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# Designing a safety management system for higher education centers

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## Abstract:

**INTRODUCTION:** The system of safety management in higher education centers can prevent the complications caused by harmful issues to students and bring their potential talents closer to perfection. Therefore, this study aimed to design a safety management system (SMS) in higher education centers of Iran in 2016.

**MATERIALS AND METHODS:** This study was a descriptive study of qualitative type. This study was conducted in three independent phases, including (1) evaluating theoretical concepts, (2) developing an initial system by determining the points of sharing and differentiation of the evaluated systems, and (3) validating the SMS using the Delphi technique. Consensus on opinions and identifying similarities and differences of reviewed studies have been used for qualitative data analysis, and the descriptive statistics (sum of scores and mean) by means of SPSS version 21 has been used for quantitative data analysis.

**RESULTS:** In the first stage, 108 indexes were identified by reviewing the studies and evaluating the SMS in the world's educational and noneducational organizations for the 12 main categories of SMS. In the Delphi phase, 83 components were identified as a key index of the SMS in higher education centers of Iran. Furthermore, the average mean of participants' views on the dimensions of the SMS for higher education centers has been 4.32, with the highest average mean of 4.59 related to the dimension of the facility and the firefighting department and the lowest mean of 4.10 for the student dimension.

**CONCLUSION:** The indexes presented in this study will provide a fairly complete tool for designing SMS in higher education centers, which by applying it will provide a good opportunity to improve the performance of these systems over time.

## Keywords:

Higher education centers, safety management, system

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## Introduction

The structure of the school or university, the quality of education, and the combination of educational and noneducational staff, along with the complex environment of the educational centers, create conditions that are important for the search and evaluate the status of safety to improve and extend the situations and opportunities for the educational process.<sup>[1]</sup> Therefore, the educational safety

and continuity in schools and universities require a continuous and dynamic process initiated by the management and the involved staff, students, parents, and the local community.<sup>[2]</sup>

Every year, many educational centers suffer from disasters and a significant number of students and staff members of these centers are victims of disasters.<sup>[3]</sup> In a report, which was conducted using the data collected from the Marsh's Higher Mental Health Risk Management study, uncertainty in finances, competition among students, international registration, population, and deficiencies in

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the perception of risk and safety management programs were expressed as key issues of safety management programs at higher education centers.<sup>[4]</sup> Furthermore, in the usage guide of risk management at the University of London, withdrawal from the budget, collapse of key markets which lead to significant loss of earnings, college dissatisfaction with customer service and college missions, inability to manage dormitories (power outages, firefighting, etc.), and damage to university reputation by negative media coverage were mentioned as the dangers of university and higher education centers.<sup>[5]</sup> Therefore, it is necessary to have a specific structure of safety management for preventing disasters and coping with risks, taking into account the health and safety of staff, customers, and other stakeholders in higher education centers or schools.

Safety management is the process of identifying, analyzing, and forecasting risks that are considered a threat or risk for organizations. Therefore, safety management is an organized attitude to risk management in an organization.<sup>[6]</sup> Following the systematic methods in safety management can guide the organization to reach the causes of disasters in a logical way and direct them away from pursuing an unstructured approach based on mental and tact thoughts that lead to waste of time.<sup>[7]</sup> Moreover, safety management system (SMS) can assess the risks and present strategies to reduce and prevent them. This can also provide preparedness actions to cope with the risks.<sup>[8]</sup> On the other hand, enjoying a pattern of structural and specified SMS which follows legal obligations can provide a safe workplace for all workers, students, and visitors.<sup>[9]</sup>

In general, safety management is an integral part of the activities of excellent training centers, in addition to taking advantage of it and avoiding many disasters, to prevent injury to financial resources and equipment of the organization, and consequently creating dissatisfaction.<sup>[10]</sup> In recent years, the UK Higher Education Budget Council required that all universities implement safety management as a governmental tool to increase productivity in decision-making.<sup>[11]</sup> The SMS in the higher education sector can include different sections, each of which has its own indexes. However, except big universities (with >15,000 full-time enrollments), which are relatively advanced in their safety management programs, many centers, such as higher education centers in Iran, are in the early stages of maturity in safety management.<sup>[4]</sup>

According to the presented articles, having an acceptable SMS in higher education centers can prevent the complications caused by harmful issues to students and can bring their potential talents closer to perfection; this study has been conducted with the aim of designing the

SMS for higher education centers in Iran in 2016. In this research, the meaning of safety management refers to those dimensions and indexes that the incidence of errors is controlled and limited.

## Materials and Methods

The present study is a qualitative descriptive study that used reviewing different systems and Delphi method to design an SMS for higher education centers.

This study was conducted in three main phases:

### First phase, study phase

In this phase, all of the world's educational and noneducational organizations that had been provided a system for safety and risk management as well as all reports, articles, and related studies were evaluated.

Official websites, articles, reports, guidelines, and authoritative guidance of worldwide were used for collecting search data. In addition, the English databases available at the Iranian National Digital Medicine Library (Web of Knowledge, PubMed, Springer, Google Scholar, Cochran, Elsevier) the Persian (SID database), and Magiran (and Google) were used to find articles and studies published electronically and without time limitations. Search using Persian and English keywords such as "safety, risk, safety and risk management, educational centers, university and higher education" was done separately or a combination with Boolean functions, as well as a list of references published has been conducted to increase sensitivity and select more studies.

