



The Applicability of Linehan Risk Assessment Scale: a Cross-Sectional Study from Alexandria Poison Centre, Egypt, During the COVID-19 Pandemic

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Abstract

Background/Objective Suicide is a critical health problem that is significantly rising during the COVID-19 pandemic worldwide, yet it is still under-reported in Egypt. To date, a deficiency of a reliable scale to probe the risk factors underlying suicide liability among patients with deliberate self-poisoning. The study's objective was to offer a snapshot of the pattern of self-poisoning in Egypt during the COVID-19 pandemic.

Methods Using the Linehan Risk Assessment and Management Protocol LRAMP, a psychological assessment was applied to evaluate vulnerable patients needing urgent psychiatric support and emphasize the influence of previous suicidal behaviors. A cross-sectional study was conducted on all patients admitted to Alexandria Poison Centre with deliberate self-poisoning biosocial and poisoning data that were recorded in a specially designed sheet. All patients were interviewed for underlying risk factors and protective factors for suicidal behavior.

Results Significant relation was recorded between previous suicidal attempts and psychiatric diseases. CNS depressant drugs and rodenticides recorded the highest frequency. The calculated score (suicide and protective factors) was higher in patients with previous suicidal attempts.

Conclusion The study was the first to test the applicability of Linehan scale in Alexandria Poison Centre. The results are promising; however, multicenter replication of the concluded findings will be valuable.

Keywords COVID-19 · Deliberate self-poisoning · Egypt · LRAMP · Risk factors · Suicide

Key Points

1. People who have a history of suicidal behavior are at a greater risk of attempting suicide in the future.
2. The LRAMP scale appears to be a useful tool for the identification of vulnerable patients, and it is independent of previous psychiatric opinions regarding the specific case.
3. The application of the structured questionnaire, which includes both risk and protective factors, does not necessitate a high level of qualification or psychiatric expertise.
4. Educational training can improve the ability of multidisciplinary care providers to identify and manage the risk of suicide outside conventional mental health services.

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Introduction

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) has introduced suicide attempt as a self-initiated sequence of behaviors by a person who, at the time of commencement, anticipated the series of events that would lead to his or her own death [1].

Suicide is a global health issue that is expected to account for more than 700,000 fatalities/year (WHO 2019), and it is the second leading cause of premature deaths among teenagers and young adults [2].

The terms “parasuicide” or “attempted suicide” refer to gestures of self-harm without clear intent of self-harm. Deliberate self-poisoning (DSP) is defined by the WHO as the non-fatal purposeful act of ingesting substances that were not intended for human consumption or of more than a prescribed or accepted therapeutic dose [3].

DSP is used as a means of gaining attention, expressing one's feelings, or retaliating against someone. Both parasuicides and DSP require the same level of attention as suicide attempts [4].

Suicide risk factors are a dynamic combination of psychological, environmental, social, genetic, and neurobiological factors. One of the strongest indicators of suicide death is a prior suicide attempt [5].

Protective variables are suggested to reduce the likelihood of suicidal behavior while boosting individual's ability to cope with stress and life difficulties. Internal protective factors include future hope, confidence, life satisfaction, and fear of death. Healthy interpersonal relationships, social support, and a comfortable work environment are considered as external protective factors [6].

Therefore, the ability to assess concurrently risk and protective factors is bound to improve the clinical ability to identify and properly respond to suicide threats.

The actual number of suicide deaths is underestimated globally because non-fatal suicidal behaviors are not always acknowledged due to religious and social considerations, perceived stigmatization, and cultural taboos in many Arabic societies. Consequently, the decedents may attempt to conceal their suicide plans to protect their families emotionally or financially [7].

The absence of a national suicide register and lack of data on suicide in Egypt add a barrier for tracking vulnerable individuals [8].

A significant number of patients with suicidal attempts admitted to the poison center are underestimated regarding the actual suicide risk due to denial or fear of stigmatization in the community. Despite the fact that patients are discharged, the underlying problem remains neglected, and no actual solution is taken to prevent the imminent risk of suicidal attempts in the future. Thus, it is essential to investigate a reliable, easily applicable, and alerting tool to assess these patients and identify the high-risk group.

The lockdown during the COVID-19 pandemic posed additional risks to these vulnerable populations. Being forced out of their comfort zones due to time spent confined at home, while grappled with fear of contagion, insecurity, stress, depression, overuse of social media, and economic crises, has been associated with escalation of suicidality. In addition, during that period, susceptible patients had to overcome additional challenges, such as limited access to mental health services, abuse of medications, or even unprescribed treatment [9].

Back in 2012, Linehan Risk Assessment and Management Protocol (LRAMP) was formulated to better assess and manage suicidal behaviors in clinical settings [10].

The protocol consists of four main sections: the *first* section specifies the reason of completion and the specific incident/behavior that occurred; the *second* section includes

a check list for acute risk factors of suicide, the nature of population affected, and the existence of proposed protective factors; the *third* and *fourth* sections involve the management and subsequent clinical decision-making processes. Therefore, this standardized protocol comprises an organized documentation for assessment and follow-up of individuals with suicidal tendencies [10].

Linehan and his colleagues discovered that persons who had previously expressed suicidal intentions were pessimistic about their current situation compared to those who had never engaged in suicidal behavior [11].

The purpose of this study was to investigate the pattern of poisoning during the COVID-19 pandemic upon suicidal admission to the Alexandria Poison Centre (APC). *Secondly*, we aimed to undertake a psychological assessment of the studied patients using LRAMP to evaluate its applicability in detecting risk of suicide. The authors proposed that this scale may guide the toxicologist to identify patients susceptible to suicidal risk and could thus advise these individuals to seek psychiatric therapy. *Finally*, this study intended to evaluate whether a previous history of suicidal attempts could have an impact on both the suicide risk and protective factors.

