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COVID-19 control management in central corona hospitals using SWOT and QSPM matrices: A case study in Kashan central hospitals

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Abstract

Background: During the COVID-19 pandemic, hospitals have been the most important centers for the virus spread. Therefore, this study aimed to evaluate the management of infection control in central corona hospitals in Kashan using the quantitative strategic planning matrix (QSPM) matrix.

Methods: The existing documents studied the strengths, weaknesses, opportunities, and threats of the organization identified by environmental health experts. The internal and external factors were identified as internal factor evaluation (IFE) and external factor evaluation (EFE) matrices, respectively, then, prioritized and weighted. In the next step, the SWOT matrix was formed and the type of used strategy by the organization was determined, and solutions to improve the current situation were presented by experts. Finally, the attractiveness table was compiled and weighted using the QSPM method to prioritize the proposed strategies.

Results: After identifying 25 strengths, 28 weaknesses, 15 opportunities, and 13 threats, weighting was performed, the final score for internal and external factors was 2.6475 and 2.3825, respectively. The final strategy for implementing COVID-19 disease control in the studied hospitals was the Conservative Strategy (WO). Based on this, six control strategies were presented. The priority and attractiveness of each strategy were evaluated using the QSPM matrix. Finally, the strategy of "structuring the system and providing and upgrading the equipment and infrastructure facilities" was implemented as a priority.

Conclusion: According to the results, the combination of SWOT (Strengths, Weaknesses, Opportunities, and Threats) and QSPM methods can play an efficient role in identifying and evaluating the factors affecting the management of the COVID-19 pandemic in hospitals and further developing and prioritizing control strategies for this infectious disease.

Keywords: COVID-19, Environmental health, Hospitals, Research design

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Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was identified in December 2019 in Wuhan, China, among a cluster of patients with unknown viral pneumonia (1). In recent decades, several outbreaks of the coronavirus family have been observed with a wide range of symptoms, including SARS (severe acute respiratory syndrome), MERS (Middle East respiratory syndrome), and recently, COVID-19 (2-5). The prevalence of the disease has been so high that it affected millions of people worldwide (3, 6). The World Health Organization (WHO) declared the COVID-19 pandemic as a public health emergency and an international concern (7). The most significant ways of transmitting the coronavirus are exposure to tiny respiratory droplets caused by sneezing or coughing, contact with an infected person or the patient's blood, secretions, and touching infected surfaces (8-10). The results of studies show that more than 80% of patients has asymptomatic or mild symptoms and less than 20% of patients has acute problems and a serious need for clinical intensive care (2, 11). Therefore, health centers and hospitals were considered as one of the

most important outbreaks of the disease (12), which was evidenced by the disease situation in Iran at the beginning of 2020. Consequently, it is important to pay attention to the implementation of infection prevention and control (IPC) measures in these centers, in the form of engineering and management reforms (13-15). Although several health protocols have been developed by the WHO and CDC to prevent and control COVID-19 for health care workers (16-18), however, due to various problems such as direct contact with infected patients for a long time and deficiency of personal protective equipment (PPE) (19, 20), numerous reports have been published about the corona incidence and death of employees in this field (21-24) that are related to the disease management and control in these centers. Therefore, in order to better understand the issues and problems related to disease control strategies in hospitals, it is necessary to evaluate the measures taken.

The SWOT (Strengths, Weaknesses, Opportunities, and Threats) and quantitative strategic planning matrix (QSPM) matrices can be mentioned among the most efficient methods of analysis and evaluation of organizations. SWOT was initially used to provide an overall systematic analysis of organizations other than health care systems (25, 26), but the usefulness and advantages of this method have led to numerous applications in recent years in health care systems and centers, especially in developing countries such as Pakistan and South Africa (27, 28).

The QSPM matrix is also a popular method for evaluating strategic options and identifying the relative attractiveness of the strategies used in the decision-making phase (29). This matrix help to decision-makers to think more about the weight of factors determined through SWOT and more accurate and in-depth position analysis (30), and attempts to quantify strategies through quantification. By the way, the best strategies should be prioritized (31).

Given the unfavorable situation of the COVID-19 pandemic in the world and the existence of shortcomings and problems related to health management and environmental control of this disease in hospitals, this study aimed to identify and evaluate COVID-19 control strategies in Central Corona Hospitals in 2020.

Materials and Methods

The present study is a descriptive-analytical study using SWOT internal and external environment assessment technique and QSPM. Central corona hospitals in Kashan from February 19 to the end of 2020 were selected as a case study.

Identification of strengths, weaknesses, opportunities, and threats

The first step to assess the current situation was to identify all internal SWOT based on library studies and field surveys (32, 33). Initially, SWOT introductory training and its role in health prevention was conducted for environmental health experts; and an expert team was formed. Then, the weaknesses, strengths, threats, and opportunities were identified by experts in four sessions. According to their thoughts and personal experiences regarding COVID-19 expansion methods and the current situation in the region, they expressed various factors affecting the spread of the virus. Then, these factors were recorded in Excel form.