The search assessment was done by one of the researchers randomly to evaluate the non-deletion of the studies. Finally, related articles were selected and acted to remove nonrelated items. After determining the related studies, the assessment of the quality of the studies was evaluated through authors' agreement using the evaluating observation and avoiding errors by observing standards criteria and extracting information by researchers based on the title, type of text, authors, year, country, study purpose, title of safety or risk model, dimensions and indexes of safety and risk management, and level and location of model implementation.

The criteria for the entry of studies and reports in this phase were related to safety and risk management and the presentation of dimensions or system for safety and risk assessment. Furthermore, the exit criteria of the studies included cases that have merely described the importance of safety and risk management and had been not provided any specific indexes or criteria.

### Second phase, formation of the primary model

In this phase, by determining the points of sharing and differentiation of the safety and risk management indexes extracted in the first phase, a preliminary draft was designed to determine the components of safety management in the educational centers of Iran by the authors. The prepared draft was also criticized and agreed by the research authors and three experts in the area of safety and risk management (one person at the Department of Health in Disasters, one assistant professor of disaster, and one Ph.D. in Health Services Management).

### Third phase, pattern validation

The third phase was final pattern presentation of safety management and validation of this pattern by the Delphi method. All experts in the fields of educational management, risk, and safety management were research population in this phase. Sampling was targeted in the field of expertise and was used by those who had the expertise and experience required in this field. In this phase, the input criteria of the study include at least one of the following: (1) having related researches in safety and risk management or membership at specialized risk and safety committees and (2) having a work experience in related organizations with the issue of safety and risk or having work experience in higher education centers.

Participants in two rounds were rated each of the subdimension under study using a researcher-made questionnaire on the 5-point Likert scale (very low value = 1, low value = 2, average value = 3, high value = 4, very high value = 5). The number of participants included 20 people of experts. Three follow-ups were conducted to increase the response rate to a questionnaire by one of the researchers.

The scores obtained in the questionnaire were entered into the SPSS software version 21. It was acquired by International Business Machines Corporation (IBM) in Armonk, New York. In the first round, indexes were removed with a score of <50% and also indexes were accepted with a score of over 50%. Furthermore, indexes with a score of 50%–75% were considered in the second round questionnaire after the proposed modifications proposed by the study group. After redistributing and recollecting questionnaires, the indexes that were scored over 80% were suggested as final indexes for entering the final pattern.

In other words, those components were considered as the key component to enter the final pattern by consulting 15 scholars, and 12 of them indicated these components as very important.

The determination of face validity was done through reviewing the texts, the consensus of the authors'

comments and the three experts mentioned in the second phase of the research, and the cases of difficulty level (difficulty in understanding the words and phrases and the probability of misunderstandings of phrases or insufficiency of words meanings).

Measuring the content validity quantitatively using content validity ratio (CVR) and content validity index (CVI). The content validity shows that to what extent the questions introduce the content and its objective with the topic.<sup>[12]</sup>

## Results

In the first phase, 4708 related articles or reports were obtained after searching for various sources. After evaluating repeated cases and after evaluating their title and summary, 178 items were selected for the study of complete text; of 178 cases, 32 items were selected for the subject field to extract information.

In the second phase, the sharing points and differentiation of the studied studies in the first phase are determined and its results are presented in Table 1.

Overall, 108 key indexes in terms of 12 subject areas are determined based on Table 1 results and the consensus of the authors' views and three experts in the field of safety and risk management field.

In the Delphi stage, experts' opinions were gathered through a questionnaire to prioritize and determine the validity of 108 components identified. A total of 15 out of the 20 invited experts participated in the Delphi study, consisting of 5 (33.3%) males and 10 (66.7%) females. Furthermore, 46.7% of the participants were aged between 30 and 40 years, 6.7% had no teaching experience, and 40% had a degree in health care management. In addition, the average response time for participants in the Delphi phase has been 8 days (1–15 days). The results of this phase are presented in Table 2 by the 12 main dimensions of safety management indexes in higher education centers.

Based on Table 2, the average mean of participants' views on dimensions of the SMS in higher education centers in Iran has been equal to 4.32, with the highest mean of 4.59 for the dimension of the facilities and the fire department and the lowest mean of 4.10 for the student dimension.

