



## Developing inpatient suicide prevention strategies in medical settings: Integrating literature review with expert testimony

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### ABSTRACT

**Objective:** According to some recent evidence, suicide rate is higher in inpatients than in the general population around the world. However, suicide prevention strategies (SPS) are poorly focused and understood in medical settings. This study aimed to develop effective SPS and interventions in medical settings of Iran and provide evaluation checklists/procedures for them.

**Methods:** The study was performed in two steps, including literature review and expert opinions panel. In the first stage, we conducted a comprehensive literature review to find relevant suicide prevention programs, strategies, interventions, or any efforts to prevent suicide in the medical settings. In the second stage, an expert panel was arranged for developing effective and feasible SPS in medical settings. Data were analyzed through content analysis approach.

**Results:** Overall, 11 records were included in the literature review. SPS varied from staff training, safety plan and quality improvements, and prevention programs to therapy methods. Finally, in the second stage, the following seven major SPS were recommended by the expert panel: 1) Integration and application of obtained suicidal behavior data through evaluating medical records, 2) Screening and suicide risk assessment, 3) Staff training, 4) Quality improvement, 5) Follow-up of inpatients with high-risk behaviors, 6) Reducing stigma and improving public awareness, and 7) Follow-up of discharged high-risk inpatients. Also, 23 interventions within the strategies were presented.

**Conclusion:** Given that SPS are poorly focused in medical settings, the practical framework that emerged in this study could be used to develop or advance SPS in various medical settings.

### 1. Introduction

Suicide is an intentional act to take one's own life with multiple etiologies (Fakhari et al., 2021). During the years, suicide has been an

important and ongoing public health concern around the world (Waserman et al., 2005). Approximately, one million people die due to suicide every year (Azizi et al., 2021). The age-adjusted suicide rate was estimated 10.5 per 100,000 people globally (Fakhari et al., 2021);

**Abbreviations:** SPS, Suicide prevention strategy; MHEOCC, Mental health environmental of care checklist; QPR, Question, persuade, refer.

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Farahbakhsh et al., 2020; Hassanian-Moghaddam and Zamani, 2017).

Suicide is a public health concern in Iran (Mirhashemi et al., 2016). Evidence indicated that the incidence rate of suicide has been increasing in the last decades in Iran (Hassanian-Moghaddam and Zamani, 2017; Mojahedi et al., 2021; Mokhtari et al., 2019). In East Azerbaijan province (northwestern Iran), an epidemiological survey showed that suicide has been increasing with a smooth slope (Farahbakhsh et al., 2021).

Suicide is a priority condition worldwide (Fleischmann and Saxena, 2013). In this regard, suicide prevention strategies (SPS) should recommend a comprehensive assessment and monitoring framework to measure the effectiveness of interventions (Fakhari et al., 2021). Suicide prevention is a collective responsibility and should be arranged by the political commitment and civil society around the world (Korczak et al., 2020; Vijayakumar et al., 2021).

The suicide rate is higher among hospitalized patients than the general population rendering them as a high-risk group in medical settings (Fässberg et al., 2016). In a meta-analysis, Walsh et al., (2015) reported that suicide rate in inpatients was very high (147 per 100,000 inpatients). Suicide in medical settings is a rare impactful event that can negatively influence patients' families and healthcare providers (Ballard, Pao, Horowitz et al., 2008). Although there is no accurate data about the suicide and suicidal behavior rates in medical settings around the world, most SPS have focused on at-risk people in the general population (Azizi et al., 2021). Recently, a meta-analysis (Chi et al., 2021) found that patients with heart failure have a high incidence of suicide. Moreover, Liu et al. (2020) suggested timely and effective psychological counselling for patients who believe they may be responsible for disease transmission.

Nevertheless, few inpatient suicide prevention programs have been conducted on different aspects of suicide and suicidal behaviors in medical and psychiatric settings (Navin et al., 2019). Therefore, recognition and development of effective SPS, risk factors, and protective factors in medical settings is still uncertain (Walsh et al., 2015).

