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An investigation into resilience strategies in the medical tourism supply chain

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ABSTRACT

The present study has adopted a mixed method approach to investigate the risks occurring in the supply chain for Iranian medical tourism, and suggests resilience strategies for their prevention and improvements to the current situation. The participants were experts in the medical tourism supply chain chosen via purposive and snowball sampling. The results obtained via thematic analysis of interviews, as well as failure modes and effects analysis (FMEA) and failure analysis after occurrence (FAAO) techniques, led to identifying 75 risks which were classified into five major categories: supply, demand, internal, external and supply chain management risks. Additionally, a literature review and interview results revealed several resilience strategies categorized as pre-risk coping or post-risk recovery strategies for tackling the risks. Furthermore, the resilience number of the medical tourism supply chain increased from 0.4 (pre-risk occurrence) to 0.5 (post-risk occurrence). Implications and suggestions for future research are presented.

KEYWORDS

coping strategies, medical tourism supply chain, recovery strategies, supply chain resilience, supply chain risks

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1. Introduction

Tourism, which is defined as travelling outside one's place of residence for different purposes such as business or entertainment for at least one night (Bovy & Stern, 1990), has evolved and modernized remarkably over recent decades (Andrades & Dimanche, 2017; Liu et al., 2017). Tourism is currently considered as one of the top 10 industries in the world since it plays an undeniably important role in generating considerable income and foreign exchange for governments (Burke, 2018; Ghaderi et al., 2018; Jones & Wynn, 2019; Okafor et al., 2022).

Medical tourism as an important type refers to travelling outside one's country to receive treatments which are not available in one's own (Habibi et al., 2022). As a growing global phenomenon and a significant branch of tourism, medical tourism has recently

attracted considerable attention by both academia and professionals (de la Hoz-Correa et al., 2018) due to several reasons including, but not limited to, destination appeal and culture (Campra et al., 2022), technological developments, increased waiting time for receiving medical treatments in developed countries, the low cost of medical services in developing countries, and international exchange rates (Gholami et al., 2020).

Tourism supply chains cover a wide range including restaurants, hotels and travel agencies which aim to efficiently fulfil tourists' expectations (Ahmadimanesh et al., 2019). Coordination among these is considered as a very valuable competitive advantage, therefore managing supply chains could help organize and coordinate their operations (Mandal & Saravanan, 2019). Previous studies have found many challenges in medical tourism supply chains including limitations relating to physical infrastructure (Vishnu et al., 2020) and medicine supply (Jaberidoost et al., 2013), the competence of the medical staff (Ahmadimanesh et al., 2019), environmental disasters (Lubowiecki-Vikuk et al., 2023), medical errors, patients' safety (Farrokhvar, 2013) and intellectual property (Vishnu & Regikumar, 2016). These challenges could cause serious problems for reducing expenses and promoting tourism sustainability, which can consequently cause risks and negatively affect the efficiency and competitive advantage of this business.

A considerable body of empirical research has focused on risk management in supply chains (e.g. Fan & Stevenson, 2018; Pfohl et al., 2011; Pournader et al., 2020; Rao & Goldsby, 2009). However, although risks in supply chains for medical tourism have negatively influenced the health system economy by neglecting infrastructure and natural resources, as well as reducing job opportunities, the number of foreign tourists and contribution to gross domestic product (GDP) (Doshmangir et al., 2018), they have received considerably less research attention vis-à-vis risks from other supply chains (e.g. production). Therefore, it is highly essential to take into account these risks and propose useful effective resilience strategies so as to improve the quality of health care (Bauer, 2017), generate more foreign exchange, create a better trade balance and promote medical tourism (Ramirez de Arellano, 2011).