Compilation of SWOT matrix based on the factors registered

In the first stage, the factors affecting corona emission were classified into four groups of SWOT matrix. Then, internal factor evaluation (IFE) and external factor evaluation (EFE) matrices were evaluated and these items were prioritized based on their importance.

In weighing and determining the degree of importance of the external strategic factors (opportunities and threats) and internal strategic factors (strengths and weaknesses), weight 5 was assigned to the most important factors, and weight 1 was assigned to the least important factors. Then, to normalize the weights determined in the previous step, the importance coefficient of each internal or external factor was changed from a scale of one to five to a scale of zero and one because the sum of the coefficients must be one.

Each internal strategic factor was scored based on a 4-point scale (very strong = 4, strong = 3, weak = 2, and very weak = 1).

In this step, external strategic factors were scored, but with a difference, scoring would be out of control due to the adaptability of the studied unit to factors. In other words, score 4 was assigned to the factors to which the studied unit staff had a very good response, and score 1 was assigned to the factors to which the unit staff had a very weak response.

As a general rule, the rank assigned to the matrix of external factors was between 1 and 4 with an average of 2.5, so that score 4 or 3 was assigned to opportunities and score 2 or 1 was assigned to threats. Subsequently, by multiplying the normalized degree of importance and the determined score, the weighted scores of internal factors (strengths and weaknesses) and external factors (opportunities and threats) were calculated. Finally, if the total score of the internal factors matrix of the organization is less than 2.5, it indicates the weakness of the organization and if it is more than 2.5, it indicates the strength of the organization in terms of internal factors affecting performance. Similarly, in the matrix of external factors, a score lower than 2.5 shows the dominance of threats, and a score higher than 2.5 shows the superiority of opportunities.

Development of control strategies (34-36)

After determining the score of internal and external factors, the type of strategy to improve the situation was determined (Table 1). The strategies are defined as follows:

- SO strategy (offensive; with internal and external factors scores greater than 2.5) that all organizations are interested in being in this position, to be able to take full advantages of external opportunities by taking advantages of internal strengths.
- ST strategy (competitive; internal factors scores greater than 2.5 and external factors scores lower than 2.5), in which the organization uses its internal strengths to deal with external threats.
- WO strategy (conservative; internal factors scores lower than 2.5 and external factors scores higher than 2.5), in which the organization uses external opportunities to compensate for internal weaknesses.
- WT strategy (defensive; with internal and external factors scores lower than 2.5). This situation is risky for the organization, they should try to reduce internal weaknesses and avoid external threats.

Finally, health experts provided effective solutions to eliminate the shortcomings and strengthen the opportunities and strengths of the organization.

Prioritization of strategies with QSPM

The QSPM determines the relative attractiveness of appropriate alternative strategies by examining internal and external factors. Conceptually, QSPM determines the relative attractiveness of different strategies based on the extent to which strengths and opportunities used to address weaknesses and to prevent or reduce threats (37-39).

The attractiveness table was compiled according to the strategies presented by environmental health experts. Thus, the attractiveness score of each strategy was determined according to the importance coefficient of the internal and external factors.

In other words, the attractiveness score was defined as a numerical value that indicates the relative attractiveness of each strategy in a set of strategy options designed according to the importance factor of each factor that ranges from 1 to 4. The total value of the attractiveness score was obtained by multiplying the attractiveness score by the importance coefficient of each internal (IFE) or external factor (EFE) (40, 41). Finally, the prioritization of strategies was determined according to the sum of the total points of each strategy attractiveness.

Priority strategy was done using QSPM matrix. The six established strategic alternatives were determined by the attractiveness score (AS) of each external and internal factor. The interest rate of each element was multiplied by the weight of each element to calculate the total attractiveness score (TAS).

Table 1. SWOT matrix

SWOT	Strengths (S)	Weaknesses (W)
Opportunities (O)	Zone 1 (SO) Aggressive strategies	Zone 3 (WO) Conservative strategies
Threats (T)	Zone 2 (ST) Competitive strategies	Zone 4 (WT) Defensive strategies

Results

The results obtained from the SWOT matrix indicate the existence of 25 strengths, 28 weaknesses, 15 opportunities, and 13 threats in the studied hospitals (Tables 2 and 3).

The results of studies conducted by a team of environmental health experts showed that among 25 effective internal factors, three factors were the preparation and rapid allocation of other treatment spaces for suspected patients with COVID-19, procurement and purchase of ventilators, suction devices, by-pipes, corrugated mattresses and spray pumps by donors, and organizing a training session for staff and interns on how to use personal protection equipment (PPE) in the COVID-19 pandemic with 0.1 points are considered as the most important strengths of this system, and high diversity of industrial, semi-industrial and traditional disinfectant, disinfectant products and the uncertainty of their quality and effectiveness, and the unfavorable condition of hospital ventilation systems with a score of 0.06 are considered as the most important weaknesses of this system.

The results of this study showed that the two factors of implementation of COVID-19 screening plan in households covered by comprehensive community health centers, employment and addition of environmental health and public health workforce from the first days of the crisis, with a score of 0.22 and 0.18, respectively, have the highest weight importance among the external opportunities in the system. However, the lack of complete familiarity with the mechanism of virus activity and the confusion of officials in the methods of dealing with the virus was identified as the most important threats to the organization.