Finally, the components reaching 80% score at Delphi phase in the eye of interviewees are recognized as the key indexes for the framework of safety management at the higher education institutes. Accordingly, 25 items were omitted out of 108 primary items. By calculating the remaining items, content validity index and content

**Table 1: Points of sharing and differentiation of evaluated studies**

Row	Dimensions of safety	Indexes
1	-	Number of students and reports related to occupational safety and health <sup>[13]</sup>
2	Fires and settlement	The type and measurement of the materials used, the discharge time, the design building, the number of people in the building, the ability to diagnose the risk or the probability of detection (the safety measurement), the frequency of the fire and the accidental settlement <sup>[14]</sup> Fire alarm system, emergency and floors evacuation plan, warning signs in outlets, construction control due to combustion, adequacy of storage of combustible materials and extinguisher caps, and status of electricity services <sup>[15]</sup>
3	Building and the environment	Building: Dimensions and lists of rooms and all requirements for protection and maintenance such as (roof, plumbing, etc.), release of noise, smoke and odor, the correctness of building structures, obstruction in pipes, sliding surfaces <sup>[15]</sup> Environment: External environment: Air temperature, surface and temperature moisture and ventilation, adequate light, water quality, <sup>[15]</sup> supplying required drinking water, <sup>[16]</sup> indoor air quality <sup>[16]</sup> Acoustic environment: Control of inoperative sounds, <sup>[15]</sup> hearing protection <sup>[16]</sup> Environmental and laboratories safety <sup>[17]</sup> Radiation safety <sup>[16]</sup> Adaptation to air pollution <sup>[16]</sup> Determination of asbestos and lead issues <sup>[16]</sup> Determination of hazardous materials and wastes <sup>[16]</sup> Public health: Public cleaning of buildings, control of rodents and insects <sup>[15]</sup> Access and use by disabled: <sup>[15]</sup> Allocation of physical resources, conditions of facilities, capital projects <sup>[18]</sup> Environmental <sup>[19]</sup> Physical <sup>[20]</sup> Facilities <sup>[20]</sup> Ergonomics <sup>[16]</sup> Criteria for enclosure class: Flooring status, electric wires and cables, adequate lighting for safe exit, easy access to stairs or ramps, window and opener to open windows at high altitudes, furniture and accessories, use of portable equipment with high durability, use of a trolley for moving heavy objects, fixed electric switches with socket, portable electrical equipment, for example: audiovisual equipment, controlling ventilation, and heating and cooling equipment <sup>[21]</sup> Structural safety assessment: Location and examination of site soil, cargo system, building height, plan and construction details, water examination <sup>[2]</sup> Noninstrumental safety assessment: Preventing fire and safety from fire, safety against storms and steep winds, earthquake safety <sup>[2]</sup>
4	Earthquake	Fire alarm system, emergency and floor drain plans, alarm system, emergency alarm signs on emergency exit, locked cabinets, and drainage areas <sup>[15]</sup>
5	Flood	Supply and access to upper floors during floods, creating a warning system and supplying warning signs for highlands <sup>[15]</sup>
6	IT	Communication systems, data protection, final user education, disasters responsiveness, network integrity, privacy, security, supportive, system capacity, <sup>[17]</sup> data security, business, affiliation, data recovery, IT resource allocation <sup>[18]</sup>
7	Student affairs	Behavioral, freedom of expression, crime on campus, experimental programs, financial assistance, study abroad <sup>[17]</sup> student satisfaction, registration management, determining capacity, health, security, and safety <sup>[18]</sup>
8	Financial field	Budget, audit, cash management, conflict of interest, contract and purchase, cost management, bailout, capital absorption, insurance, long-term debt, reserve fund <sup>[17]</sup> Financial market, internal control, financial commitments, operational costs, revenue sources, resource allocation <sup>[18]</sup> Financial <sup>[19,20,22]</sup> Organizational value, financial strategy and synergy and financial conflict, decision-making to assess financial strategy parameters, measure decisions and actions, commercialization of researches, budget contradiction, evaluating basic costs and additional costs, costs for different purposes, expansion of activities related to contracts, controlling and managing results, financial indexes, performance measurement in education, cost management, data dashboards creation, standard criteria <sup>[23]</sup>

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**Table 1: Contd...**

Row	Dimensions of safety	Indexes
9	Research field	Research, copyright, clinical research, privacy, disclosure policy, spiritual property rights, technology transferring <sup>[17]</sup>
10	Scientific field	Adjustment of academic programs, education, quality, allocation of scientific resources, integration of the scientific activities <sup>[18]</sup>
11	Laboratory	Chemical and physical properties of the materials, nature of the risk, physical and chemical properties of the warning system, the risks associated with the materials, the level of exposure to the materials, <sup>[24]</sup> laboratory safety <sup>[16]</sup>