Given the utmost importance of risks in the medical tourism supply chain, several studies have meticulously examined them and offered practical and constructive solutions. For example, some works have identified the major risks in the supply chains (e.g. Kumar et al., 2019; Silva et al., 2020). Another line of research has gone further by not only identifying the risks but also providing some general classifications (e.g. Elleuch et al., 2014; Vishwakarma et al., 2016). In addition, others have considered the risks and threats and offered strategies and measures for controlling them (e.g. Tukamuhabwa Rwakira, 2015; Wang, 2018). A careful review of the literature indicates that few studies have proposed a detailed classification of the risks identified (e.g. Raja Sreedharan et al., 2019; Vishnu et al., 2020) and, to the best of our knowledge, empirical literature on efficient coping and recovery strategies is still in its infancy. Therefore, the present study focuses on the medical tourism supply chain in Iran, as a popular destination for medical purposes, and identifies the existing risks. The resilience strategies used by different components of the supply chain are also explored and other potentially useful strategies are suggested.

2. Literature review

2.1. Medical tourism

Medical tourism, which refers to national and international trips made for medical purposes (Büyüközkan et al., 2021), using regular tourism services (Loh, 2015), consists of two key parts, namely, tourism and medicine. The tourism part includes components such as hotels, travel agencies, transportation companies and airlines (Kaczmarek et al., 2021). The medical element includes components such as hospitals as well as medical, facilitator and insurance companies (Secundo et al., 2019). This type of tourism is a highly profitable, economic activity based on the integrated services of the medical and tourism sectors (Momeni et al., 2018) to provide health care with the best quality, lowest cost and minimum waiting time for patients (Nikraftar et al., 2016).

Recent research indicates that lack of attention to educating professional physicians, investing in medical infrastructure, building modern clinics and hospitals, providing advanced medical equipment, and monitoring medical regulations can result in serious risks to supply chains (Davoudi & Hasanabadi, 2020). In addition, risks could be created by global economic crises and terrorist attacks (Paraskevas & Arendell, 2007). These can in turn lead to a significant decrease in tourism demand and negatively influence businesses (Jiang et al., 2019), therefore, supply chains in medical tourism are very susceptible to a wide range of risks from different sources.

2.2. Resilience in supply chains

Previous research has shown that risks can have destructive effects on supply chains (e.g. de Souza et al., 2019). Businesses can use resilience strategies to reduce the possibility of encountering risks and disruption as

well as how to overcome them, which may in turn help businesses return to a sustainable state (Hall et al., 2023; Senbeto & Hon, 2020). Resilience strategies help supply chains become more responsible and improve a situation when unexpected events are encountered. As Sharma et al. (2021) maintain these strategies require attention to be paid to coordination, crisis management techniques, constructive relationships among all stakeholders, a supportive network, identification of risks and opportunities, and effective interventions.

Resilience in a supply chain can be defined as its ability to prepare for and adapt to unexpected events as well as respond to and recover from disruptions by keeping operations at a desirable level while controlling structure and function (Ali et al., 2017). Depending on when supply chains take measures to deal with risks, resilience strategies could be classified as either coping or recovery (Hohenstein et al., 2015). Coping strategies are specific behavioral efforts for preventing, controlling, tolerating, reducing or minimizing unexpected, stressful events (Folkman & Lazarus, 1980). Accordingly, there are three categories of coping strategy: assertive coping, avoidance and adaptive coping, which could be used based on the condition of an organization (Webster et al., 2016). A significant body of research has shown that these strategies could help prevent the occurrence of disruptions (Meneghel et al., 2019).

After the occurrence of a risk, supply chains must be resilient and able to quickly turn around by using recovery strategies. More specifically, they can use their resources to respond to risks and disruptions as soon as they occur or take effective measures in the long run which could help them stabilize and return to a sustainable condition (Scholten et al., 2014). Recovery strategies include remanufacturing, repurposing, repairing, reconditioning, cannibalization, redesigning, refurbishing and recycling services and products (Thierry et al., 1995).

Given that risks can inflict irreversible damage to industries and supply chains (Ritchie & Jiang, 2019; Truong Quang & Hara, 2017), it is vital to identify them and propose effective coping and recovery strategies. A review of the literature indicates that little attention has been paid to risks and strategies in medical tourism. Hence, the present study aims to address this research gap by identifying the risks relating to the medical tourism supply chain in Iran and examining different coping and recovery strategies to deal with them. The risks in the supply chain have reduced the number of medical tourists in some time periods, and this can justify the significance of focusing on resilience strategies. The findings of the present study could be beneficial for Iran and possibly other countries by suggesting practical strategies for enhancing resilience.