Subjects

A cross-sectional study was conducted on all patients admitted to APC of the Alexandria Main University Hospital, Egypt, with a history of attempted suicide between the 1st of January 2020 and the 30th of June 2020.

APC is the first specialized toxicological unit in Egypt, established in June 1979, which provides toxicology services to a considerable percentage of intoxicated patients in Egypt, serving approximately 8000 patients/year. APC covers a significantly large area of Alexandria and nearby governorates.

Psychotic patients cognitively unfit patients having difficulty in comprehending the scale, or clinically unstable cases were excluded from this study.

Methods

Measures

This study was approved by the Ethics Committee of the Faculty of Medicine, Alexandria University (Approval serial number: 0304539).

Informed consent was obtained before participation and confidentiality was ensured.

All patients were interviewed, and data, including patients' detailed history (biosocial data, past medical history of psychiatric illness, and previous suicidal attempts),

were recorded in a specially designed sheet. Data related to poisoning, length of hospitalization, and clinical outcome were also documented. All patients were clinically examined.

Causative toxic agents were identified by the toxicologist based on the patients' history and clinical presentation or by patients' bringing their medicine/toxic product and revising its label.

Psychological Assessment

Our aim was to help the toxicologist and the emergency physician to diagnose susceptible patients, to make the job more applicable, rapid to implement, feasible, and easy for any general practitioner. Therefore, section two of the scale (suicide risk assessment) was applied. It included a checklist of 15 acute suicide risk factors (current suicide intent, current suicide plan, preferred method currently or easily available, etc.) and a checklist of 11 suicide protective factors (hope for the future, confidence in ability to solve or cope with problems, attachment to life, etc.) [10].

Participants

The interviewer (researcher 4) was trained under the supervision of an experienced assessor skilled in working with suicidal cases (researcher 3). The researcher role-played the test battery with the trainer, who pretended to be suicidal clients at different levels of risk.

The psychological assessment was performed by the same interviewer (researcher 4) upon admission, in a single session. In case of patient fatigue or upon request, short breaks were allowed. The interview lasted approximately 10 to 15 min.

Interpretation

Due to the subjectivity of the instrument, and to simplify the interpretation of the studied items, the section of the scale specific for acute suicide risk factors included 15 questions. Answers were yes, if the patient affirmed the presence of this risk, "no" in case of denial, and "somewhat" if the patient gave no answer or was in doubt and hesitant. The answers were coded as "No" (1 mark), "Somewhat" (2 marks), and "Yes" (3 marks). The risk of suicide was proportional to the overall value obtained from these answers. The greater the number, the greater the risk.

In contrast, coding was reversed for the suicide protective factors: the absence of any protective factor was given a value of 3, "somewhat" was 2, and "yes" was 1. Then, the values from all answers were summed together, and the value was inversely proportional with the presence of

protection, i.e., the greater the value, the less the protection offered against suicide.

Statistical Analysis

Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). The significance level of p value was set at 0.05. Chi-squared test and Fisher's exact (Monte Carlo correction) were applied to assess data between different groups.

Statistical analysis was performed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp).

Results

The study was conducted on 201 patients with age ranging between 10 and 60 years old. 33.9% of the patients were below 20 years old, 41.3% aged from 20 to 30 years old, and 9.5% were above 40 years old. Females represented 73.6% of cases. Patients from urban regions represented 64.2% of admitted cases. History of comorbid organic diseases, such as diabetes, hypertension, cardiac diseases, and hyperthyroidism, was encountered in 18.9% of cases. 27.4% of patients were on medical therapy, such as antidepressant drugs, antipsychotics, mood stabilizers, and antiepileptics. Approximately 15% of all studied cases confirmed a history of previous suicidal attempts (Table 1). A statistically significant relationship was noted between previous suicidal attempts and medications intake, where $X^2 = 21.2$, $p < 0.001$. Moreover, a significant relationship was noted between previous suicidal attempts and the history of psychiatric diseases, where $X^2 = 43.4$, and $p < 0.001$ (Table 2).

Ingestion of single and multiple substances was also noted. CNS depressants and rodenticides represented the highest percentage (26.4% and 24.9% respectively) in all age groups and both genders. Regarding patients from urban regions, CNS depressants, analgesics, and other drugs, such as diuretics, antidiarrheals, and laxatives, were most frequently used when attempting suicide (31%, 21.7%, and 20.9%, respectively). In contrast, patients from rural areas frequently used rodenticides and pesticides (37.5% and 27.8%, respectively). Table 3 demonstrates a list of the encountered poisons and presenting symptoms of toxicity.

LRAMP protocol

About three-quarters of the admitted cases (74.6%) stated recent stressful life events. A significant number of cases