IT=Information technology

**Table 2: Frequency distribution of participants on indexes of safety management pattern in higher education centers**

Indexes	Mean	Very important (%)	Important (%)	Moderate (%)	No significant (%)	Unimportant (%)
<b>Area of organizing and operating the Safety Committee or disasters</b>						
The need for creating and holding a regular safety committee in higher education centers	4.46	9 (60)	4 (26.7)	2 (13.3)	0	0
The commitment and support of senior managers to the principles of safety management (safety culture)	4.86	13 (86.7)	2 (13.3)	0	0	0
The existence of a clear and structured style sheet for the selection and appointment of members of the Safety Committee	4.26	6 (40)	8 (53.3)	1 (6.7)	0	0
Existence of job descriptions and clear scope authority for committee/safety team	4.53	9 (60)	5 (33.3)	1 (6.7)	0	0
Determining the safety interface at the level of subsidiary units	4.46	9 (60)	4 (26.7)	2 (13.3)	0	0
Availability of regulations and guidelines issued and determined by the Safety Committee at subsidiary units	4.13	5 (33.3)	7 (46.7)	3 (20)	0	0
Guarantee of execution of regulations and the instructions issued and determined by the Safety Committee in subsidiary units	4.53	10 (66.7)	4 (26.7)	1 (6.7)	0	0
Developing policies and executive policy on safety management field	4.53	9 (60)	5 (33.3)	1 (6.7)	0	0
Executing guaranty of policy and executive policy in the field of safety management by the individual/guiding individuals	4.33	8 (53.3)	5 (33.3)	1 (6.7)	1 (6.7)	0
Identifying and prioritizing internal and external risk factors in higher education centers	4.73	11 (73.3)	4 (26.7)	0	0	0
Providing and availability of the program for the overall management of disasters and internal and external emergency cases	4.46	9 (60)	4 (26.7)	2 (13.3)	0	0
Performing regular and moderated visits with a safety management approach	4.4	9 (60)	3 (20)	3 (20)	0	0
Establishing a mechanism to regularly obtaining results of activities from subsidiary units to board of directors of the university	4.13	4 (26.7)	9 (60)	2 (13.3)	0	0
Provide periodic report from colleges safety status to the board of directors of the university	3.93	4 (26.7)	6 (40)	5 (33.3)	0	0
<b>Resource allocation area</b>						
Needs assessment for preventive facilities to deal with disasters and Incidents by the board of directors of the university	4.6	7 (46.7)	7 (46.7)	1 (6.7)	0	0

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**Table 2: Contd...**

Indexes	Mean	Very important (%)	Important (%)	Moderate (%)	No significant (%)	Unimportant (%)
<b>Resource allocation area</b>						
Assignment of preventive resources in the event of incidents and disasters	4.4	8 (53.3)	6 (40)	1 (6.7)	0	0
Identify and take protective measures from resources within the university	4.33	6 (40)	8 (53.3)	1 (6.7)	0	0
<b>Field of continuing education</b>						
Need assessment of educational programs in the field of safety and work environment for internal and external clients of the Institute	4.64	9 (64.3)	5 (35.7)	0	0	0
Setting up a desktop workout (based on evidence scenario) and performing hypothetical maneuvers	4.6	9 (60)	6 (40)	0	0	0
Effective implementation of educational programs and hypothetical maneuvers	4.53	9 (69.2)	3 (23.1)	0	1 (7.7)	0
Evaluation of training programs and performed maneuvers	4.66	10 (66.7)	5 (33.3)	0	0	0
Inclusion of safety training program in job promotion of staff	4.46	8 (53.3)	6 (40)	1 (6.7)	0	0
<b>Student field</b>						
Monitoring the safety field of managing dormitories	4.53	8 (53.3)	7 (46.7)	0	0	0
Determine the health status, security, and safety of students	4.4	7 (46.7)	7 (46.7)	1 (6.7)	0	0
Identify the dimensions and types of crime on campus	4	6 (40)	3 (20)	6 (40)	0	0
Determine the method and measure the amount of complaints and/or error report and potential incidents	4.26	4 (26.7)	11 (73.3)	0	0	0
Student training and counseling before, during, and after the incident to increase awareness and resilience of students	3.86	5 (33.3)	5 (33.3)	4 (26.7)	0	1 (6.7)
assessment of students about the fields of safety, threatening risks, and coping strategies	3.6	4 (26.7)	4 (26.7)	5 (33.3)	1 (6.7)	1 (6.7)
<b>Financial field</b>						
The need for a dedicated budget for safety management fields	4.73	12 (80)	2 (13.3)	1 (6.7)	0	0
Managing organization costs	4	6 (40)	5 (33.3)	3 (20)	0	1 (6.7)
Create a reserve fund	4.06	6 (40)	4 (26.7)	5 (33.3)	0	0
Fundraising	4.26	7 (46.7)	6 (40)	1 (6.7)	1 (6.7)	0
Identification of financial obligations	3.9	4 (26.7)	6 (40)	5 (33.3)	0	0
Ability to withdraw from the budget	4.2	7 (46.7)	6 (40)	1 (6.7)	0	1 (6.7)
Identify revenue sources	4	5 (33.3)	6 (40)	3 (20)	1 (6.7)	0
Establishment of the mechanism for the insurance of occupational incidents and civil liability of staff for incidents and disasters	4.7	11 (73.3)	4 (26.7)	0	0	0
Establishment of the mechanism for the insurance of occupational incidents and civil liability of staff for incidents and disasters	4.6	11 (73.3)	3 (20)	1 (6.7)	0	0
Determination and decision making to assess the parameters of financial strategies	4	5 (33.3)	6 (40)	3 (20)	1 (6.7)	0
Control and audit of annual financial performance	3.93	4 (26.7)	7 (46.7)	3 (20)	1 (6.7)	0
<b>The field of IT</b>						
Final user training	4.46	9 (60)	4 (26.7)	2 (13.3)	0	0