Suicide in the medical settings may have a different demographic profile and employ different methods of suicide in comparison with general population (Ballard, Pao, Henderson et al., 2008). Meanwhile, evidence around the world (Bassett and Tsourtos, 1993; Cheng et al., 2009; Tishler and Reiss, 2009) and a prospective study in Iran (Esmaeili et al., 2022) suggested that suicide prevention programs should be tailored in psychiatric and non-psychiatric wards considering the risk characteristics profile of different suicide attempters. Such data can be used to develop effective strategies and provide support and ongoing education to healthcare providers (Wang et al., 2016).

Recently, suicide and suicidal behaviors have increased in medical settings in Tabriz, Iran (Farahbakhsh et al., 2021). Previous evidence recommended further investigations to clarify the extent to which patient factors and the characteristics of hospital and inpatient facilities contribute to the deaths by suicide in psychiatric hospitals (Walsh et al., 2015). Moreover, recent evidence has focused on published literature reviews in special groups or patients (Chung et al., 2019; Large et al., 2018; Navin et al., 2019). However, the views of medical professionals and psychiatrists who worked with suicidal patients in combination with literature review for developing SPS in medical settings are poorly understood.

In order to reduce suicide in psychiatric and non-psychiatric settings in Iran, this study was conducted to develop SPS and interventions in medical settings through using literature review in combination with an expert panel.

## 2. Methods

### 2.1. Study design and setting

This study was conducted to develop effective SPS and interventions among hospitalized patients in Tabriz, Iran in June 2021. The study was performed in two steps, including literature review and expert panel

comments in northwestern Iran to develop inpatient suicide prevention executive solutions for the whole country. In the first stage, we conducted a comprehensive literature review to find relevant suicide prevention programs, strategies, interventions, or any efforts to prevent suicide in the medical settings. In the second stage, we used an expert panel to develop effective and feasible SPS in Iranian medical settings. In this stage, the main strategies were suggested by the expert panel. Then, the effective and feasible interventions/efforts in each strategy were generated.

### 2.2. Literature review

A comprehensive literature review was conducted using keywords and index terms (MeSH and Emtree) in MEDLINE, Scopus, Web of Science, and Embase in June 2021. The reference lists of all articles and reports selected for critical appraisal were searched for any additional study. In addition, the websites of the World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) along with such databases as Gray.net, Google Scholar, and Google were used to search for unpublished studies, institutional and organizational reports, and gray literature.

The retrieved articles were screened by two independent reviewers based on the title, abstract, and full-text after removing the duplicates. Finally, the results of studies were reported descriptively. Since we used the contents of all records and there was a huge diversity in this regard, we did not assess the quality of studies and risk of bias.

### 2.3. Expert panel

In this stage, the retrieved records in the literature review were combined with expert comments and opinions for developing and generating effective strategies and interventions/actions to prevent suicide in medical settings for hospitalized patients. We organized an expert team to explore the strategies. The panel included the Vice-Chancellor for Treatment Affairs, the Deputy for Public Health, psychiatrists and psychologists working with suicidal patients, health policy-makers and executives from the Department of Mental Health at Tabriz University of Medical Sciences, one epidemiologist, two experts in the Vice-Chancellor for Treatment Affairs, one nurse in Razi Psychiatric Hospital, one hospital manager, and three health service providers.

### 2.4. Expert panel sessions and comments

The expert panel sessions were arranged for the participants to develop and explore SPS and interventions step by step. An experienced member in the Vice-Chancellor for Treatment (FA) at Tabriz University of Medical Sciences, who had efficient prior experience in training and conducting such sessions, moderated the panel discussions and sessions. All members had sufficient experience in researching, training, and case management of suicidal behavior and ideation. We conducted five expert panel sessions (120 min), each with seven to eight participants. All sessions were audio-recorded, then transcribed by two authors (FA and ZE). The sessions were guided using a set of key themes and questions to keep the participants focused on the purpose of the study. The key themes and questions were as follows: 1) Presenting the session objectives and goals, 2) Identifying the effective and feasible strategies to prevent suicide and suicidal behaviors among inpatients in the medical settings, and 3) Identifying the effective and feasible interventions/actions to prevent suicide in the medical settings.