The current study was guided by the following research questions (RQs) relating to the hospital in this study:

RQ_1: What are the risks in the medical tourism supply chain?

RQ_2: How could these risks be classified?

RQ_3: What coping strategies are used in the medical tourism supply chain?

RQ_4: What is the resilience number before the occurrence of the risks?

RQ_5: What recovery strategies are used in the medical tourism supply chain?

RQ_6: What is the resilience number after the occurrence of the risks?

3. Methods

The statistical population of the present study is the supply chain for medical tourism in Iran. A total of 18 experts in this supply chain were selected through purposive and snowball sampling. The inclusion criteria were having either an academic degree in management or at least five years of experience in this field. Detailed information about the participants (e.g. gender, age, academic degree, organizational position and working area) can be found in Appendix A. In addition, since the customers are considered as an integral part of the supply chain, their opinions were also checked by referring to the results of surveys previously conducted by other participants (e.g. hospitals and medical equipment companies).

The current case study used a mixed-method approach since the medical tourism supply chain is multi-faceted, i.e. it has several different elements closely related to each other, and this approach will be suitable in providing more in-depth and comprehensive findings. More specifically, qualitative and quantitative data were collected using interviews and questionnaires, respectively. Following Ravansetan (2017), the study was conducted in seven major steps from March 2020 to September 2022.

Phase one: Identifying the risks

This phase was exploratory, interpretative and qualitative. Semi-structured interviews were conducted with the 18 participants to explore their views on the risks related to the medical tourism supply chain in Iran. Theoretical saturation was achieved when 15 experts had been interviewed, although followed by three more for further assurance. Each interview took about 45–60 minutes and was conducted in the participants' first language, i.e. Persian, to ensure understanding. First the data were transcribed, next the transcripts were meticulously

read several times, then the data were coded and recoded many times to ascertain higher-order codes from lower-order ones. Member checking was used to examine the validity of the results and, additionally, any discrepancies between the raters were resolved through discussion which led to an inter-rater reliability of 0.91.

Phase two: Prioritizing the risks

This phase was applied, positivistic and quantitative. Based on the interview results, 12 supply chain experts were chosen from the 18 who took part in the previous phase and was based on their academic degree, professional experience and familiarity with the concepts of risk and resilience. It should be noted that care was exercised to choose at least one expert from each part of the medical tourism supply chain. The experts responded to a five-point Likert scale questionnaire developed based on the interview results. The questionnaire comprised 75 items relating to the importance of the risks in terms of their probability of occurrence, severity and detection (Appendix B). Since the questionnaire was constructed based on experts' views, it was considered to have adequate construct validity. Cronbach's alpha coefficients for the three sub-scales ranged from 0.91 to 0.96. The data were then analyzed using failure modes and effects analysis (FMEA).

Phase three: Determining the strategies for coping with risks

This phase was similar to phase one, i.e. it was exploratory, interpretative and qualitative. After computing the risk priority number (RPN), 30% of the those with the highest RPN were chosen. The participants' views on the coping strategies extracted from the research literature were obtained, and their suggestions as to other useful strategies were added. The validity of the results was checked using member checking. Triangulation of sources (e.g. different experts) and methods (e.g. interviews, questionnaires and survey data) were used to investigate the reliability of the results. The transcribed data were carefully read many times to obtain different coping strategies.

Phase four: Calculating the resilience number before risk occurrence

This phase was similar to the second phase since it was applied, positivistic and quantitative. 12 experts responded to a five-point Likert scale researcher-designed questionnaire with 72 items by assigning coping strategies to resilience parameters (Appendix C). The questionnaire used in this phase was developed based on experts' opinions, thus it had sufficient construct validity. Cronbach's alpha coefficients for the different sub-scales ranged from 0.96 to 0.99.