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**Table 2: Contd...**

Indexes	Mean	Very important (%)	Important (%)	Moderate (%)	No significant (%)	Unimportant (%)
<b>The field of IT</b>						
Determining data protection	4.33	6 (40)	8 (53.3)	1 (6.7)	0	0
Determining communication systems	4.46	7 (46.7)	8 (53.3)	0	0	0
Network integration	4.2	7 (46.7)	4 (26.7)	4 (26.7)	0	0
Creating privacy for users	4.33	5 (33.3)	10 (66.7)	0	0	0
Provide network security	4.53	9 (60)	5 (33.3)	1 (6.7)	0	0
Determining the capacity of the IT system	4.2	6 (40)	6 (40)	3 (20)	0	0
Data and information continuity	4	4 (26.7)	7 (46.7)	4 (26.7)	0	0
existence of supportive programs for data recovery	4.53	10 (66.7)	3 (20)	2 (13.3)	0	0
Identifying preventive plans for IT field in response to incidents and disasters	4.57	9 (64.3)	4 (26.7)	1 (6.7)	0	0
<b>Health and safety field</b>						
The existence of the responsible internal organization in relation to occupational safety and health issues	4.2	5 (33.3)	8 (53.3)	2 (13.3)	0	0
Provision of health and safety programs for staff and students by the board of directors	4.28	6 (42.9)	7 (50)	0	1 (7.1)	0
The need for ongoing medical counseling to support the safety program	4	4 (26.7)	7 (46.7)	4 (26.7)	0	0
Need to determine the mechanisms to prevent physical injuries of staff and students	4.2	5 (33.3)	9 (60)	0	1 (6.7)	0
Determine and measure the harmful factors of the work environment	4.26	6 (40)	8 (53.3)	0	1 (6.7)	0
The need for safety against radiation	4.2	11 (73.3)	0	2 (13.3)	0	2 (13.3)
The need to control inoperative sounds	3.86	7 (46.7)	3 (20)	3 (20)	0	2 (13.3)
The need for personal protective equipment and facilities	4.4	10 (66.7)	3 (20)	1 (6.7)	0	1 (6.7)
public cleaning of the building	3.6	2 (13.3)	7 (46.7)	4 (26.7)	2 (13.3)	0
Determine hazardous materials and wastes	4.2	9 (60)	2 (13.3)	3 (20)	0	1 (6.7)
Perform spraying to control rodents and insects	3.93	5 (33.3)	5 (33.3)	4 (26.7)	1 (6.7)	0
The need to establish a support phase and following reports and inspections of staff from potential risks and possible incidents at workplace	4.26	7 (46.7)	5 (33.3)	3 (20)	0	0
<b>Building area</b>						
Presence of building use identity for higher education centers	4.26	7 (46.7)	5 (33.3)	3 (20)	0	0
The need to determine the list and dimensions of the rooms and all maintenance and protection requirements such as roof and plumbing	4.26	7 (46.7)	5 (33.3)	3 (20)	0	0
The need to determine the correctness of building structures and their correct use	4.33	7 (46.7)	6 (40)	2 (13.3)	0	0
The need to determine the accuracy of slider surfaces (stairs, ramps, etc.) and their correct use	4.2	6 (40)	6 (40)	3 (20)	0	0
Evaluating design and construction details	4.13	6 (40)	5 (33.3)	4 (26.7)	0	0
Evaluating the height of the building	3.93	6 (40)	4 (26.7)	3 (20)	2 (13.3)	0
<b>The field of assessment of the indoor area</b>						
Determine the condition of the floor covering	4.13	5 (33.3)	7 (46.7)	3 (20)	0	0
The need to determine the function of the blockage in the tubes	4.42	7 (50)	6 (42.9)	1 (7.1)	0	0