Table 1 Characteristics of the studied patients

		Males (<i>n</i> = 53)	Females (<i>n</i> = 148)	Total (<i>n</i> = 201)	<i>p</i> value
Age (years)					
< 20	No (%)	14 (26.4)	54 (36.5)	68 (33.9)	0.173
20–30		25 (47.2)	58 (39.2)	83 (41.3)	($\chi^2 = 4.981$)
30–40		6 (11.3)	25 (16.9)	31 (15.4)	
≥ 40		8 (15.1)	11 (7.4)	19 (9.5)	
	Mean (SD)	26.91 ± 11.07	23.98 ± 8.42	24.75 ± 9.25	0.085 (<i>U</i> = 3296.50)
	Median (IQR)	23.0 (19.0–30.0)	21.0 (18.0–29.0)	22.0 (18.0–29.0)	
Marital status					
Single	<i>N</i> (%)	37 (69.8)	75 (50.7)	112 (55.7)	MCp = 0.229
Married		11 (20.8)	48 (32.4)	59 (29.4)	($\chi^2 = 5.415$)
Divorced		3 (5.7)	12 (8.1)	15 (7.5)	
Widow		0	2 (1.4)	2 (1)	
Engaged		2 (3.8)	11 (7.4)	13 (6.5)	
Occupation					
Employee	<i>N</i> (%)	33 (62.3)	10 (6.8)	43 (21.4)	< 0.001*
Unemployed		5 (9.4)	92 (62.2)	97 (48.3)	($\chi^2 = 78.787^*$)
Student		15 (28.3)	46 (31.1)	61 (30.3)	
Psychiatric diseases					
No	<i>N</i> (%)	47 (88.7)	126 (85.1)	173 (86.1)	0.523
Yes		6 (11.3)	22 (14.9)	28 (13.9)	($\chi^2 = 0.409$)
Major depression		4 (7.5)	19 (12.8)	23 (11.4)	
Personality disorders		0	5 (3.4)	5 (2.5)	
OCD		2 (3.8)	0	2 (1)	
Insomnia		1 (1.9)	0	1 (0.5)	
Anxiety		1 (1.9)	2 (1.4)	3 (1.5)	
Schizophrenia		0	1 (0.7)	1 (0.5)	
Bipolar		0	1 (0.7)	1 (0.5)	
Previous suicidal attempts					
No	<i>N</i> (%)	48 (90.6)	122 (82.4)	170 (84.6)	0.159
Yes		5 (9.4)	26 (17.6)	31 (15.4)	($\chi^2 = 1.979$)

χ^2 , Chi-squared test; *U*, Mann–Whitney test; *SD*, standard deviation

p, *p* value for comparing between male and female

IQR, interquartile range; *statistically significant at $p \leq 0.05$

Table 2 Distribution of patients admitted to APC with deliberate self-poisoning (*n* = 201) according to previous suicidal attempts with psychiatric diseases and medications

	Previous suicidal attempts (<i>n</i> = 31)	No previous suicidal attempts (<i>n</i> = 170)	χ^2	<i>p</i> value
Psychiatric diseases				
No	15 (48.4%)	158 (92.9%)	43.4	$p < 0.001^*$
Yes	16 (51.6%)	12 (7.1%)		
Medications				
No	12 (38.7%)	134 (78.8%)	21.2	$p < 0.001^*$
Yes	19 (61.3%)	36 (21.2%)		

χ^2 , Chi-squared test; *statistically significant at $p \leq 0.05$

attempting suicide had access to lethal means and suffered from severe hopelessness or pessimism (45.8% and 48.3%, respectively) (Table 4).

The greatest percentage of patients with previous suicidal attempts have access to lethal means and current severe hopelessness or pessimism (74.2% each), followed by 54.8% of cases who had diminished concentration and impaired decision-making ability, and 51.6% of the cases had perceived burdensomeness. In contrast, 90.3% of the patients with previous suicidal attempts had not been recently discharged from a psychiatric hospital.

The relationship between the acute risk factors of suicide in studied patients according to the presence or absence of previous suicidal behavior was also studied (Table 5).

Regarding the suicidal protective factors, the highest percentage of cases who attempted suicide (86.1%) were not attached to a therapist, counselor, or another service provider, followed by 77.1% of admitted cases that had

Table 3 Distribution of the patients by poison type and presenting complaints

Type of poison	No	%
CNS depressants	53	26.4
Antipsychotic	20	10.0
Anticonvulsant	21	10.4
Hypnotic	5	2.5
Antidepressant	15	7.5
Benzodiazepines	5	2.5
Antiparkinsonian	3	1.5
Tramadol	1	0.5
CVS drugs	26	12.9
Beta blocker	10	5.0
Calcium channel blocker	5	2.5
Unknown antihypertensive	9	4.5
Rodenticide	50	24.9
Zinc phosphide	34	16.9
Anti-coagulant rodenticide	6	3.0
Carbamate	11	5.5
Pesticides	23	11.4
Organophosphates	6	3.0
ALP	17	8.5
Analgesics	33	16.4
Paracetamol	18	9.0
NSAIDS	17	8.5
Aspirin	2	1.0
Oral hypoglycemic drugs	14	7.0
Metformin	7	3.5
Sulfonylureas	7	3.5
Vitamins and hormones	9	4.5
Theophylline	13	6.5
Antibiotics	6	3.0
Others (diuretics, antidiarrheals, antihistaminics, etc.)	37	18.4
Presenting complains		
Nausea	90	44.8
Vomiting	96	47.8
Abdominal pain	121	60.2
Fatigue	10	5.0
Dizziness	34	16.9
Drowsiness	64	31.8
Blurring of vision	8	4.0
Dyspnea	3	1.5
Palpitation	18	9.0
Other (headache, dysarthria, etc.)	46	22.9

not attended religious services frequently. Yet, many cases believed that suicide was immoral and that they had hope for the future (69.7% and 63.2%, respectively) (Table 6).

The greatest percentage of patients (87.1%) were afraid of the social disapproval of suicide, followed by 64.5% who

were frightened of suicide, death, and dying, and 61.3% had confidence in their ability to solve or cope with problems. Significant variables are shown in Table 7.

The mean of the summed acute suicide risk factors was 23.14 with a standard deviation of 4.38. Furthermore, the calculated mean of the suicide protective factors was 23.11 and has a standard deviation of 3.73.

The combination of the suicide risk and protective factors scores ranged from 36 to 66, with a mean of 47.6 and a standard deviation of 6.43. The mean score of suicide risk and protective factors was higher in male patients (48.03 ± 6.4), compared to female patients (47.4 ± 6.3); however, there was no statistically significant difference in the mean scores of suicide risk and lack of protective factors between both sexes, where $t=0.56$, and $p=0.572$. The mean score of suicide risk and lack of protective factors was the highest among patients who were divorced (52.9 ± 7.1), followed by widows (50.5 ± 0.7), and singles and engaged with nearly equal means (47.3 ± 6.17 and 47.2 ± 6.4 , respectively). Notably, the mean score was the lowest among married patients (46.7 ± 6.3). A significant difference was noted in the mean score of suicide risk and lack of protective factors regarding the marital status, Fisher exact test (FE) = 3.09, and $p=0.017$.