The number 2.3825 obtained from the total IFE matrix scores indicates the predominance of existing weaknesses over the strengths of the hospital under study in the field of COVID-19 disease control management. By the way, the proximity of this number to the average of 2.5 indicates a relatively small difference between the strengths and weaknesses of these medical centers. Furthermore, the number 2.6475 from the EFE matrix indicates that the organization has more opportunities to reduce internal weaknesses and external threats.

According to the results, the final strategy for the implementation of COVID-19 disease control measures in the hospitals is a conservative plan based on reducing weaknesses and using existing opportunities to reduce the

Table 2. Internal factor evaluation matrix

Row	Strengths	Importance Coefficient	Rank (3) and (4)	Points = Weight × Rank
S1	Development of a guide for washing and disinfecting wards to prepare and return to normal condition for admission of non-coronary patients	0.03	3	0.09
S2	Organizing relief forces (municipality, Basij, personal volunteer) to provide relief in the hospital	0.02	3	0.06
S3	Rapid preparation and allocation of other treatment spaces for suspected patients with coronary heart disease	0.025	4	0.1
S4	Daily needs assessment and quotas, division, and segregation of personnel coverage	0.01	3	0.03
S5	Procurement and purchase of ventilators, suction devices, by-pipes, corrugated mattresses, and spray pumps by donors	0.025	4	0.1
S6	Preparing and supervising the process of delivering the patients' food by the patients' family	0.015	3	0.045
S7	Collecting information and statistics related to activities and reflecting to the relevant authorities	0.025	3	0.075
S8	Pursuing the supply of manpower required for health services	0.02	4	0.08
S9	Coordinating with representatives and officials of charities to estimate and meet the needs	0.02	4	0.08
S10	Increasing the capacity of the oxygen output to twice the initial capacity	0.015	3	0.045
S11	Activity and online availability of ICS chart people	0.015	4	0.06
S12	Permanent presence of the boss and manager and matrons and encouraging the forces	0.015	4	0.06
S13	Communication and coordination of hospital officials with the network representative	0.025	3	0.075
S14	Control and supervision of infection control	0.03	3	0.09
S15	Installation of HEPA filter after exit (exhaust) in hospital wards	0.02	3	0.06
S16	Training on hygiene and infection control for volunteers and relief workers	0.02	3	0.06
S17	Do not allowing the patients enter the hospital	0.015	3	0.045
S18	The way the distributed security packages are used (monitoring)	0.015	3	0.045
S19	Daily monitoring of environmental disinfection and tools and equipment	0.03	3	0.09
S20	Supervising hospital waste management	0.025	3	0.075
S21	Use of flu outbreak experiences in December	0.015	3	0.045
S22	Holding a briefing training session for staff and interns on how to use personal protection equipment in the COVID-19 pandemic	0.025	4	0.1
S23	Establishment of a joint crisis headquarters and follow-up of approvals by the officials	0.02	3	0.06
S24	Presence of a network representative in the hospital to manage the relief forces	0.0125	1	0.0125
S25	Existence of specialists, nurses, caring and interested forces	0.0125	4	0.05
Row	**Weaknesses**	**Importance Coefficient**	**Rank (1) and (2)**	**Points = Weight × Rank**
W1	Non-compliance with the protocol of returning personnel involved to work due to the impossibility of performing serological tests and PCR in the crisis	0.02	2	0.04
W2	Impossibility of crushing protective clothing by a safety device	0.01	1	0.01
W3	Lack of health care for Central Corona Hospital	0.015	1	0.015
W4	Abuse and absence of some colleagues in the hospital and receiving treatment without having medical documents	0.01	1	0.01
W5	Various industrial, traditional, and semi-industrial disinfectants and disinfection products, as well as lack of trust and confidence in them	0.03	2	0.06
W6	Lack of timely access and information of health and medical operations staff of instructions, guidelines and protocols	0.015	2	0.03
W7	Lack of work plan and documentation group (poor public communication of ICS chart)	0.01	1	0.01
W8	Lack of protective equipment in the early days of the outbreak of COVID-19 and its low quality	0.03	1	0.03
W9	Traffic of wearing special protective clothing by personnel in the corona section compared to other sections	0.02	2	0.04
W10	Lack of and challenge in preparing and delivering consumer clothes in terms of size, material, and quality	0.015	2	0.03
W11	Lack of medical equipment (suction, ventilator, anesthesia, and respiratory bypass)	0.01	1	0.01
W12	Lack of support and cooperation between some medical staff	0.01	1	0.01
W13	Use of inappropriate and warm clothes (causing fatigue and colds)	0.02	2	0.04