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**Table 2: Contd...**

Indexes	Mean	Very important (%)	Important (%)	Moderate (%)	No significant (%)	Unimportant (%)
<b>The field of assessment of the indoor area</b>						
Existence of window and door handle to open the windows at high altitude	4.26	6 (40)	7 (46.7)	2 (13.3)	0	0
Control of ventilation and heating and cooling equipment	4.4	7 (46.7)	7 (46.7)	1 (6.7)	0	0
Easy access to stairs or ramps	4.53	9 (60)	5 (33.3)	1 (6.7)	0	0
The presence of escape stairs and emergency exits with clear signs of guidance with paling and stairs	4.73	12 (80)	2 (13.3)	1 (6.7)	0	0
Determining adequate lighting for safe evacuation	4.4	8 (53.3)	5 (33.3)	2 (13.3)	0	0
Accessibility of audiovisual equipment	4.06	6 (40)	4 (26.7)	5 (33.3)	0	0
Accessibility and use of facilities by disabled people	4.46	7 (46.7)	8 (53.3)	0	0	0
Accessibility and use of the carriage for the transfer of heavy objects	4.2	6 (40)	7 (46.7)	1 (6.7)	0	0
The presence of lockers and cabinets	4.06	4 (26.7)	8 (53.3)	3 (20)	0	0
fixed electric switches with connection sockets	4.33	7 (46.7)	6 (40)	2 (13.3)	0	0
Determine the status of electrical wires and cables	4.26	6 (40)	7 (46.7)	2 (13.3)	0	0
Supply and access to upper floors during floods	4.4	7 (46.7)	7 (46.7)	1 (6.7)	0	0
<b>The area of the external environment</b>						
Determine the temperature of air, moisture and ventilation	3.73	2 (13.3)	7 (46.7)	6 (40)	0	0
Suitable natural daylight and artificial light with an international standard of intensity	3.66	2 (13.3)	6 (40)	7 (46.7)	0	0
Determine indoor air quality of building	4.06	5 (33.3)	6 (40)	4 (26.7)	0	0
Determine the quality of drinking water	4.46	9 (60)	4 (26.7)	2 (13.3)	0	0
Evaluating water reserves	4.33	7 (46.7)	6 (40)	2 (13.3)	0	0
Evaluating the site soil	4.14	5 (35.7)	6 (42.9)	3 (21.4)	0	0
Existence of earthquake and flood safety programs	4.64	9 (64.3)	5 (35.7)	0	0	0
Existence of safety program against storms, steep winds, and other hazards	4.35	7 (50)	5 (35.7)	2 (14.3)	0	0
<b>Utilities and fire department</b>						
Determine the plan and time schedule for discharging units due to internal and external events	4.73	11 (73.3)	4 (26.7)	0	0	0
Identification of hazardous and fire hazardous places and identifying these places in higher education centers	4.6	9 (60)	6 (40)	0	0	0
Existence of fire prevention program and fire safety	4.66	10 (66.7)	5 (33.3)	0	0	0
Develop programs to deal with the fire, according to fire codes and rules	4.53	9 (60)	5 (33.3)	1 (6.7)	0	0
The need for a fire alarm system and sensitive identifiers	4.73	12 (80)	2 (13.3)	1 (6.7)	0	0
The existence of an alarm system and other warning systems	4.73	11 (73.3)	4 (26.7)	0	0	0
Existence and controlling extinguishing capsules	4.73	11 (73.3)	4 (26.7)	0	0	0
Settlement detection system	4.66	10 (66.7)	5 (33.3)	0	0	0
The ability to identify or probability of fire	4.6	9 (60)	6 (40)	0	0	0
Creation of a cooling, heating, and ventilation maintenance program for higher education centers	4.33	7 (46.7)	6 (40)	2 (13.3)	0	0

*Contd...*



**Table 2: Contd...**

Indexes	Mean	Very important (%)	Important (%)	Moderate (%)	No significant (%)	Unimportant (%)
<b>Utilities and fire department</b>						
Developing control program of generator function and emergency power supply systems	4.4	7 (46.7)	7 (46.7)	1 (6.7)	0	0
Existence of necessary measures to prevent the spread of smoke and air pollutants through the powerhouse to other university/college buildings	4.4	8 (53.3)	5 (33.3)	2 (13.3)	0	0
Control the status of electricity services	4.57	8 (57.1)	6 (42.9)	0	0	0
<b>Laboratory area</b>						
Determine the hazards associated with the material	4.6	10 (66.7)	4 (26.7)	1 (6.7)	0	0
Determine the nature of the risk	4.46	8 (53.3)	6 (40)	1 (6.7)	0	0
Determination of the level of exposure to materials	4.46	8 (53.3)	6 (40)	1 (6.7)	0	0
Measure chemical and physical properties of materials	4.26	7 (46.7)	5 (33.3)	3 (20)	0	0
Matching alarm systems according to the physical and chemical properties of laboratory materials	4.46	8 (53.3)	6 (40)	1 (6.7)	0	0
Separation and storage of hazardous and flammable materials in a safe place	4.66	10 (66.7)	5 (33.3)	0	0	0

IT=Information technology

validity ratio mean of total questionnaire was accounted as 0.90 and 0.81, respectively [Figure 1]. It is worth noting that the remaining components in the final pattern of safety management are in gray in Table 2.

## Discussion

Education is a human right, universal, and certain. In particular, education is important in enabling people to reach their full potential and achieve other important rights. School safety and educational continuing require a continuous and dynamic process initiated by management and staff involved students, parents, and the local community.<sup>[25]</sup> Hence, considering the importance of reducing the vulnerability of universities, due to the availability of human, scientific, documentary, and equipment assets, it is imperative to develop a safety management program. Therefore, this study was conducted with the aim of studying the design of SMS of higher education centers in Iran in 2016.

In the review phase of text, after reviewing the studies and evaluating SMSs in educational and non-educational organizations in the world, 108 indexes were obtained based on 12 classes. In general, extensive studies have been conducted in other countries on the assessment of safety management in higher education centers; however, unfortunately, there are no comprehensive indexes that have considered aspects of the assessment of these centers in Iran.

Although the framework of safety management varies in studies in the format, they act same to determine the

key aspects and indexes for appropriate evaluation of safety management. The history of developing incident risk management plans in the college campus area is very young and it dates back to the late twentieth century.<sup>[26]</sup> The first crisis management policy and school emergency plan were issued jointly by Minnesota’s Ministry of National Security and Ministry of Education in 1999. The emergency methods were revised in 2005. The first comprehensive secure guide of school was published in 2008. The 2011<sup>th</sup> copy included new guides in the emergency scheduling of disabled students, assessing secure school, and revising the scheduling. In addition, the procedures of comprehensive, secure guidelines of school included general guidelines according to local, state and the best national method.<sup>[27]</sup> Fernández-Muñiz *et al.* in their study considered determining the work policies incentives, training, communication, planning (reactive and preventive), control (internal and benchmarking) as dimensions of the SMS.<sup>[28]</sup> In addition, Vaughn *et al.* have mentioned the organizational design, organizational changes, monitoring and supporting, training and staff competence, communications, resource and facilities provision, operational procedures, work permits, and resource allocation in emergency condition as components of improving the performance of the safety process.<sup>[29]</sup> In 2015, Shimada *et al.* described the definitions safety, employee participation, process safety information, process hazard analysis, operating procedures, training, contractors, prestartup safety review, mechanical integrity, how work permit, management of change, incident investigation, emergency planning and response, compliance

