., access to lethal means, social stressors, and early life adversity), and suicide intent among the participants. These factors have all been shown to lead to different suicide mortalities and suicidal behaviors,^[11,19-22] resulting in potential interactions and biases. Fourth, the suicide ideators included in this study presented suicidal thoughts when they sought help from the NSSS, regardless of whether they had a history of suicide attempts. Therefore, we could not ascertain the impact of a history of suicide attempts on the risk of recurrence of suicide-related episodes among index cases. Fifth, the individuals with suicidal ideation who reported to the NSSS in New Taipei City may not be citizens of New Taipei City. The outcomes of recurrences of suicide-related episodes (i.e., ideation, attempts, and deaths) were retrieved from the NSSS in New Taipei City and the national mortality database. Hence, we might have missed those who had suicidal ideation and suicide attempts not in New Taipei City. Due to the aftercare program's follow-up nature, we believe this bias should be minimal. Moreover, we did not know the percentages of the recurrences of suicide attempts and actual suicides in our data during the study period. It is interesting to compare the effect of aftercare service on those who had suicide ideation and suicide action in future studies. Sixth, our data were limited to New Taipei City in Taiwan, where the population is predominantly Taiwanese, implying that the results of aftercare effectiveness among suicide ideators may not apply to other countries with different cultures in suicide-related behaviors.^[14,19,22] Readers need to be cautious when extrapolating our results to other countries. Finally, since there was 26.7% missing contact information among those who did not receive aftercare service, we suggest that the contact information of either the index case or the family member should be double-checked to increase the rate of receiving aftercare service.

In conclusion, this study highlights that providing adequate and timely aftercare services for suicide ideators is an effective suicide prevention intervention. Suicide ideators and their family members who received more than two follow-ups of aftercare services were less likely to have subsequent suicidal ideation, attempts, and deaths. Additionally, receiving aftercare services among index suicide ideators was associated with being a woman, suicide due to occupation/finance, and reporting from suicide hotlines. Family members who received aftercare services were related to index cases aged ≤ 19 years, suicide due to school problems, and reporting from hospitals and schools. Therefore, future research to target suicide ideators may focus on these factors to facilitate the implementation of suicide prevention interventions.

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Author contributions

WHSS interpreted the data, wrote the manuscript, revised the manuscript and contributed to data visualization. YYJ and BHW interpreted the data and revised the manuscript. TMH and SRL provided the dataset, and designed the study. CCC, HTT, and WMC performed the data analysis. LCS conceptualized, designed the study, and critically revised the manuscript for important intellectual content.

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