Table 2. Continued

Row	Weaknesses	Importance Coefficient	Rank (1) and (2)	Points = Weight × Rank
W14	More and more shortage of service personnel in crisis conditions than usual	0.02	1	0.02
W15	The challenge of announcing the death of a patient to companions (sometimes immediately after admission)	0.01	1	0.01
W16	Improper position of locker room (to change the clothes of medical and relief staff)	0.015	1	0.015
W17	Being disincentive due to unfair distribution of corona rewards	0.015	2	0.03
W18	A sudden and surprising increase in the number of patients with the disease	0.025	2	0.05
W19	Lack of cold storage and facilities and storage space for corpses	0.02	1	0.02
W20	Inadequate support for hospital environmental health issues	0.015	1	0.015
W21	Impossibility of proper triage in the hospital	0.02	2	0.04
W22	Non-standard N95 masks	0.02	1	0.02
W23	Unfavorable condition of the ventilation system	0.03	2	0.06
W24	Lack of bathing facilities for all forces	0.015	1	0.015
W25	Joint admission of patients and staff and companions in central corona hospital	0.025	2	0.05
W26	Lack of accurate estimation and purchase of personal protective equipment for the hospital depot despite the approvals of the Crisis Committee	0.015	1	0.015
W27	Failure to implement the decisions of the Crisis Committee at the beginning of the crisis and not taking seriously the depth of the incident by the authorities	0.025	1	0.025
W28	Delayed formation of the crisis headquarters and lack of sufficient sensitivity in the officials and forces at the beginning of the crisis	0.015	2	0.03
	Total	**1**		**2.3825**

vulnerability caused by threats (Figure 1). Therefore, in the formulation of strategies, the extraction of conservative plans (WO) was a priority.

After determining the strategic position of hospitals in the matrix of evaluation of internal and external factors, in the integration phase, an attempt was made to introduce efficient strategies to improve the existing situation using Tables 1 and 2. The list of the selected plans based on the SWOT analysis includes the following six items:

Preparation and promotion of health education instructions for all groups

1. Structuring the system and preparation and upgrading of equipment and infrastructure facilities

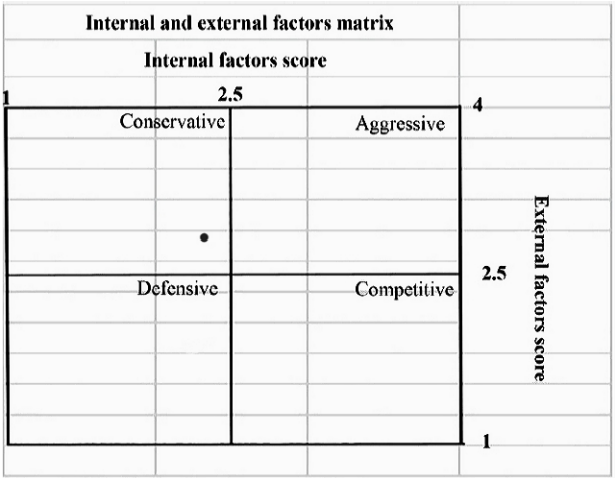

Figure 1. Strategic position of Corona hospitals affiliated to Kashan University of Medical Sciences.

2. Upgrading the system of continuous monitoring and monitoring of environmental health
3. Development and improvement of external cooperation
4. Pursuing the establishment and development of remote control systems
5. Preparation of operating instructions in medical centers

To prioritize and determine the most effective corona control management strategy, six selected strategies according to the strengths, weaknesses, opportunities, and threats identified in the SWOT method, were weighted by environmental health experts using the QSPM matrix and the degree of attractiveness. The results are presented in Table 4.

According to the results of the total attractiveness scores of each of the presented strategies, the structuring of the system, the provision, upgrading of equipment and infrastructure facilities with 6.82 point were determined as the most important plan. Based on the attractiveness score obtained, the priority of the strategies presented is shown in Table 5.

Discussion

Over the past two decades, several viral diseases including SARS-CoV-1 in 2003, MERS-CoV in 2012, Ebola and Zika viruses in 2014, and the SARS-CoV-2 in 2019 have been spread worldwide (42-45). Following the prevalence of COVID-19 in the world, hospitals have had a potential contribution to the transmission of infection to health