Experts were encouraged to present SPS and interventions based on their own ideas and the literature review. Then, effective SPS and interventions were selected through consensus discussion. Participants were encouraged to present any additional comments and suggestions if required. After providing the strategies, the content of each strategy was clarified using participants' comments and then the feasible interventions/actions were recommended for each strategy. The

participants were encouraged to polish each strategy and/or intervention up to the saturation stage to the extent that strategies are well-defined and generated. We took measures to assure that all members provided their comments in detail. Therefore, we devoted sufficient time to finalizing each strategy and its interventions to assure the validity and credibility of the data. The participants examined the first draft of strategies and they were encouraged to add any comments and additional corrections if necessary.

### 2.5. Analysis

Data were analyzed based on the content analysis approach. The content analysis process was conducted based on the method suggested in a qualitative study (Darban et al., 2021), including writing the participants' ideas and comments in a brief explanation, reading and discussing the entire text of the participants' views several times, determining semantic units and summarizing them, extracting the primary codes, classifying the similar primary codes (strategies) under the same subcategories, classifying similar codes under more comprehensive categories, extracting latent and manifesting the views and concepts, and generating the final themes (prevention strategies and interventions). After constructing the transcriptions, the text was reviewed several times. To this end, the codes and semantic units were recognized for generating SPS and interventions after a consensus discussion (Babazadeh et al., 2019).

## 3. Results

### 3.1. Literature review

Table 1 shows the characteristics of the included studies. Overall, 11 records (eight quasi-experimental studies, two comprehensive reports, and one randomized controlled trial) were included in the literature review. Out of the final included records, six studies had been conducted in general hospitals, three studies in psychiatric hospitals or mental wards, and two records in medical settings. The SPSs were varied from health service providers training, environmental equipment and/or quality improvements, after discharge, special prevention programs to treatment efforts.

Four studies evaluated the effectiveness of environmental and architectural improvements in reducing suicide among hospitalized patients (Changchien et al., 2019; Jun et al., 2014; Mohl et al., 2012; Watts et al., 2017, 2012) using Mental Health Environment of Care Checklist (MHEOCC) (Watts et al., 2017) and Health care Failure Mode and Effect Analysis (HFMEA) (Changchien et al., 2019). Two records evaluated and recommended a set of comprehensive and applicable SPS by the National Action Alliance for Suicide Prevention (Prevention, 2019) and the International Association for Healthcare Security and Safety–Foundation (IAHSS Foundation) (Dunn, 2020) in medical setting. Training the health service providers and general practitioners in medical settings (Pfaff et al., 2001) (Appleby et al., 2000; Van Landschoot et al., 2017) was another intervention to enhance the ability to identify and manage inpatients at risk for suicide. Therapeutic interventions (such as electroconvulsive therapy) were also used in one study.

### 3.2. Expert comments

After presenting and combining literature with expert ideas and testimony, a total of seven strategies were identified as follows: 1) Integration and application of obtained information through evaluating suicidal behavior and ideation in medical records in the psychiatric hospitals, 2) Screening, early detection, and suicide risk assessment in non-psychiatric hospitals, 3) Training health service providers and improving their practice, 4) Safety plan and quality improvement of environmental and architectural aspects of medical settings, 5) Follow-