The mean score of suicide risk and lack of protective factors among patients with previous suicidal attempts was 52.32 ± 5.9 , while among patients without previous suicidal attempts was 46.7 ± 6.1 . A statistically significant relationship was noted between the mean score of suicide risk and protective factors of patients with previous suicidal attempts, $t=4.6$, and $p<0.001$.

The relationship between the calculated mean of the acute suicide risk factors and that of protective factors (separately) and age groups, sex of the admitted patients, and the history of previous suicide behavior is shown in Fig. 1.

The duration of hospital stay for cases who had attempted suicide ranged from 4 h to 18 days, with a mean of 1.56 ± 1.72 days. Three patients with aluminum phosphide poisoning were admitted for 10 days for the treatment of the underlying sequelae (ventilator acquired pneumonia and heart failure), and one patient suffered from intermediate syndrome as a complication from organophosphorus poisoning and stayed for 18 days till improvement.

Nearly three-quarters (74.1%) of the admitted cases were completely recovered, 23.9% of the cases were discharged against the medical advice, and only 2% of cases had been discharged with various complications (heart failure and muscle weakness due to poisoning with organophosphates and aluminum phosphide). No deaths were recorded in this study.

In the current study, it was found that the number of suicide cases increased in the second 3 months (the initial

Table 4 Distribution of the patients admitted to APC with deliberate self-poisoning ($n=201$) according to acute suicide risk factors

Acute suicide risk factors	No.		Somewhat		Yes	
	No.	%	No.	%	No.	%
Current suicide intent, including client belief that he/she is going to commit suicide or hurt self	149	74.1	35	17.4	17	8.5
Current suicide plan, rehearsals, and/or preparation	190	94.5	3	1.5	8	4.0
Preferred method currently or easily available	192	95.5	1	0.5	8	4.0
Access to lethal means	58	28.9	51	25.4	92	45.8
Perceived burdensomeness to others	110	54.7	24	11.9	67	33.3
Current severe hopelessness or pessimism	58	28.9	46	22.9	97	48.3
Diminished concentration and impaired decision-making	76	37.8	47	23.4	78	38.8
Alcohol intoxication (currently or likely to be)	196	97.5	1	0.5	4	2.0
Severe loss of interest or pleasure (anhedonia)	91	45.3	49	24.4	61	30.3
Recent discharge from psychiatric hospital	196	97.5	1	0.5	4	2.0
Currently or will be isolated or alone	165	82.1	10	5.0	26	12.9
Recent stressful life events (e.g., recent interpersonal losses, disciplinary and legal crises)	31	15.4	20	10.0	150	74.6
Recent diagnosis of a mental disorder	198	98.5	1	0.5	2	1.0
Recent diagnosis of chronic and/or life-threatening physical illness (e.g., cancer, multiple sclerosis)	194	96.5	3	1.5	4	2.0
Client motivated to under-report/lie about risk	139	69.2	15	7.5	47	23.4

period of COVID-19 lockdown in Egypt) more than that of the first 3 months of the 6-month study period (58.7% and 41.3% respectively) (Fig. 2).

Discussion

Various biological, social, and environmental factors have been linked to an increased risk of DSP in the young age group: life stressors, financial crises, and illicit substance abuse. The pubertal onset of depression, impulsivity, lack of family supervision, immature cognitive development, social isolation, and vulnerability to bullying from colleagues are prominent in youth [12–14].

The least affected group of individuals included in this study was those above 40 years old, which might be explained by the fact that economic worries decrease with age [15, 16]. Suicide in older patients tends to be underreported due to the negative stigma associated with this act [17]. However, neurocognitive problems and social isolation are considered powerful motivators for ending one's life [16].

The prevalence of cases among youngsters and early young adults was different from the age groups reported to be affected a few years ago. A retrospective study conducted by Gad ElHak et al. in Port Said, Egypt (1998 to 2004), concluded that 20% of cases were under 20 years of age [18]. In addition, 28% of cases were between 12 and 18 years old in Eldin et al. study in Egypt (2015–2016) [1, 19].

The present study demonstrates a higher percentage of the rate of DSP during the COVID-19 pandemic in younger age groups.

Several studies have identified female gender as a prevalent risk factor for the development of mental health disorders [20, 21]. The results of the current study were consistent with previous studies, such as Ali et al. (2019) in Egypt, Cook et al. (2008) in the UK, and Benedict et al. (2019) in South Africa [22–24].

In most underdeveloped countries, females are more vulnerable to aggression and stress [25]. Female suicidal behavior is influenced by limited customs, lack of education, limited job opportunities, and the added weight of being a spinster [26]. COVID-19 lockdowns appear to have created a perfect setting for a rise in violence against women [27].

Suicide rates differ between urban and rural regions. More specifically, the incidence of psychiatric comorbidities, physical ailments, and exposure to psychological stressors is significantly higher with a greater density and diversity in urban populations [28]. Socio-cultural barriers may impede access to medical care and accurate rural reporting of cases [29].

Women in rural areas also have a low level of education and limited social involvement, making it more difficult to deal with stress [25].

The current study demonstrated that more than half of the cases with suicidal behavior were single (55.7%) in agreement with the results of Rezaie et al. (2011) in Iran and Ali et al. (2019) in Egypt [22, 30].

Suicide is more prevalent among singles and individuals who live alone. In other words, having another person in the house might operate as a protective factor by alleviating social isolation and developing a sense of responsibility toward others. The presence of children in the home may also provide more protection for women [31].