The resilience number was calculated based on Carvalho Remigio's (2012) equation:

$$RI = \left(\frac{\sum_{i=1}^{m} S_i}{5N_i}\right) \times \left(\frac{\sum_{j=1}^{n} S_j}{5N_j}\right) \times \left(\frac{\sum_{z=1}^{p} S_z}{5N_z}\right)$$

where: RI – resilience index, S_i – scores of resilience strategies relating to probability of occurrence, S_j – scores of resilience strategies relating to severity, S_z – scores of resilience strategies relating to detection, N – number of resilience strategies, m – number of resilience strategies related to the probability of occurrence, n – number of resilience strategies related to severity, p – number of resilience strategies related to detection.

Phase five: Prioritizing the risks after their occurrence

In this phase, the identified risks after their occurrence were prioritized using a researcher-made questionnaire with 75 items (Appendix D). The participants were asked to assess their importance in terms of time, cost and quality of recovery on a five-point Likert scale. Given that the questionnaire was designed based on experts' views, it had sufficient construct validity. Cronbach's alpha coefficients for different sub-scales were 0.91–0.96 and the data were then analyzed using failure analysis after occurrence (FAAO).

Phase six: Determining the recovery strategies

The RPN was calculated. Then, 30% of the risks with the highest RPNs were selected, followed by a determination of relevant recovery strategies. The participants were asked whether they used the researchers' suggested strategies and/or any others. The interview responses were carefully listened to, transcribed and thematically analyzed, which led to extracting several recovery strategies.

Phase seven: Calculating the resilience number after risk occurrence

The experts assigned recovery strategies to one or more parameters (i.e. time, cost and quality of recovery) and rated them on a five-point Likert scale. The data collection instrument in this phase was a questionnaire (56 items) with adequate construct validity, with a design based on experts' views (Appendix E). Cronbach's alpha coefficients for the different sub-scales ranged from 0.97 to 0.98.

The resilience number was calculated based on Carvalho Remigio's (2012) equation:

$$RI = \left(\frac{\sum_{i=1}^{m} S_i}{5N_i}\right) \times \left(\frac{\sum_{j=1}^{n} S_j}{5N_j}\right) \times \left(\frac{\sum_{z=1}^{p} S_z}{5N_z}\right)$$

where: RI – resilience index, S_i – scores of resilience strategies relating to probability of occurrence, S_j – scores of resilience strategies relating to severity, S_z – scores of

resilience strategies relating to detection, N – number of resilience strategies, m – number of resilience strategies related to the probability of occurrence, n – number of resilience strategies related to severity, p – number of resilience strategies related to detection.

4. Results

This section presents a summary of the results obtained from all phases of the study. Each sub-section is dedicated to one of the seven phases.

Table 1. Major categories and sub-categories of supply chain risks

Major categories	Sub-categories	Codes
Supply	Supplier	1. Problems related to working with suppliers
		2. Dependence on a limited number of suppliers
		3. Problems related to outsourcing
		4. Delays in supply
		5. Inadequate supply
	Medicine and medical equipment	6. Drug compatibility
		7. Drug and equipment referral
		8. Differences in the quality of medical items
		9. Counterfeit medicine
		10. Drug supply
		11. Problems related to drug therapy
		12. Pharmaceutical recall
		13. Insufficient raw materials
Internal	Financial	14. High taxes
		15. Accounting errors
		16. Errors in allocating budgets
		17. Receivable accounts
		18. Cash purchase
	Human resources	19. Dependence on a particular employee
		20. Recruitment
		21. Violation of laws
		22. Inadequate human resources
		23. Inappropriate training
		24. Mistakes made
		25. Health and safety
		26. Dissatisfaction with human resources
		27. Delays by the logistics staff
		28. Poor skills and inadequate knowledge
	Pricing	29. Fluctuations in exchange rates
		30. Pricing policies
	Marketing	31. Ineffective marketing
	Organizational equipment	32. Infrastructure
		33. Maintenance
		34. Equipment essential for production

Table 1 (cont.)