Safety Management pattern in Higher Education Centers	Components	Frequency of indexes in the systematic review phase	Frequency of Key Indexes in the Delphi Phase
		Organizing and productivity of the Safety Committee	14 indexes
	Allocation of resources	3 indexes	3 indexes
	Information Technology	10 indexes	8 indexes
	Financial	11 indexes	5 indexes
	Student	6 indexes	3 indexes
	Laboratory	6 indexes	6 indexes
	Utilities and fire department	13 indexes	13 indexes
	External environment	8 indexes	4 indexes
	Evaluation of the indoor area	14 indexes	13 indexes
	building	6 indexes	4 indexes
	Health and safety	12 indexes	6 indexes
	continuous education	5 indexes	5 indexes

Figure 1: A safety management system for higher education centers

audits, trade secrets as essential components of safety management.<sup>[30]</sup> In addition, Ruzic-Dimitrijevic and Dakic mentioned the essential components of designing the safety management of enterprises as teaching, information system, cooperation, conferences, finances, management, student experience, attractive programs, practice, school reputation, and propaganda.<sup>[22]</sup>

In the third phase of the study, the average mean of participants' views on the dimensions of the SMS in higher education centers in Iran has been equal to 4.32, with the highest average of 4.59 for the dimension of the facilities and the firefighting department with a mean and the lowest average of 4.1 related to the student dimension. Finally, 82 components were identified as key indexes in the SMS in higher education centers of Iran.

In the field of organizing and productivity of the safety or incident committee, 13 components were identified as key components of this field. One of the best indexes that show establish a safe and good condition in the organization is the existence of a positive attitude toward safety throughout the organization.<sup>[31]</sup> Management, in collaboration with the Safety and Incident Committee, should develop safety plans to address potential deficiencies, preventing hazards, and appropriate performance when there is a risk in the organization.<sup>[32]</sup> Yassi *et al.* necessitated the holding of common health and secure committees for having a secure workplace, which was in line with the results of the current study.<sup>[33]</sup>

In the area of resource allocation, three components were identified as key components of this field. The

disaster and incident management system needs resources and facilities to prevent and manage incidents and disasters and the crises caused by them.<sup>[9]</sup> To improve the performance of higher education, funding allocation has also been welcomed as an effective and efficient solution.<sup>[26]</sup> In general, planning, organizing, and directing resources should be done in the event of incidents and disasters.<sup>[34]</sup>

In the field of continuing education, five indexes were determined as key indexes of this field. People's education and community readiness are very effective in dealing with disasters and incidents.<sup>[35]</sup> Omidvari and Mansouri in their study have also pointed to the empowerment and reduction of vulnerability of higher education centers through education and the creation of appropriate structures for a higher education center that is consistent with the present study.<sup>[14]</sup> In addition, Bradley *et al.* have emphasized in their study that the needs assessment and holding training courses in the field of disasters for managers and personnel play an important role in increasing the level of organization's readiness. In general, the high awareness of the medical staff can be effective in improving the safety of the organization.<sup>[36]</sup> Educating and increasing the competence of workers, stakeholders, and volunteers in terms of needs assessment as well as holding educational courses for having secure works in this university is necessary.<sup>[37]</sup>

In the student field, indexes of monitoring the dormitory's safety area; determining the status of health, safety, and security of students; and determining the method and scale assessment of complaint and/or error reporting and potential incidents were identified as the main indexes of this area. Student dormitory for many young people is an inadequate substitute for the family's safe environment. Having support and living with the family is one of the most important psychological and emotional needs of all age groups. Hence, the safety of the dormitory management should be on the agenda.<sup>[38]</sup>

In the financial field, five components have been identified as key components of this area. Today, countries are trying to recreate their higher education financing system in a way to realize development objectives even better and more.<sup>[39]</sup> Furthermore, occupational incident insurance is not just a source of compensation for financial losses from incidents, but it can also be used with the proper policy of insurance to prevent abnormal incidents. This requires changing the look of insurance and if necessary preparing and developing new rules and regulations.<sup>[40]</sup>

In the field of information technology, eight indexes were identified as key indexes of this field. Communicating

and informing among organs and people are the first step in disaster planning and management.<sup>[41]</sup> Therefore, the use of an effective system of preventing incidents requires a conscious exposure to the environment and accurate, getting correct, accurate, and up-to-date information. In addition, studies have been conducted on the confidentiality and security of data and information related to patients in the hospital information system; among them, the study by Fernando and Dawson can be mentioned.<sup>[42]</sup>

Five indexes were identified as key indexes of health and safety field.