Table 5 Distribution of the patients admitted to APC with deliberate self-poisoning ($n=201$) according to acute suicide risk factors and previous suicidal attempts

	Previous suicidal attempt ($n=31$)	No previous suicidal attempt ($n=170$)	χ^2	p value
Current suicide intent, including client belief that he/she is going to commit suicide or hurt self				
No	15 (48.4%)	134 (78.8%)	14.7	0.001*
Somewhat	9 (29%)	26 (15.3%)		
Yes	7 (22.6%)	10 (5.9%)		
Current suicide plan, rehearsals and/or preparation				
No	29 (93.5%)	161 (94.7%)	1.113	0.573
Somewhat	0 (0%)	3 (1.8%)		
Yes	2 (6.5%)	6 (3.5%)		
Preferred method currently or easily available				
No	29 (93.5%)	163 (95.9%)	1.536	0.563
Somewhat	0 (0%)	1 (0.6%)		
Yes	2 (6.5%)	6 (3.5%)		
Access to lethal means				
No	4 (12.9%)	54 (31.8%)	11.9	0.003*
Somewhat	4 (12.9%)	47 (27.6%)		
Yes	23 (74.2%)	69 (40.6%)		
Perceived burdensomeness to others				
No	9 (29%)	101 (59.4%)	9.7	0.008*
Somewhat	6 (19.4%)	18 (10.6%)		
Yes	16 (51.6%)	51 (30%)		
Current severe hopelessness or pessimism				
No	3 (9.7%)	55 (32.3%)	10.5	0.005
Somewhat	5 (16.1%)	41 (24.1%)		
Yes	23 (74.2%)	74 (43.6%)		
Diminished concentration and impaired decision-making				
No	5 (16.1%)	71 (41.8%)	7.48	0.024*
Somewhat	9 (29.1%)	38 (22.3%)		
Yes	17 (54.8%)	61 (35.9%)		
Alcohol intoxication (currently or likely to be)				
No	30 (96.8%)	166 (97.6%)	0.466	0.792
Somewhat	0 (0%)	1 (0.6%)		
Yes	1 (3.2%)	3 (1.8%)		
Severe loss of interest or pleasure (anhedonia)				
No	7 (22.6%)	84 (49.4%)	8.4	0.015*
Somewhat	9 (29%)	40 (23.5%)		
Yes	15 (48.4%)	46 (27.1%)		
Recent discharge from psychiatric hospital				
No	28 (90.3%)	168 (98.8%)	—	MCP=0.009*
Somewhat	0	1 (0.6%)		
Yes	3 (9.7%)	1 (0.6%)		
Currently or will be isolated or alone				
No	25 (80.6%)	140 (82.4%)	0.524	0.770
Somewhat	1 (3.2%)	9 (5.3%)		
Yes	5 (16.1%)	21 (12.4%)		

Table 5 (continued)

	Previous suicidal attempt (n = 31)	No previous suicidal attempt (n = 170)	χ^2	p value
Recent stressful life events (e.g., recent interpersonal losses, disciplinary and legal crises)				
No	7 (22.6%)	24 (14.1%)	3.497	0.174
Somewhat	5 (16.1%)	15 (8.8%)		
Yes	19 (61.3%)	131 (77.1%)		
Recent diagnosis of a mental disorder				
No	31 (100%)	167 (98.2%)	0.555	1
Somewhat	0 (0%)	1 (0.6%)		
Yes	0 (0%)	2 (1.2%)		
Recent diagnosis of chronic and/or life-threatening physical illness (e.g., cancer, multiple sclerosis)				
No	30 (96.8%)	164 (96.5%)	1.467	0.333
Somewhat	1 (3.2%)	2 (1.2%)		
Yes	0 (0%)	4 (2.4%)		
Client motivated to under-report/lie about risk				
No	18 (58.1%)	121 (71.2%)	2.997	0.223
Yes	2 (6.5%)	13 (7.6%)		
Somewhat	11 (35.5%)	36 (21.2%)		

χ^2 , Pearson Chi-squared test; MCP, Monte Carlo significance; *statistically significant at $p \leq 0.05$

Table 6 Distribution of the patients admitted to APC by deliberate self-poisoning (n = 201) according to suicide protective factors

Suicide protective factors	No.		Somewhat		Yes	
	No.	%	No.	%	No.	%
Hope for the future	46	22.9	28	13.9	127	63.2
Confidence in ability to solve or cope with problems	83	41.3	74	36.8	44	21.9
Attachment to life	50	24.9	41	20.4	110	54.7
Responsibility to children, family, or others, including pets, who client would not abandon	125	62.2	9	4.5	67	33.3
Social support or connectedness	52	25.9	38	18.9	111	55.2
Attached to therapist, counselor, or other service providers	173	86.1	5	2.5	23	11.4
Fear of suicide, death, and dying	79	39.3	54	26.9	68	33.8
Fear of social disapproval of suicide	112	55.7	27	13.4	62	30.8
Belief that suicides is immoral	26	12.9	35	17.4	140	69.7
Frequently attends religious services	155	77.1	17	8.5	29	14.4
Client motivated to over-report risk	141	70.1	22	10.9	38	18.9

Our findings also revealed a statistically significant difference between males and females regarding occupation, in agreement with the study of Ghanem et al. performed in Egypt [32]. Suicide rates among unemployed women were higher compared to the suicide rate among unemployed men within a society where discrimination prevents women from obtaining equal employment prospects [33].

Despite all evidence suggesting that psychiatric disorder is a significant predictor of suicide, a history of psychiatric

problems was detected in only 13.9% of the cases analyzed. This discrepancy could be explained by the small sample size, short study duration, and exclusion of other modalities of suicide attempt (such as self-wounding and firearm injuries) [34–36].

Furthermore, our study showed that depression was the most common psychiatric disorder among patients with DSP. There is a clear correlation between depressed suicide attempters and increased levels of impulsive and aggressive behavior [25, 37].