Table 3. External factor evaluation matrix

Row	Opportunities	Importance Coefficient	Rank (3) and (4)	Points = Weight × Rank
O1	Donation of medical equipment (by Pep) by Isfahan Heart and Radiology Association	0.025	3	0.075
O2	Delivery of antiseptics and disinfectants from popular groups (Health Soldiers Campaign)	0.035	4	0.14
O3	Cooperation of the laboratory of the Faculty of Health in approving or rejecting solutions and disinfection and disinfection devices	0.035	3	0.105
O4	Employment and addition of environmental health forces and public health forces from the first days of the crisis	0.045	4	0.18
O5	Deployment and presence of support staff of Kargarnejad and Matini hospitals	0.03	3	0.09
O6	Honorary presence of anesthesiologists from hospitals in other provinces	0.0325	4	0.13
O7	Use of private sector radiology and central laboratory	0.0325	3	0.0975
O8	Presence of relief forces for environmental disinfection	0.04	4	0.16
O9	Cooperation of the city health center for environmental disinfection	0.02	3	0.06
O10	Employment of free nursing staff	0.03	4	0.12
O11	Delivery of donated food from charity centers	0.02	3	0.06
O12	Use of Samen Hospital equipment (under construction) for Seyed Al-Shohada Central Hospital	0.04	3	0.12
O13	Existence of interested health donors and their favorable cooperation in all hospital procedures	0.03	4	0.12
O14	Implementation of COVID-19 screening plan in households covered by comprehensive health service centers	0.055	4	0.22
O15	Existence of students interested in helping in this situation	0.03	3	0.09
Row	**Threats**	**Importance Coefficient**	**Rank (1) and (2)**	**Points = Weight × Rank**
T1	Requesting information and statistics by a large number of references	0.02	2	0.04
T2	Lack of organized and correct process of selection and training of relief forces, especially Basij	0.015	2	0.03
T3	Leaving masks and personal protective equipment on the hospital grounds	0.015	1	0.015
T4	Neglecting to cut the transmission chain and continuing the activity of passenger vehicles with maximum capacity from neighboring cities (Corona Center)	0.02	1	0.02
T5	Prolonging the correct decision-making process in managers in disease prevention	0.025	2	0.05
T6	Late formation of the prevention working group at the university	0.03	2	0.06
T7	Prolonging the process of justifying city and provincial managers	0.05	2	0.1
T8	Lack of complete familiarity with the function of the virus and the confusion of the authorities in the methods of dealing with the virus	0.07	2	0.14
T9	Late school closures and an increase in the number of patients in the hospital	0.05	1	0.05
T10	Various changes and variations in the instructions sent by the Ministry and confusion of specialists and experts	0.045	2	0.09
T11	Impossibility of communicating with the forces and holding training sessions	0.055	2	0.11
T12	Poor cooperation of some organs in corona prevention	0.04	1	0.4
T13	Low attitudes and beliefs about the dangers and importance of the disease	0.065	1	0.065
	Total	**1**		**2.6475**

care workers, and thus, the spread of the disease in the community (46, 47). Reports indicate that transmission of SARS-CoV-2 to human beings has been confirmed by 15 health professionals after close contact with patients at Wuhan hospital (48). Jin et al found that 84.5% of those surveyed in a study of infection transmission pathways, control measures, and psychosocial changes in COVID-19-infected health care workers in Wuhan, China, were infected at work in the hospital (49). This indicates the great importance of hospital settings in transmitting infection during the corona crisis. Therefore, this study was conducted to evaluate corona control management in hospitals.

The results of the present study showed that the strategy of the two hospitals to control the virus and infection is a conservative strategy that indicates the predominance of internal weaknesses and external opportunities of the organization. One of the main strengths identified in this study is the rapid preparation and allocation of other treatment spaces for suspected patients with coronavirus disease. Changing the use and transformation of hospitals during the outbreak of COVID-19 and allocating separate hospitals and wards to admit these patients in South Korea were among the effective strategies to control the infection (50). Knowledge and skills training to prevent and control COVID-19 are very important for health care providers

Table 4. Quantitative planning matrix in strategic planning

Internal and External Factors		The Importance Coefficient	Strategies											
			Strategy 1		Strategy 2		Strategy 3		Strategy 4		Strategy 5		Strategy 6	
			AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS
Strengths	S1	0.03	3.874	0.11622	3.8	0.114	3.531	0.10593	3.62	0.1086	3.265	0.09795	3.12	0.0936
	S2	0.02	3.28	0.0656	3.25	0.065	2.37	0.0474	2.68	0.0536	2.65	0.053	2.67	0.0534
	S3	0.025	3.45	0.08625	3.398	0.08495	2.961	0.074025	2.871	0.071775	2.71	0.06775	2.808	0.0702
	S4	0.01	2.39	0.0239	2.95	0.0295	2.18	0.0218	2.364	0.02364	1.65	0.0165	1.53	0.0153
	S5	0.025	3.187	0.079675	3.5	0.0875	3.264	0.0816	2.98	0.0745	2.6	0.065	2.69	0.06725
	S6	0.015	2.64	0.0396	3.44	0.0516	2.503	0.037545	2.846	0.04269	1.987	0.029805	1.4	0.021
	S7	0.025	3.16	0.079	2.872	0.0718	3.28	0.082	3.265	0.081625	2.543	0.063575	2.55	0.06375
	S8	0.02	2.435	0.0487	2.67	0.0534	3.105	0.0621	3.0124	0.060248	2.317	0.04634	2.5	0.05
	S9	0.02	2.605	0.0521	2.804	0.05608	3.014	0.06028	2.92	0.0584	2.605	0.0521	2.22	0.0444
	S10	0.015	1.5	0.0225	2.431	0.036465	2.71	0.04065	2.782	0.04173	2.341	0.035115	1.64	0.0246
	S11	0.015	1.785	0.026775	2.96	0.0444	2.67	0.04005	2.462	0.03693	2.6	0.039	1.37	0.02055
	S12	0.015	2.435	0.036525	3.12	0.0468	2.364	0.03546	2.364	0.03546	2.56	0.0384	1.66	0.0249
	S13	0.025	2.989	0.074725	3.48	0.087	2.813	0.070325	3.45	0.08625	2.78	0.0695	2.51	0.06275
	S14	0.03	3/542	0.10626	3.65	0.1095	3.22	0.0966	3.62	0.1086	3.29	0.0987	2.98	0.0894
	S15	0.02	2.653	0.05306	2.785	0.0557	2.98	0.0596	3.025	0.0605	2.635	0.0527	2.536	0.05072
	S16	0.02	1.754	0.03508	3.209	0.06418	2.803	0.05606	3.14	0.0628	2.605	0.0521	2.4	0.048
	S17	0.015	1.681	0.025215	2.836	0.04254	2.53	0.03795	3.236	0.04854	2.321	0.034815	2.203	0.033045
	S18	0.015	2.105	0.031575	2.918	0.04377	2.461	0.036915	3.105	0.046575	2.361	0.035415	2.11	0.03165
	S19	0.03	3.48	0.1044	3.815	0.11445	3.29	0.0987	3.458	0.10374	3.212	0.09636	3.15	0.0945
	S20	0.025	2.646	0.06615	3.581	0.089525	3.15	0.07875	3.452	0.0863	2.485	0.062125	2.776	0.0694
	S21	0.015	1.88	0.0282	2.74	0.0411	2.362	0.03543	2.961	0.044415	1.965	0.029475	2.635	0.039525
	S22	0.025	2.793	0.069825	3.361	0.084025	3.21	0.08025	3.326	0.08315	2.58	0.0645	1.45	0.03625
	S23	0.02	2.453	0.04906	3.29	0.0658	2.847	0.05694	2.486	0.04972	2.452	0.04904	1.51	0.0302
	S24	0.0125	1.354	0.016925	2.58	0.03225	2.314	0.028925	1.987	0.0248375	1.69	0.021125	1.29	0.016125
	S25	0.0125	1.205	0.0150625	2.687	0.0335875	2.37	0.029625	2.34	0.02925	1.5	0.01875	1.224	0.0153