**Table 1**  
Suicide prevention interventions in medical settings through the literature review.

Study setting or organization	Study/record	Major Findings/ recommendations
General Hospital Setting	1) Pfaff, JJ (2001)(Pfaff et al., 2001)	<b>General practitioners (GPs) training and assessing:</b> A total of 23 GPs were trained for recognizing, assessing, and managing young patients (15–24) at risk of suicide. Then, 423 patients were assessed by GPs before and after training workshop.
	2) Changchien, T-C (2019) (Changchien et al., 2019)	<b>Quality improvement:</b> Five steps including admission, screening, consultation, liaison with department of psychiatry, referral for psychiatric treatment and follow-up were conducted to prevent suicide in at-risk inpatients in the hospital.
	3) Mohl, A (2012)	<b>Equipment improving:</b> Creating guard rail in front of window in inpatient units
	4) Watts, BV (2012)(Watts et al., 2012)	<b>Improving environment and architectural:</b> Specific recommendations to prevent potential hazards in the sleeping room, bathrooms, seclusion rooms, unit entrance, dining room, staff offices and nurses station.
	5) Patel, M (2006)(Patel et al., 2006)	<b>Treatment:</b> Electroconvulsive therapy (ECT) with bilateral front temporal electrode placement, 5–10 sessions at a frequency of three per week was conducted for inpatients with mental disorder.
Psychiatric Hospital Setting	6) Watts, BV (2016)(Watts et al., 2017)	<b>Hospital environment improving and architectural:</b> Specific recommendations developed for inpatients by using Mental Health Environment of Care Checklist (MHEOCC)
	7) APPLEBY, L (2000) (Appleby et al., 2000)	<b>Training:</b> A total of 359 first-line healthcare providers trained for suicide risk management. The outcomes were the rate of attendance at training, and changes in suicide risk assessment and management skills following training.
	8) Landschoot, RV (2017)(Van Landschoot et al., 2017)	<b>Training:</b> Poster campaign information on identifying and responding to high-risk patients was displayed for four weeks for healthcare providers.
	9) Jun, WH (2013)(Jun et al., 2014)	<b>Training and care services:</b> Experimental group received over four weeks and included eight sessions (two per week) vs. Control group received treatment or surveillance as usual.
Guidelines or Position Statements	10) The National Action Alliance for Suicide Prevention (2019) (Prevention, 2019)	<b>Comprehensive suicide prevention strategies</b> 1) Developing relationships, protocols, and procedures for safe and rapid referrals, 2) Involving family members and other natural supports,

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Table 1 (continued)

Study setting or organization	Study/record	Major Findings/recommendations
		3) Collaboratively developing a safety plan as part of pre-discharge planning, 4) Connecting with the outpatient provider, 5) Follow up with the patient and outpatient provider
	11) The International Association for Healthcare Security and Safety – Foundation (IAHSS Foundation) (2020)(Dunn, 2020)	<b>Suicide prevention strategies</b> 1) Staff training, 2) Proper environment modification and improvement, 3) Patient risk assessment, 4) Protocols to ensure patients are cared for in a healthy and low-risk way.

up of patients with high-risk behaviors, 6) Stigma-reduction and changing misconceptions about suicide and suicidal behaviors in medical settings, and 7) Follow-up of discharged high-risk patients.

As presented in the Appendixes, each strategy included various interventions/actions along with checklists and methods or suggested valid instruments. Overall, 23 interventions were suggested by the expert panel. Appendix 1 included ‘risk factors for suicide and suicidal behaviors’; Appendix 2 included ‘protective factors on suicide and suicidal behaviors’; and Appendix 3 included ‘suicide risk assessment using SAD PERSONS Scale (Bolton et al., 2012)’. Table 2 shows the detailed information on suicide strategies and interventions.

To assess the environmental and architectural status in medical settings, the Mental Health Environment of Care Checklist (MHECC) was recommended by the expert panel as it had been used in most studies. This checklist was developed by Watts et al. (2012).

To train health care providers/staff, the Question, Persuade, Refer (QPR) suicide prevention gatekeeper training program (Aldrich et al., 2018; Litteken and Sale, 2018; Quinnett, 2007) was suggested, as it needed low-educated providers.

#### 4. Discussion

This study is among few studies providing strategies for inpatient suicide prevention in medical settings where death by suicide and suicidal behaviors is an unacceptable concern in psychiatric and non-psychiatric hospitals. Despite most SPS and intervention efforts conducted in the general population, suicide rates in inpatients are higher than in the general population; this issue has been neglected in the previous investigations and suicide surveillance systems (Walsh et al., 2015). This study developed interventions within each strategy. We also provided checklists to assess suicide risk and interventions on suicide prevention in the medical settings.

The first strategy that emerged in this study was using medical records information practically to detect suicidal ideation and behaviors in psychiatric hospitals. This strategy was proposed for psychiatric hospitals given that many high-risk people may refer to psychiatric hospitals, including emergency wards, psychiatric and psychological clinics, and hospitalized patients in various psychiatric rooms. Integration and application of the obtained information from medical records can lead to early detection of suicidal ideations and behaviors.

The second strategy was screening and early case detection in the general hospitals’ inpatients, given that psychiatric and psychological profile has been poorly assessed and registered in the general hospitals. Recognition and screening of at-risk inpatients through using scaled instruments could play an important role in inpatients’ suicide prevention. This strategy is in line with the screening of suicidal ideation and case management of high-risk groups in the general population or some

Table 2

Effective suicide prevention strategies after combining the literature review with expert comments.