Table 7 Distribution of the patients admitted to APC with deliberate self-poisoning ($n=201$) according to suicide protective factors and previous suicidal attempts

	Previous suicidal attempts ($n=31$)	No previous suicidal attempt ($n=170$)	χ^2	p value
Hope for the future				
No	11 (35.5%)	35 (20.6%)	3.422	0.181
Somewhat	3 (9.7%)	25 (14.7%)		
Yes	17 (54.8%)	110 (64.7%)		
Confidence in ability to solve or cope with problems				
No	4 (12.9%)	40 (23.6%)	6.1	0.047*
Somewhat	8 (25.8%)	66 (38.8%)		
Yes	19 (61.3%)	64 (37.6%)		
Attachment to life				
No	11 (35.5%)	99 (58.2%)	14.02	0.001*
Somewhat	4 (12.9%)	37 (21.8%)		
Yes	16 (51.6%)	34 (20%)		
Responsibility to children, family, or others, including pets, who client would not abandon				
No	20 (64.5%)	105 (61.8%)	0.173	0.917
Somewhat	1 (3.2%)	8 (4.7%)		
Yes	10 (32.3%)	57 (33.5%)		
Social support or connectedness				
No	11 (35.5%)	100 (58.8%)	6.5	0.039*
Somewhat	7 (22.6%)	31 (18.2%)		
Yes	13 (41.9%)	39 (23%)		
Attached to therapist, counselor, or other service providers				
No	12 (38.7%)	11 (6.5%)	—	MCP < 0.001*
Somewhat	2 (6.5%)	3 (1.8%)		
Yes	17 (54.8%)	156 (91.7%)		
Fear of suicide, death, and dying				
No	8 (25.8%)	60 (35.3%)	—	MCP = 0.005*
Somewhat	3 (9.7%)	51 (30%)		
Yes	20 (64.5%)	59 (34.7%)		
Fear of social disapproval of suicide				
No	4 (12.9%)	58 (34.1%)	10.6	< 0.001*
Somewhat	0	27 (15.9%)		
Yes	27 (87.1%)	85 (50%)		
Belief that suicide is immoral				
No	16 (51.6%)	124 (73%)	16.5	< 0.001*
Somewhat	4 (12.9%)	31 (18.2%)		
Yes	11 (35.5%)	15 (8.8%)		
Frequently attends religious services				
No	28 (90.3%)	127 (74.7%)	3.632	0.185
Somewhat	1 (3.2%)	16 (9.4%)		
Yes	2 (6.5%)	27 (15.9%)		
Client motivated to over-report risk				
No	21 (67.7%)	120 (70.6%)	0.163	0.922
Somewhat	4 (12.9%)	18 (10.6%)		
Yes	6 (19.4%)	32 (18.8%)		

χ^2 , Pearson Chi-squared test; MCP, Monte Carlo significance; *statistically significant at $p \leq 0.05$

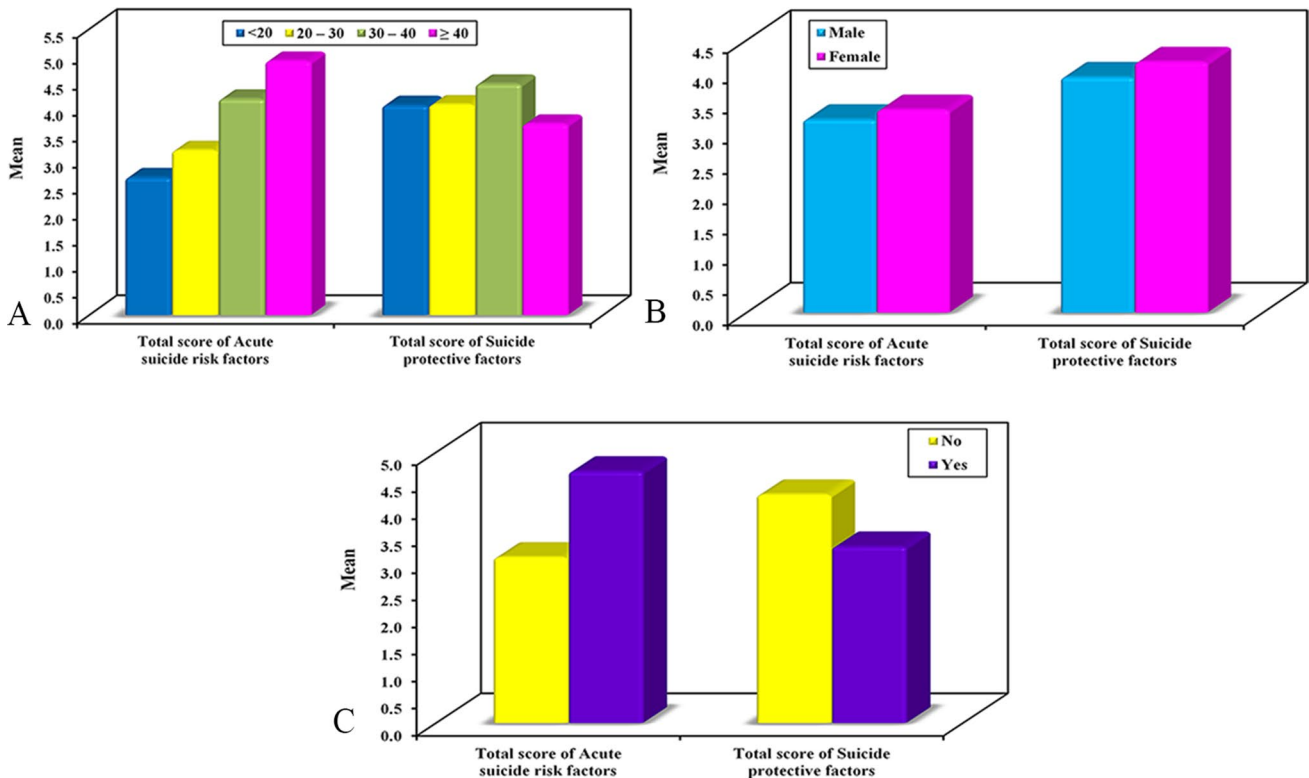
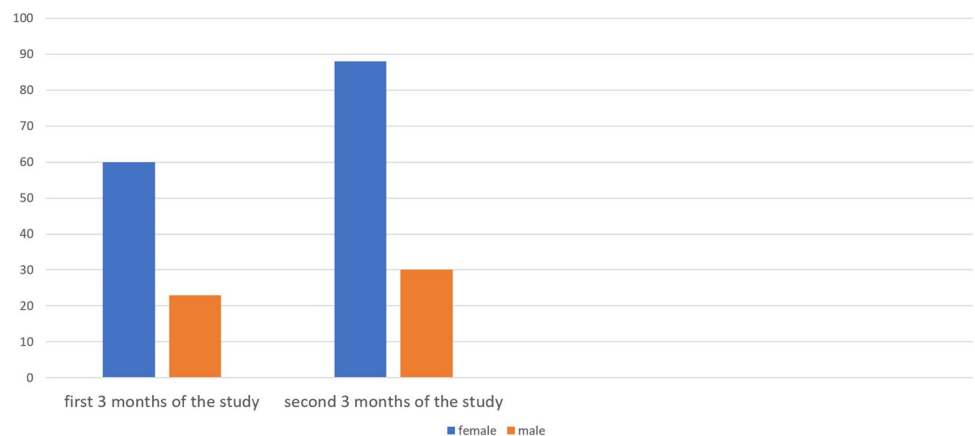