Major categories	Sub-categories	Codes
Internal (cont.)	Providing services and products	35. Services
		36. Differences in doctors' prescriptions
		37. Product development
		38. Intellectual property
		39. Insufficient scientific research
		40. Inadequate welfare facilities
		41. Suppliers' inability to adapt to competitive conditions
Demand	Customer	42. Failing to identify customer needs
		43. High-risk patients
		44. Demanding customers
		45. Customers' ignorance about the service procedure
	Demand	46. Random fluctuations in demand
		47. Adding to/changing one's needs
		48. Seasonal demand
Supply chain management	Transportation	49. Transport
	Inventory	50. Inventory corruption
		51. Inventory shortage
		52. Warehousing
	Information technology	53. Information technology
		54. Information system
	Coordination	55. Lack of coordination between supply chain components
		56. Lack of coordination within the organization
	Strategic	57. Partial perspective
		58. Process interference
		59. Decision making
External	Competitors	60. Competitors
		61. Black market
	Social	62. Negative news from the media
		63. Urban security
	Cultural	64. Cultural differences
		65. Behavioral problems in the supply chain
	Political	66. Problems in customs clearance
		67. Sanctions
		68. Terrorism
		69. Government policies
	Environmental	70. Natural disasters
		71. Environmental issues
	Legal/regulatory	72. Ineffective supervision
		73. Non-compliance with contracts
		74. Laws and regulations
		75. Poor coordination among regulatory organizations

Source: authors.

Table 2. The risk priority numbers (RPNs) assigned to risks before their occurrence

Codes	RPN	Codes	RPN	Codes	RPN
44	125	35	40	8	24
43	80	68	40	3	24
29	80	46	36	26	24
17	80	45	36	62	24
1	64	71	36	75	24
13	64	27	36	74	24
72	60	6	36	63	24
33	60	14	36	21	24
10	60	24	36	48	24
30	60	34	36	38	24
66	60	64	36	32	24
67	60	41	32	9	20
23	60	16	30	65	18
58	60	55	30	12	18
70	50	11	30	31	18
73	48	40	27	50	16
36	48	39	27	2	15
21	48	53	27	56	15
20	45	59	27	51	12
25	45	60	27	15	12
49	45	47	27	52	12
4	45	42	27	7	10
54	40	57	27	19	9
69	40	61	27	18	8
28	40	5	24	37	6

Source: authors.

Coding the risks

To answer RQ_1 and RQ_2, the interview results related to phase one were thematically analyzed, resulting in 107 codes. After removing several overlapping codes, a total of 75 remained, which were classified into five major risk categories and 21 sub-categories (Table 1).

Failure modes and effects analysis (FMEA)

In the second phase, a panel of experts, including 12 from the medical tourism supply chain in Iran, completed the FMEA questionnaire to prioritize the identified risks before their occurrence. More specifically, they determined the 'occurrence probability', 'severity' and 'detection' of the risks, and assigned numerical values to them. Accordingly, the RPN was computed by multiplying the numerical values assigned by the experts. Average RPNs were assigned to each risk based on their priority (Table 2).

Determining resilience strategies before risk occurrence (coping strategies)

In order to answer RQ_3, 30% of the FMEA outputs (N = 22) with the highest RPNs were selected for implementing corrective measures in the third phase. The expert panel identified pre-risk resilience strategies before risk occurrence (Table 3).

Table 3. Coping strategies

Risks	Resilience strategies
44. Demanding customers	1. Designing VIP and private rooms for health tourists
	2. Increasing flexibility in hotel services
	3. Establishing a unit for respect
	4. Assigning one particular host/hostess for each department
	5. Providing communication facilities such as the internet, TV and internet protocol television (IPTV)
43. High-risk patients	1. Obtaining informed consent before operations
	2. Rejecting high-risk patients
	3. Providing physical and mental health records
29. Fluctuations in exchange rates	1. Having alternative plans
	2. Inexpensive workforce
17. Receivable accounts	1. Continuous management of resources and consumption
	2. Using enterprise resource planning (ERP) software
	3. Accepting cash for some services
1. Problems related to working with suppliers	1. Having alternative plans in case of problems with a supplier
	2. Securing international contracts to claim damages
	3. Considering additional suppliers
	4. Using a 'black and white' list
13. Insufficient raw materials	1. Depot inventory
	2. Tracking deficiencies
	3. Securing appropriate agreement contracts
72. Ineffective supervision	1. Supervision of the treatment manager and supervisors
	2. Paying attention to rules and regulations of the supervisory agencies
	3. Auditing and online assessment of activities
33. Maintenance	1. Purchasing high-quality products with guarantees
	2. Maintenance
10. Drug supply	1. Supplying products from the local market
	2. Forming drug and treatment committees
	3. Using similar products
30. Pricing policies	1. Setting prices in proportion to increasing costs
	2. Providing services with different prices for various customer groups
66. Problems in customs clearance	1. Cooperating with the government for importing medical items
	2. Selecting and working with companies specialized in import
	3. Having a minimum number of documents for clearance
67. Sanctions	1. Cooperating with friendly countries
	2. Promoting collaborations with the Board of Trustees in foreign exchange savings when treating patients