No	Strategy	Interventions/Actions
1	Integration and application of obtained information through assessing suicidal ideation and suicidal behaviors in medical records of patients in the <i>psychiatric hospitals</i>	1) Recording suicide and suicidal behaviors information (risk factors and protective factors) in detailed based on the relevant emergency checklist as presented in Appendix 1 , and Appendix 2 2) Evaluation measures and indexes should be defined based on facilities and structure of each hospital after consulting with pole universities and provincial centers. 3) Identifying and recording suicidal ideation or history of suicide attempts in in-patients 4) Psychiatric counseling for high-risk cases 5) Providing brief contact and psychological interventions for at-risk hospitalized patients
2	Screening, early detection, and suicide risk assessment in patients of non-psychiatric hospitals; Appendix 3 .	6) Arranging and holding periodic training workshops (QPR *) for hospital staff (including physicians, nursing, service providers, and hospital physical protection staff) 7) Evaluating the effectiveness of training workshops continuously and periodically 8) Forming and training an experienced specialized team for suicide prevention and providing emergencies services for suicidal behaviors cases. 9) Establishment and development of a psychiatric emergency unit in non-psychiatric hospitals for case management of high-risk suicidal patients 10) Providing access to psychiatric and psychological services in non-psychiatric hospitals 11) Safety plan by using <i>Mental Health Environmental of Care Checklist (MHECC)**</i> 12) Development safety hospitals standards for psychiatric hospitals to prevent suicide 13) Restriction to means and removing breakable and sharp objects in medical settings 14) Smartening of physical inspection (examination) of patients and companions upon entering high-risk wards 15) Patient monitoring using closed-circuit television camera (CCTV) to monitor the patient’s behavior and condition 16) The nurse visits the patient at specific and different times, especially during night shifts 17) Re-checking patients’ belongings, after encounter (meeting) hours with companions
3	Training health service providers and improving their practice	18) Installing related reminders on suicide prevention in front of staff and patients in medical centers 19) Encouraging and institutionalizing the correct behaviors against suicidal behaviors and ideation with preventive goals 20) Record linkage or data transmission of patients with suicidal
4	Safety plan and quality improvement of environmental and architectural aspects of medical centers	
5	Follow-up monitoring of patients with high-risk behaviors	
6	Stigma-reduction and changing misconceptions about suicide and suicidal behaviors in medical settings	
7	Follow-up monitoring of discharged high-risk patients	

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Table 2 (continued)

No	Strategy	Interventions/Actions
		ideation and behaviors to community health centers with aiming psychological and brief contact interventions.
		21) Educating and encouraging patients' families to continue contact and relationship with medical centers and post-discharge care services such as community mental health centers (CMHC)
		22) Use of social workers for specialized measures necessary for help during hospitalization and after discharge for patients with suicidal ideation

\* QPR (Question, Persuade, and Refer) Gatekeeper Training for Suicide Prevention is a 1–2 h educational program designed to teach lay and professional "gatekeepers", the warning signs of a suicide crisis and how to respond.

\*\* MHECC checklist was developed by Watts et al. (2012). This checklist was translated to Persian and then localized and validated by the expert panel.

at-risk patients. Therefore, forming, training, and evaluating an experienced specialized team for suicide prevention and providing emergency services for suicide attempters was proposed in the study.

The third strategy included training the health service providers, which was also emphasized in the literature (Appleby et al., 2000; Dunn, 2020; Pfaff et al., 2001; Van Landschoot et al., 2017). This strategy is comparable with gatekeeper training in the general population. Training of healthcare providers in both general and psychiatric hospitals was proposed by an expert based on QPR technique. QPR, which is a gatekeeper training for suicide prevention, included a 1–2 h training program to teach lay and professional "gatekeepers" the warning signs of a suicide crisis and how to respond (Aldrich et al., 2018).