Fig. 1 Relation between each of the mean of the acute suicide risk factors and the mean of lack of suicide protective factors with age groups, sex, and previous suicide attempts. **A** The relation between different age groups with mean score of acute risk factors and lack of protective risk factors. For the age group <20 years (21.65 ± 4.18 for risk factors and 23.16 ± 3.56 for protective factors); for the age from 20 to 30 years (22.94 ± 4.49 for risk score and 22.77 ± 3.27 as protective score); for the age group 30 to 40 years, the mean of risk factors is 25.13 ± 3.17 and that of protective factors is 22.94 ± 4.55; and for the age more than 40 years, the risk factor mean is 26.16 ± 3.80 and the mean of protective factors is 24.68 ± 4.55. By applying Kruskal Wallis test, significant statistical relation was recorded between the mean score of acute suicide risk factors and different ages ($H=30.122$ and $p<0.001$); however, no statistical relation was noted between different age groups and mean of lack of protective factors ($H=2.178$ and $p=0.536$). **B** The mean of acute sui-

cidal score in males is 22.94 with a standard deviation of 3.93 and for females 23.22 ± 4.54. The males have as mean of protective factors, 23.72 ± 3.78 standard deviation and 22.89 ± 3.69 for females. No statistically significant relation was found between sex and the mean of suicide risk factors ($U=3863.50$ and $p=0.872$) and the calculated mean of lack of protective factors ($U=3462.0$ and $p=0.204$) by applying the Mann–Whitney test. **C** Patients with no previous suicidal behavior and has a mean of 22.64 and a standard deviation of 4.31 for acute risk of suicide and a mean of 22.71 ± 3.52 for protective factors. Patients with a positive history of previous attempts and had 25.94 ± 3.71 as a mean for acute suicide risk factors and 25.29 ± 4.09 for protective factors. Significant relation was recorded between each of suicide risk ($U=1387.50$ and $p<0.001$) and lack of protective factors ($U=1680.50$ and $p<0.001$) and the presence of previous suicidal attempts

Fig. 2 Distribution of the patients admitted to APC with deliberate self-poisoning ($n=201$) according to date of admission



Additionally, the current study discovered that 15.4% of cases have a previous history of suicidal attempts. This is consistent with the findings of a study conducted in Iran (2003), where only 7% of suicidal cases had a history of prior suicidal attempt [38].

Antipsychotics, anticonvulsants, and antidepressants were the most reported CNS depressants, followed by rodenticides (zinc phosphide, carbamates, and anticoagulant rodenticides). In general, CNS medications are the most frequently used medicines for self-poisoning in underdeveloped countries [24]. The current findings are consistent with a study conducted on suicide patterns in Northern Tunisia (2005–2015) and another study conducted in Japan (2017), in which psychotropics were the most commonly used drugs for self-poisoning [39, 40].

The widespread usage of antidepressants, including prescription drug overdoses or use of medications belonging to their relatives or acquaintances, could be explained by the fact that depression is common in situations of DSP. The prevalence of CNS depressants in DSP can also be related to the increased rates of depression during the COVID-19 lockdown period [41].

In the current study, the use of rodenticides (24.9%) was more common than pesticides (11.4%), which contradicts the findings from a previous study performed in Northern Tunisia (2005–2015), where pesticides (70.1%) were more commonly used than rodenticides (28.7%) [39].

Recently, the incidence of aluminum phosphide poisoning has been increasing steadily in Egypt, as demonstrated by the study conducted by El-Sarnagawy in 2017 [42]. Low cost and easy accessibility render aluminum phosphide more suitable for suicide; however, our study showed that this accounted for only 8.5%. This may be explained by the fact that the rapid deterioration of patients' conditions excluded a considerable number of admitted cases.

Over the last years, a noticeable change in the selection of poisons used for suicide among Egyptians has been recorded. A study conducted in one of the largest agriculture cities of Upper Egypt, Assiut (2005–2009), reported that organophosphorus compounds represented 75% of all implicated toxins, and drugs accounted for less than 2% [43]. Similar figures were recorded in the Damietta Governorate (2004–2007), where use of organophosphorus was 69.1% and that of medicinal drugs was less than 5% [44].