23. Inappropriate training	1. Knowledge management for equipping employees and increasing their awareness
	2. Frequent and regular training
	3. Assessing the effectiveness of training courses
	4. Implementing PDP (Personnel development plan) system (ISO 1015)
58. Process interference	1. Promoting cooperation in the supply chain
	2. Running workshops for managers
70. Natural disasters	1. Having alternative plans
	2. Predicting epidemics, pandemics and nuclear threats
	3. Depot inventory
	4. Performing maneuvers for improving preparedness
73. Non-compliance with contracts	1. Securing appropriate agreement contracts
	2. Promoting relations with suppliers
	3. Receiving guarantees
	4. Determining damages in case of non-fulfillment of obligations
36. Differences in doctors' prescriptions	1. Using the treatment protocols of the Health Ministry
	2. Adapting the hospital medicine handbook with medical items approved by doctors
	3. Organizing clinical committees in hospitals
21. Inadequate human resources	1. Redundancy in the workforce
	2. Applying professional mobility for human resources
	3. Having a succession plan
	4. Establishing and maintaining relationships with universities and institutions and securing contracts
20. Recruitment	1. Recruiting workforce via exams
	2. Running training and internship courses
25. Health and safety	1. Annual examination
	2. Providing human resources with insurance
	3. Developing a framework for examining current and future health conditions
	4. Monitoring occupational risks (ISO 18000)
	5. Using personal protective equipment
	6. Providing a suitable place to relax
4. Delays in supply	1. Considering additional suppliers
	2. Improving transportation conditions
	3. Securing long-term and legal contracts
	4. Promoting supply chain accountability
49. Transport	1. Insuring cargos and patients
	2. Securing contracts with reliable and committed couriers
	3. Careful and ongoing monitoring of transportation of cargo, equipment and patients
	4. Using roofed vehicles and equipped
	5. Assigning trucks by companies

Source: authors.

Determining the resilience number before risk occurrence

For answering RQ_4, the experts rated coping strategies and assigned them to resilience parameters in the fourth phase. The mode of the experts' ratings was calculated and substituted in the equation of the resilience number. The resilience parameters at the pre-risk time include 'occurrence probability', 'severity' and 'detection' of the risks (Table 4).

Table 4. The modes of experts' rating of resilience strategies before risk occurrence

Resilience parameters	Risk code, strategy No.	Score	Resilience parameters	Risk code, strategy No.	Score
Occurrence probability	44-1	4	Severity	44-2	3
	44-3	3		43-1	5
	44-4	4		29-1	3
	44-5	3		29-2	4
	43-2	5		17-3	4
	17-1	5		1-1	4
	17-2	4		1-2	3
	13-3	3		1-3	5
	72-1	4		10-1	4
	72-2	4		10-2	4
	72-3	4		10-3	4
	33-1	5		30-1	4
	33-2	4		30-2	3
	66-1	4		67-1	5
	66-2	5		67-2	5
	66-3	5		70-2	5
	23-1	4		70-3	3
	23-2	4		70-4	4
	23-4	4		73-1	3
	58-1	4		73-3	4
	58-2	4		73-4	5
	73-2	5		36-3	4
	36-1	5		21-2	4
	36-2	5		25-2	5
	21-1	5		4-3	4
	21-3	3		4-4	4
	21-4	3		49-1	5
	20-1	3	Detection	43-3	5
	25-5	3		29-1	4
	25-6	3		1-4	4
	4-2	4		13-2	3
	49-2	4		23-3	5

Occurence probability (cont.)	49-3	3
	49-4	4
	49-5	3

Detection (cont.)	23-4	4
	20-2	4
	25-1	4
	25-3	4
	25-4	4

Source: authors.