The fourth strategy included providing a safety plan in medical settings by quality improvement of environmental and architectural aspects. The quality improvement was also the most common SPS in previous studies. This strategy seems to be a major intervention in medical settings to prevent suicide. The MHECC checklist (Watts et al., 2012) is a reliable instrument for assessing quality improvement in medical settings. This checklist was generated for all mental healthcare providers to reduce potential hazards. It includes 114 items assessing these hazards in such places as nursing station, healthcare providers' offices, sleeping room, bathroom, seclusion room, unit entrance, and dining room. Watts et al. (2012) assessed the effectiveness of the checklist and reported that using the checklist decreased 48% of inpatient suicide cases. They also used this tool in their veterans' health administration hospitals (Watts et al., 2017).

The fifth strategy included follow-up monitoring of patients with high-risk behaviors. Case management of high-risk inpatients attempting suicide was one of the interventions in this study, which was also highlighted by the WHO (Fleischmann and De Leo, 2014; Organization, 2018). Evidence indicated that the risk of suicide re-attempt is high within the months following an attempt. Likewise, a prospective study in Iran indicated that more than 80% of suicide re-attempts took place within the first 18 months of follow-up (Esmaeili et al., 2022). In agreement with the present study, a community-based suicide prevention study reported significant suicide reduction measures through follow-up and case management of attempters (Azizi et al., 2021).

Stigma reduction and changing misconceptions about suicide in medical settings was the sixth proposed strategy in this study. This strategy can be compared to mental health training programs and stigma reduction for receiving mental health services in the community. Providing primordial prevention and training programs to prevent suicide was highlighted in several previous studies (Shim and Compton, 2010; Wilcox and Wyman, 2016).

The seventh strategy for inpatient suicide prevention included follow-up monitoring of discharged high-risk patients. Mental disorders need a long time of care support and therapeutic measures. Mental disorder patients and some chronic diseases after discharge should be followed up and monitored regarding suicidal behaviors and other psychiatric disorders (Forte et al., 2019; Matthew Large et al., 2011). Follow-up of patients with high-risk profiles by therapeutic environments and community-based mental health centers can be effective in preventing suicide. Record linkage of at-risk discharge patients with community mental health centers can also be used for appropriate utilization and following these patients (Babigian, 1977; Krupski et al., 2016).

Generally, the most emphasized strategies by the experts were suicide risk assessment, early case detection, training healthcare providers, and safety plan and quality improvement in the medical settings. Furthermore, integration of inpatients' records with suicidal behaviors, follow-up of high-risk inpatients, post-discharge case management, stigma-reduction, and misconceptions about suicidal behaviors were other significant strategies suggested in this study.

Although the majority of suicides occur in low- and middle-income settings, the majority of the comprehensive SPS have been developed in high-income countries. Asian countries responsible for almost 60% of the world's suicides, while there is a great mismatch in the region between the scale of the problem and the resources available to tackle it (Chen et al., 2012). For example, in India, media reporting of suicide is poorly adherent to WHO reporting guidelines, with very little focus on educating the public (Menon et al., 2021). Also, findings indicated that the COVID-19 pandemic (Nakhband, et al., 2021) restrictions impacted suicide demographics in India and Bangladesh (Kar et al., 2021). Numerous countries around the world and Asia are developing SPS for which up-to-date, high-quality evidence is required. Currently, a study in Japan found that the gatekeeper training is an effective SPS for university teachers in Japan (Hashimoto et al., 2021). A systematic review has been reported there is no single strategy clearly stands above the others, in the quest for effective SPS (Zalsman et al., 2016).

Currently, there are several suicide prevention programs in Iran (Azizi et al., 2021; Malakouti et al., 2015) and around the world (Mann et al., 2005; Zalsman et al., 2016) for the general population or at-risk groups. Our study focused on developing SPS for inpatients through using an integrated method.

The practical framework emerged in the present study could be used to develop or advance SPS in medical settings in Iranian context and worldwide because we used the results of published studies around the world. The current study can also help to bridge the gap between research and field programs. These all suggest the need to strengthen the knowledge about suicide and evaluate the efficiency of the national health approach in addressing the issues of suicide in medical settings.

#### 4.1. Strengthens and limitations

The main strength of this study is integrating the existing literature with experts' opinions to develop SPS. The current study used a literature review to develop SPS, and not a systematic review using pooled estimation of the relevant measure of association. To minimize this shortage, we applied experienced experts, suicide investigators, and hospital managers to generate strategies and interventions and used an expert panel to receive additional thoughts and comments on suicide prevention among inpatients.