Table 4. Continued

Internal and External Factors		The Importance Coefficient	Strategies											
			Strategy 1		Strategy 2		Strategy 3		Strategy 4		Strategy 5		Strategy 6	
			AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS
Weaknesses	W1	0.02	2.534	0.05068	3.41	0.0682	2.818	0.05636	2.652	0.05304	2.556	0.05112	2.87	0.0574
	W2	0.01	1.63	0.0163	2.03	0.0203	2.115	0.02115	2.364	0.02364	1.356	0.01356	1.05	0.0105
	W3	0.015	1.985	0.029775	2.47	0.03705	2.225	0.033375	2.843	0.042645	1.852	0.02778	1.487	0.022305
	W4	0.01	1.25	0.0125	2.36	0.0236	2.173	0.02173	2.165	0.02165	1.156	0.01156	1.214	0.01214
	W5	0.03	3.69	0.1107	3.42	0.1026	3.254	0.09762	3.75	0.1125	3.171	0.09513	3.41	0.1023
	W6	0.015	2.817	0.042255	2.14	0.0321	2.195	0.032925	2.697	0.040455	1.88	0.0282	1.95	0.02925
	W7	0.01	1.415	0.01415	1.6	0.016	1.609	0.01609	2.892	0.02892	1.452	0.01452	1.5	0.015
	W8	0.03	3.682	0.11046	3.68	0.1104	3.56	0.1068	3.89	0.1167	3.21	0.0963	3.231	0.09693
	W9	0.02	2.62	0.0524	2.431	0.04862	2.884	0.05768	3.25	0.065	2.785	0.0557	2.47	0.0494
	W10	0.015	2.314	0.03471	2.289	0.034335	2.317	0.034755	3.015	0.045225	2.564	0.03846	2.3	0.0345
	W11	0.01	1.64	0.0164	1.99	0.0199	2.394	0.02394	2.42	0.0242	1.896	0.01896	1.92	0.0192
	W12	0.01	1.85	0.0185	1.869	0.01869	2.07	0.0207	2.98	0.0298	2.057	0.02057	1.451	0.01451
	W13	0.02	2.87	0.0574	2.55	0.051	2.85	0.057	2.452	0.04904	2.891	0.05782	2.36	0.0472
	W14	0.02	3.15	0.063	2.43	0.0486	3.08	0.0616	3.045	0.0609	2.8	0.056	2.55	0.051
	W15	0.01	2.209	0.02209	2.69	0.0269	1.978	0.01978	2.456	0.02456	2.502	0.02502	1.406	0.01406
	W16	0.015	2.95	0.04425	2.745	0.041175	2.546	0.03819	2.803	0.042045	2.644	0.03966	1.802	0.02703
	W17	0.015	2.94	0.0441	2.71	0.04065	2.67	0.04005	2.438	0.03657	2.725	0.040875	2.05	0.03075
	W18	0.025	3.286	0.08215	3.512	0.0878	3.13	0.07825	2.943	0.073575	3.15	0.07875	2.912	0.0728
	W19	0.02	2.93	0.0586	3.1	0.062	2.7	0.054	2.823	0.05646	3.02	0.0604	2.54	0.0508
	W20	0.015	2.84	0.0426	2.378	0.03567	2.089	0.031335	2.943	0.044145	2.97	0.04455	2.449	0.036735
	W21	0.02	3.61	0.0722	2.648	0.05296	2.48	0.0496	3.102	0.06204	3.1	0.062	2.843	0.05686
	W22	0.02	3.542	0.07084	3.14	0.0628	2.39	0.0478	3.261	0.06522	3.06	0.0612	2.64	0.0528
	W23	0.03	4	0.12	3.66	0.1098	3.597	0.10791	3.566	0.10698	3.212	0.09636	3.381	0.10143
	W24	0.015	3.29	0.04935	2.603	0.039045	2.26	0.0339	2.889	0.043335	2.9	0.0435	1.65	0.02475
	W25	0.025	3.43	0.08575	3.26	0.0815	3.194	0.07985	3.264	0.0816	3.054	0.07635	2.699	0.067475
	W26	0.015	2.689	0.040335	2.712	0.04068	2.489	0.037335	3.423	0.051345	2.5	0.0375	2.13	0.03195
	W27	0.025	3.145	0.078625	3.42	0.0855	2.942	0.07355	2.69	0.06725	3.04	0.076	2.48	0.062
	W28	0.015	2.94	0.0441	2.74	0.0411	2.302	0.03453	3.16	0.0474	3.1	0.0465	2.63	0.03945