Carvalho Remigio's (2012) equation was used for calculating the resilience number:

$$RI = \left(\frac{\sum_{i=1}^{m} S_i}{5N_i}\right) \times \left(\frac{\sum_{j=1}^{n} S_j}{5N_j}\right) \times \left(\frac{\sum_{z=1}^{p} S_z}{5N_z}\right)$$

where: RI – resilience index, S_i – scores of resilience strategies relating to probability of occurrence, S_j – scores of resilience strategies relating to severity, S_z – scores of resilience strategies relating to detection, N – number of resilience strategies, m – number of resilience strategies related to the probability of occurrence, n – number of resilience strategies related to severity, p – number of resilience strategies related to detection.

The resilience number, which falls in the range of 0 to 1, was calculated based on experts' responses to the questionnaire items. A value of 0 indicates that the organization is not resilient while a value of 1 shows its complete resilience. Therefore, 0–0.33 indicates poor resilience, 0.33–0.67 shows moderate resilience, and 0.67–1 indicates strong resilience. The amount of resilience for the medical tourism supply chain in Iran in the present study was computed as 0.4 before risk occurrence, which indicates the moderate resilience of its medical tourism supply chain.

Failure analysis after occurrence (FAAO)

In the fifth phase, similar to the second one, an expert panel performed FAAO by determining its main parameters, namely, time, cost and quality of recovery. Then, the effect coefficients were computed by multiplying the scores for time, cost and quality of recovery (Table 5).

Table 5. The effect coefficients assigned to risks after their occurrence

Codes	Impact coefficient	Codes	Impact coefficient	Codes	Impact coefficient
32	100	18	45	58	36
23	80	69	45	9	32
62	80	31	45	38	32
44	64	61	45	26	32
35	64	47	45	19	27
60	64	68	40	13	27
28	64	7	36	1	27
25	64	56	36	52	27
14	64	4	36	51	27
33	60	20	36	53	27
8	60	21	36	64	27
24	60	16	36	72	27
70	60	59	36	54	27
30	50	74	36	45	27
46	48	2	36	43	27
10	48	49	36	65	24
6	48	12	36	55	24
17	48	5	36	11	24

Table 5 (cont.)

Codes	Impact coefficient	Codes	Impact coefficient	Codes	Impact coefficient
3	48	37	36	39	24
29	48	34	36	50	24
73	48	27	36	21	24
36	48	57	36	63	24
67	48	48	36	42	24
71	45	41	36	15	20
40	45	66	36	75	18

Source: authors.

Determining resilience strategies after risk occurrence (recovery strategies)

In order to answer RQ_5, 30% of the risks (N = 23) with the highest effect coefficients were selected as FAAO outputs for taking corrective measures in the sixth phase. The panel of experts then identified the resilience strategies after risk occurrence for medical tourism in Iran (Table 6).

Table 6. Recovery strategies

Risks	Resilience strategies
32. Infrastructure	1. Using donors' support for expanding services and facilities
	2. Getting loans and bank facilities
	3. Reducing costs
	4. Using field equipment
23. Inappropriate training	1. Improving the quality of training courses
	2. Holding in-service training classes
62. Negative news by media	1. Transparency in sharing negative news
	2. Sharing positive news relating to the subject
	3. Establishing effective campaigns in cyberspace
44. Demanding customers	1. Increasing awareness of customers' wants by using survey forms
	2. Improving responsiveness to customers' needs by using supporting services
35. Services	1. Detecting and solving problems
	2. Holding weekly meetings with the patients' physicians
	3. Providing patients with free and fast treatments
60. Competitors	1. Offering special suggestions to customers
	2. Letting customers pay over an extended time period
	3. Cooperating with competitors
28. Poor skills and inadequate knowledge	1. Running theoretical training courses
	2. Organizing practical workshops
25. Health and safety	1. Using overtime to compensate for an injured worker
	2. Using temporary workers
	3. Training safety rules
14. High taxes	1. Obtaining tax exemptions
33. Maintenance	1. Detecting and solving problems
	2. Postponing related services
	3. Outsourcing services for a limited time