## 5. Conclusions

After integrating the literature review with expert panel opinions, seven strategies and 23 interventions were recommended for suicide prevention in the medical settings. The strategies included 1) Integration and application of obtained information through assessing suicidal ideation and suicidal behaviors in medical records of patients in the

psychiatric hospital, 2) Screening, early detection, and suicide risk assessment in the general hospitals, 3) Training health service providers and improving their practice, 4) Safety plan and quality improvement of environmental and architectural status of medical settings, 5) Follow-up of inpatients with high-risk behaviors, 6) Stigma-reduction and changing misconceptions about suicide and suicidal behaviors in the medical settings, and 7) Follow-up of discharged high-risk patients.

Given that suicide prevention programs are poorly focused in medical settings, the practical framework emerged in this study could be used to develop or advance SPS in medical settings in Iranian context, as well as other countries.

**Authors’ contributions**

HA developed the first draft of the manuscript, performed data analysis, and interpreted the results. All authors contributed to the protocol development. FA and ZE arranged the sessions and recorded data. AF, LD, BSH, MF, Ash, and EDE developed the protocol, interpreted and analyzed the data, collected the data, and provided technical comments. All authors contributed to the manuscript development and/or made substantive suggestions for revision. All authors read and approved the final version of the manuscript.

**Ethics approval and consent to participate**

This study was approved by the Ethics Committee of Tabriz University of Medical Sciences (code: IR.TBZMED.VCR.REC.1399.020). No human samples or subjects were included in the study.

**Appendix 1. Risk factors for suicide and suicidal behaviors in hospitalized patients extracted from expert panel**

Characteristics	Variables
Demographic profile	Male sex, age 65 years and older, younger age, widow, divorced, single
History of any suicidal ideation or behaviors	History of suicide attempt, suicide ideation, suicidal behaviors
Clinical sign and symptoms	Frustration, psychotic symptoms, overt restlessness, severe or persistent anxiety, panic attacks, lack of self-confidence, feelings of shame, aggression, severe vulnerability due to narcissism
Access to means	All weapons and harmful devices and materials, especially firearms weapons
Family history of any suicidal behaviors or mental disorders	In the first or second degree
Psychiatric disorders	Major Depressive Disorder (MDD), bipolar disorder, schizophrenia, type B personality disorder (especially borderline), anorexia nervosa, comorbidity of two or more psychiatric disorders
Poor socio-cultural status	Recent loss of social support, unemployment, socio-economic decline, living alone, domestic violence, poor family relationships, recent stress in life
Other variables	Physical illness, history of sexual/physical abuse in childhood, poor therapeutic relationship, accidental substance poisoning

**Appendix 2. Protective factors on suicide prevention in hospitalized patients extracted from expert panel**

No	Variables
1	Having a child at home (except in cases of psychosis or mood disorders after childbirth)
2	A sense of responsibility towards the family
3	Being religious
4	Coping skills
5	Problem solving skills
6	Social support
7	Pregnancy
8	Life satisfaction
9	Appropriate therapeutic communication

**Appendix 3. Suicide risk assessment using SAD PERSONS Scale in hospitalized patients**

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**Conflict of interests**

Authors have no competing interests to declare.

**Data Availability**

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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*Consent to participate*

Not Applicable.

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No	Variables	Score
1	S – Sex	Male: 1, Female: 0
2	A – Age	44 < or 20 > : 1
3	D – Depression	Depression: 1
4	P – Previous attempt	Any history of suicide attempts: 1
5	E – Ethanol abuse	Alcohol abuse: 1
6	R – Rational thinking loss	Rational thinking loss: 1
7	S – Social Supports Lacking	Lacking or Poor Social Supports: 1
8	O – Organized Plan	Organized Plan for suicidal behaviors: 1
9	N – No Spouse	Widow or divorced or single: 1
10	S – Sickness	Chronic, debilitating or severe illness: 1
Total Score		10

### Scoring for SAD PERSONS Scale in hospitalized patients.

Scores	Measure/Action
0–2	Discharge by follow-up
3–4	Discharge with suggestion for hospitalization
5–6	Hospitalization and under supervision
7–10	Hospitalization and supervision to prevent any self-injuries or other-injuries

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