Table 4. Continued

Internal and External Factors		The Importance Coefficient	Strategies											
			Strategy 1		Strategy 2		Strategy 3		Strategy 4		Strategy 5		Strategy 6	
			AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS
Opportunities	O1	0.025	3.28	0.082	3.31	0.08275	3.231	0.080775	3.77	0.09425	2.508	0.0627	2.986	0.07465
	O2	0.035	3.784	0.13244	3.87	0.13545	3.604	0.12614	3.841	0.134435	3.095	0.108325	3.47	0.12145
	O3	0.035	3.878	0.13573	3.84	0.1344	3.48	0.1218	3.565	0.124775	3.17	0.11095	3.5	0.1225
	O4	0.045	4	0.18	4	0.18	3.823	0.172035	4	0.18	3.36	0.1512	3.706	0.16677
	O5	0.03	3.45	0.1035	3.7	0.111	3.47	0.1041	3.44	0.1032	2.9	0.087	3.28	0.0984
	O6	0.0325	3.71	0.120575	3.83	0.124475	3.55	0.115375	3.569	0.1159925	3.1	0.10075	3.59	0.116675
	O7	0.0325	3.79	0.123175	3.78	0.12285	3.586	0.116545	3.478	0.113035	3.15	0.102375	3.641	0.1183325
	O8	0.04	3.935	0.1574	4	0.16	3.9	0.156	3.98	0.1592	3.45	0.138	3.85	0.154
	O9	0.02	2.88	0.0576	2.864	0.05728	2.594	0.05188	3.78	0.0756	2.85	0.057	2.806	0.05612
	O10	0.03	3.49	0.1047	3.541	0.10623	3.36	0.1008	3.366	0.10098	3.259	0.09777	3.307	0.09921
	O11	0.02	3.36	0.0672	3.371	0.06742	2.61	0.0522	2.951	0.05902	2.826	0.05652	3.09	0.0618
	O12	0.04	3.94	0.1576	4	0.16	3.8	0.152	3.716	0.14864	3.23	0.1292	3.9	0.156
	O13	0.03	3.54	0.1062	3.68	0.1104	3.27	0.0981	3.468	0.10404	3.11	0.0933	3.7	0.111
	O14	0.055	3.66	0.2013	4	0.22	4	0.22	4	0.22	3.5	0.1925	3.98	0.2189
	O15	0.03	3.654	0.10962	3.402	0.10206	3.312	0.09936	3.365	0.10095	3.01	0.0903	3.109	0.09327
Threats	T1	0.02	2.68	0.0536	3.33	0.0666	2.4	0.048	2.364	0.04728	2.6	0.052	2.569	0.05138
	T2	0.015	2.41	0.03615	3.363	0.050445	2.374	0.03561	2.861	0.042915	2.44	0.0366	2.41	0.03615
	T3	0.015	3.6	0.054	2.871	0.043065	2.5	0.0375	2.961	0.044415	2.556	0.03834	2.36	0.0354
	T4	0.02	3.46	0.0692	3.27	0.0654	2.84	0.0568	3.0983	0.061966	2.878	0.05756	2.671	0.05342
	T5	0.025	3.254	0.08135	3.46	0.0865	3.078	0.07695	3.298	0.08245	2.934	0.07335	2.807	0.070175
	T6	0.03	3.752	0.11256	3.85	0.1155	3.291	0.09873	3.599	0.10797	3.02	0.0906	3.25	0.0975
	T7	0.05	3.964	0.1982	3.86	0.193	3.603	0.18015	3.984	0.1992	3.689	0.18445	3.64	0.182
	T8	0.07	4	0.28	4	0.28	4	0.28	4	0.28	3.997	0.27979	4	0.28
	T9	0.05	3.938	0.1969	3.99	0.1995	3.754	0.1877	3.998	0.1999	3.51	0.1755	3.621	0.18105
	T10	0.045	3.887	0.174915	3.846	0.17307	3.607	0.162315	3.684	0.16578	3.41	0.15345	3.501	0.157545
	T11	0.055	3.97	0.21835	4	0.22	3.762	0.20691	3.98	0.2189	3.86	0.2123	3.7	0.2035
	T12	0.04	3.74	0.1496	3.809	0.15236	3.5	0.14	3.466	0.13864	3.405	0.1362	3.32	0.1328
	T13	0.065	4	0.26	4	0.26	3.98	0.2587	4	0.26	3.8	0.247	3.9	0.2535

AS, attractiveness score; TAS, total attractiveness score.