The health of human resource and friendly environment has an effect on the continuous development, effectiveness, and profitability of organizations. Therefore, any status that can lead to the preservation and protection of these causes actually increases productivity in the organization.<sup>[43]</sup> To improve Health and Safety Executive (HSE) status, it is important to pay attention to some of the features, such as competence history, education, competitive spirit, and environmental knowledge.<sup>[44]</sup> Aksorn and Hadikusumo also explain that factors such as management support, effective program planning, program evaluation, proper monitoring, control system, and safety precautions and teamwork are effective in implementing safety plans.<sup>[45]</sup>

In the field of building, four components were identified as key components of this field. Modern construction laws do not provide sufficient safety for patients in hospitals in different circumstances.<sup>[15]</sup> Therefore, user identification and building regulations provide the minimum requirements for building design and construction and provides balance between the best in safety and economic facilities.<sup>[31]</sup>

In the field of assessing indoor area of building, 13 indexes were identified as key indexes of this field. The safety of the building's indoor area is to provide a series of facilities (in compliance with legal criteria) in the building.<sup>[15]</sup> Indoor area of building helps to secure, improve health conditions and increase the staffs desire. Also, indoor area of building includes the safety of ladders, stairs, floors, ceilings, elevators, and so on.<sup>[32]</sup>

Four indexes were identified as key indexes of the external environment. Nowadays, the complications and injuries to life and property caused by natural disasters and the external environment have a tremendous impact on the lives of humans, to the extent that destructive effects disturb the ability of a society to meet basic needs.<sup>[46]</sup> Therefore, the US government describes the establishment of a plan for health care centers as a starting point for the safety of academic environments

against disasters. In addition to emphasizing the need for the formation of planning groups and crisis advisory committees at universities and flexibility in the programs, the program emphasizes the need for regular review and monitoring.<sup>[47]</sup>

In the area of installations and firefighters, 13 indexes were identified as key indexes of this field. According to the results of Beranek, all fire damage occurs while using safety principles, and 75% of the fires are before prediction and prevention.<sup>[48]</sup> Zamanian *et al.*, in their study, offered solutions such as the fitting of fire hydrants with suitable water pressure, firefighting boxes, existence of firefighting capsules that are controlled and charged periodically and embedded in alarm system, and fire extinguishing and emergency aid boxes to reduce the risks of fire.<sup>[49]</sup>

Finally, six indicators were identified as key indicators of the laboratory area. Each laboratory has risks that may pose a threat to employees, students, and personnel. Occurrence of safety incidents in laboratories may result in secondary outcomes such as loss of reputation and lowering of clients and consequently in incomes, negative impact on employee retention, and rising costs for legal and insurance issues.<sup>[50]</sup> The World Health Organization declared in 2008 that 92 countries lack a comprehensive safety program for clinical laboratories.<sup>[51]</sup>

One of the limitations of the research was the limitations of articles in the field of safety management in the phase of study search. Therefore, researchers tried to increase the thematic scope of the research and used the keywords of risk management and safety management in the study phase to increase the articles and subsequently to increase the search precision. Overall, in the monitoring process and evaluating the quality of articles, only those papers entered the findings that had complete harmony with the scientific definition of safety management.

Furthermore, in this study, the design of SMS in higher education centers has been extracted through a review of the studies, some of the components and dimensions of safety management in higher education centers have not been studied in Iran and in the world, and this has been led to lack of identification of these components in the final pattern.

Thus, it is suggested that key themes of safety management are extracted first through a more comprehensive analysis. Then, the effective components on each key theme are recognized by using the combination of qualitative method such as text survey and interview so that a comprehensive and complete pattern is designed for the safety management at the higher education institutes.

Finally, the findings in the present study can suggest a valid key index for the safety management at the higher education institutes by translating and combining the findings related to the safety management in the world and Iran and to the field of decision-making and action. Generally, widespread studies have been conducted in other countries on the evaluation of safety management at the higher education institutes, but insufficient programming and organization in Iran led to the sporadic studies and no comprehensive model has been suggested for the safety management at the higher education institutes. By implementing the proposed safety management indexes, it is possible to control the accidents beforehand for the higher education institutes and avoid the probable economic, social, and human damages in the time of occurring accidents.

## Conclusion

The SMS is an official framework for safety in performing daily activities that includes safety policy, safety and executive goals, risk assessment, responsibilities and authorities, regulations and procedures, and monitoring and assessment processes. The SMS in various studies is apparently different; however, in fact, they all seek to determine key aspects and indexes for an appropriate assessment of safety management. Therefore, it is imperative that university administrators should set up the system in their higher education centers with command lines and delegated authorities and organizational and legal tools while aware of the dimensions and components of safety management. A safety policy in each organization should be verified and supported by high-level management and the safety goals of the institute should be clear.

Finally, it can be said that safety is not isolated from other matters and is mixed with all human and machine activities, but it is effective and realistic when to be associated with detailed inspection plans and the existence of safety plans, training, exercises, and exercise to incidents and disasters. Therefore, it is suggested that the indexes of safety management are delivered to the beneficiaries, providers, and users of health services at the higher education institutes through a complete reportage. It is also suggested that the list of recognized indexes be updated based on future research and need for higher education institutes.

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## Conflicts of interest

There are no conflicts of interest.

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