Furthermore, CNS depressants were the most frequently used drugs for suicide in patients from urban regions (31%), which is in accordance with the findings of Salah Eldin et al. (2010) in Egypt and Farzaneh et al. (2010) in Iran [19, 45]. In contrast, patients from rural areas often use rodenticides and pesticides. According to Eddleston et al. (2005), pesticide use is widespread form of self-poisoning in rural parts of Sri Lanka (49%) [46].

To conduct a suicide risk assessment, professionals must first obtain information on the long-term risk factors for this condition, such as demographics and medical and family history, and short-term factors, including suicide ideation, planning, and intent. Researchers also need to be aware of the significance of protective factors, which entail social support and the belief that suicide is immoral [47, 48].

The LRAMP was developed to improve clinicians' ability to diagnose and manage suicide behaviors, reducing clinicians' anxiety and concerns on the optimal way to treat suicidal individuals. The protocol aimed to reduce assessors' and providers' malpractice anxiety by encouraging them to adopt and document standards of care when assessing and managing suicide risk and standardize protocols so that blind assessors could document and apply suicide risk management throughout clinical research assessment regardless of the treatment regimen [10].

The usability and effectiveness of the scale was studied in 2017 by Harned et al., and the results suggested that this scale was associated with significantly improved suicide assessment and management [48].

Concerning acute suicide risk factors, a significant proportion of cases attempting suicide had experienced recent stressful life events during the pandemic, had access to lethal means, and were characterized by severe hopelessness or pessimism. A study conducted in Oman in 2002 revealed that 10.6% of the patients with DSP underperformed in school or that they did not have a good insight into their lives. Chronic illness, bereavement, marital problems, financial troubles, and work stress were also encountered [49].

According to a study conducted in South Africa in 2008, suicide risk factors included relationship problems (55.4%); financial problems (22.9%); psychiatric problems (22.1%); arguments (19.8%); abuse (18.2%); low self-esteem, feelings of worthlessness, hopelessness, or prostration (16.7%); recent life changes (13.2%); unstable family life (9.3%); and academic difficulties (9.3%). A significant portion of these participants had more than one risk factor [50].

Nonetheless, when it comes to protective factors for suicide, a sizable proportion of instances involving DSP feel that suicide is immoral (69.7%) were optimistic regarding their future (63.2%), were attached to life (54.7%), and had social support or connectedness (55.2%).

The mean score of suicide risk and protective factors was the highest among divorced individuals and widows, and the lowest was among married patients. A significant difference was noted in the mean score of suicide risk and protective factors among different marital statuses. The reported findings are consistent with the protective effect of marriage and adhere to the results of previous studies on the protective effect of marital status on suicide [51–53].

The mean score of suicide risk and protective factors was significantly higher among patients with previous suicidal

attempts. A significant relationship was noted between the mean score of suicide risk and protective factors among patients with previous suicidal attempts. Even when calculating the means separately for each of the suicidal risks and the protective factors, a significant relationship was still reported. These results are in accordance with Chan et al. (2016), who reported that compared to the general population, the risk of suicide increased by 30 to 100 times in the year following a self-harm event [54].

The present study revealed a statistically significant relationship between the acute risk of suicide (calculated mean of the 15 questions proposed) and different age groups, i.e., the mean value increases with age.

These results are in accordance with Ajdacic-Gross et al. (2006) [55] and Mello-Santos et al. (2005) [56], who stated that suicide rates increase with increasing age. This correlation could be explained by known risk factors for suicide in older people, such as physical diseases, grief, social isolation, and loss of income. Therefore, this is consistent with the impact of accumulating disability on the likelihood of suicide [57].

The increase in suicide rates during the COVID-19 lockdown could be explained by many factors, including fear, anxiety and stress during lockdown, and social distancing, loss of employment, increase of domestic violence, and social stigma of being infected, in addition to increase of vulnerability to psychosocial stresses, mental health problems, and suicidal behavior [58, 59].

Our study has certain limitations to be addressed. For instance, this study included a relatively small sample and recruited patients from one poison center, which might have negatively affected our findings. Furthermore, this study was cross-sectional; thus, it provided only an empirical snapshot of suicidality at a certain point of time.

Recommendations

Further studies that will focus on extended durations and will include a larger selection of patients in multiple poison centers are highly recommended to confirm the recorded results and provide database statistics during the COVID-19 pandemic. During pandemics, additional attention must be devoted to vulnerable patient populations, including those susceptible to SARS-CoV-2 (older age, comorbidities) and mentally disturbed individuals.

A concentrated effort between toxicologists and psychiatric physicians is strongly suggested to manage self-poisoning cases.

Owing to the short-term training required, integration of the LRAMP tool into clinical settings should be highly considered. Finally, it is essential to consider the implementation of an integrated multi-specialty poison control center that includes emergency medicine, critical care,

pharmacology, pediatrics, psychiatry, preventive medicine, and laboratory diagnostics to manage all poisoned cases and formulate suicide preventive strategies.

Author Contribution Study design and conceptualization was conducted by all authors. HF conducted the study design, study supervision, and critical final revision of the manuscript. AA contributed to the conduct of the psychological assessment part of the methodology. RH was involved in data collection, interviewing patients, analysis, and interpretation of data. FB, WK, and RH were involved in the analysis and interpretation of data, reviewing the literature, drafting, and revising the manuscript.

Data Availability Database is available upon request.

Code Availability Not applicable.

Declarations

Ethics Approval Ethics Committee of the Faculty of Medicine, Alexandria University approved the study (Approval serial number: 0304539).

Consent to Participate Informed consent was obtained before participation.

Consent for Publication All authors approved the final manuscript for publication.

Conflict of Interest The authors declare no competing interests.

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