Table 5. Priority of the selected strategies

Row	Selected strategy	Attractiveness score	Priority
1	Preparation and promotion of health educational instructions for all groups	6.56	3
2	System structuring and procurement and upgrading of equipment and infrastructure facilities	6.82	1
3	Upgrading the system of continuous monitoring and monitoring of environmental health	6.35	4
4	Development and improvement of outsourcing cooperation	6.72	2
5	Tracking the deployment and development of remote control systems	5.97	5
6	Preparation of operational instructions in medical centers	5.89	6

(51). Therefore, to deal with the SARS-CoV-2 pandemic for a long time and the subsequent occurrence of public health emergencies in the future, it will be necessary to provide adequate training on how to use PPE (52, 53). Organizing briefings for staff and interns to learn how to use PPE in the COVID-19 pandemic is another strength of this organization that could be mentioned.

The results of a study conducted in a teaching hospital located in Italy show that after providing adequate training to hospital staff on the importance of disinfectants in the treatment environment, hand hygiene, and the use of PPE, the quality of their performance increased during the COVID-19 crisis (54). Analyses to identify strengths, weaknesses, opportunities, and threats at a hospital in Bolu, Turkey, indicate that occupational health and infection training courses are among the strengths identified at the hospital (55), which is consistent with the results of the present study. According to studies, contaminated surfaces can be a potential source of coronavirus transmission (56, 57). Disinfection of the surfaces of health centers has an effective role in breaking the chain of disease transmission to health care workers and other patients admitted to these centers (58). However, the high diversity of industrial, semi-industrial, and traditional disinfectant products and disinfectants can lead to uncertainty about their quality and effectiveness, which is one of the weaknesses identified in this study. The ability of a disinfectant to inactivate microbes depends on how the chemical acts, the molecular structure of the pathogen's surface, and intracellular vulnerability (59). The results of several studies indicate that chemical disinfectants were effective in reducing SARS-CoV-2 levels (60, 61). Therefore, the lack of quality of these products can lead to the transmission of as much COVID-19 as possible. In addition, the unfavorable condition of hospital ventilation systems can be considered as one of the most important weaknesses of this study.

Evaluation of hospital performance in Turkey during the COVID-19 pandemic using SWOT analysis showed that the lack of technical and mechanical infrastructure such as inadequate hospital ventilation is one of the weaknesses of this system (55). Other studies also confirm the airborne transmission of the Coronavirus and the role of air conditioning systems and the use of air filters in reducing the incidence of the disease (62-64). The analysis showed that the two factors of the implementation of the COVID-19 screening plan in households covered by comprehensive health services centers and the employment and addition of environmental health and public health experts in the first days of the crisis are the most important external opportunities of the system.

Evaluation of the performance of South Korean hospitals during the COVID-19 pandemic showed that the establishment of special teams for COVID-19 and extensive screening to identify patients and accurately track patients are considered as the essential points in controlling the pandemic (50). These cases are in line with the measures taken in Turkey (55). However, at the beginning of the outbreak of the disease, the lack of complete familiarity with the mechanism of the virus and the confusion of officials in the methods of counteracting the coronavirus caused some inconsistencies in the benefit and control of the disease, which is a threat to this system. Furthermore, according to the results of the sum of attractiveness scores of each of the proposed strategies to eliminate the existing shortcomings, the structuring of the system and the provision and upgrading of equipment and infrastructure facilities were determined as the most important strategy. According to the studies, materials and devices can play a significant role in providing better services and more effective disease control (55, 65).

Conclusion

Based on the results of this study, the SWOT strategy for corona hospitals affiliated with Kashan University of Medical Sciences is conservative (WO). The most important weaknesses identified were the high variety of disinfectants and disinfectant products available in the market, the uncertainty of their quality, and the unfavorable condition of hospital ventilation systems. The cooperation of the health college laboratory and the support of the relief forces of other organs as points of opportunity play an important role in reducing the weaknesses. Considering the total attractiveness scores of six strategies determined to deal with the existing defects, it was found that the structuring of the system and the provision and upgrade of infrastructure equipment and facilities have the highest score. As a result, it has a higher priority than other items. According to the results obtained in the whole program, the combination of

SWOT and QSPM methods has a good performance in identifying, summarizing, and combining the effective factors in controlling health crises and further developing infection and virus management strategies.

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Ethical issues

This article was extracted from a plan approved by the Environmental Health Department, Deputy of Health, Kashan University of Medical Sciences (Approval code: 400035), and the Ethics Committee of Kashan University of Medical Sciences (Ethical code: IR.KAUMS.NUHEPM.REC.1400.024).

Competing interests

The authors declare that they have no conflict of interests.

Authors' contributions

All authors contributed equally to the data collection, analysis, and interpretation. All authors critically reviewed, refined, and approved the manuscript.

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