24. Mistakes made	1. Identifying and analyzing errors
	2. Using warnings, reprimands and dismissals
	3. Providing patients with free and fast treatments
8. Differences in the quality of medical items	1. Seeking feedback from customers, followed by mass production
	2. Conducting initial tests and then using a drug
70. Natural disasters	1. Using supporting capacities
	2. Establishing field hospitals
	3. Forming crisis management teams
	4. Postponing related services
	5. Using other buildings (e.g. mosques and schools)
30. Pricing policies	1. Providing some services in cash
	2. Offering profitable ancillary services
	3. Providing complementary services
46. Random fluctuations in demands	1. Using supply management policies (e.g. flexible capacity and inventory)
	2. Using demand management policies (commercial promotions and proportional pricing)
10. Drug supply	1. Using alternative drugs
	2. Purchasing from the black market
6. Drug compatibility	1. Analyzing patients' conditions
	2. Providing patients with free and immediate treatments
17. Receivable accounts	1. Using legal capacities
	2. Not directly cooperating with hospitals and working with intermediaries
	3. Managing financial resources to compensate for budget shortages
	4. Barter
3. Problems related to outsourcing	1. Using legal capacities
	2. Using supporting capacities
	3. Securing flexible contracts
	4. Using additional outsourcing
29. Fluctuations in exchange rates	1. Converting cash into properties
	2. Planning for customers at different levels
	3. Considering the average exchange rate and providing service packages
73. Non-compliance with contracts	1. Using legal capacities
	2. Using supporting capacities
	3. Working with supporting suppliers
36. Differences in doctors' prescriptions	1. Forming clinical committees in hospitals for analyzing prescriptions
67. Sanctions	1. Cooperating with friendly countries
	2. Using cheaper foreign exchange provided by the government

Source: authors.

Determining the resilience number after risk occurrence

To answer RQ_6, the resilience number was obtained for after risk occurrence based on the experts' rating of the strategies specified in FAAO in the seventh phase. Finally, the mode of the scores was calculated and substituted in the equation for the resilience number. Resilience parameters after risk occurrence were cost, time and quality of recovery (Table 7).

Table 7. Scores of resilience strategies after risk occurrence

Resilience parameters	Risk code, strategy No.	Score	Resilience parameters	Risk code, strategy No.	Score
Recovery quality	32-1	5	Recovery time	23-2	4
	32-4	3		62-3	5
	23-1	4		44-1	5
	62-1	5		35-1	4
	62-2	4		35-2	4
	62-3	5		35-3	4
	44-2	4		25-2	4
	35-1	4		70-1	4
	60-1	4		10-1	5
	60-2	4		17-2	3
	60-3	4		17-4	4
	28-1	5		3-3	3
	28-2	5		73-3	4
	25-1	4	Recovery cost	32-2	5
	33-3	5		32-3	3
	24-1	5		25-3	4
	70-2	4		14-1	5
	70-3	5		24-2	4
	70-4	4		8-1	4
	46-1	4		8-2	5
	46-2	4		70-5	4
	10-2	3		30-1	5
	6-1	4		30-2	4
	17-3	4		30-3	4
	3-3	4		17-1	3
	36-1	5		29-1	5
	67-1	5		29-2	4
	67-2	5		29-3	3

Source: authors.

The resilience number was calculated based on Carvalho Remigio's (2012) equation:

$$RI = \left(\frac{\sum_{i=1}^{m} S_i}{5N_i}\right) \times \left(\frac{\sum_{j=1}^{n} S_j}{5N_j}\right) \times \left(\frac{\sum_{z=1}^{p} S_z}{5N_z}\right)$$

where: RI – resilience index, S_i – scores of resilience strategies relating to probability of occurrence, S_j – scores of resilience strategies relating to severity, S_z – scores of resilience strategies relating to detection, N – number of resilience strategies, m – number of resilience strategies related to the probability of occurrence, n – number of resilience strategies related to severity, p – number of resilience strategies related to detection.

The resilience number was computed as 0.5 after risk occurrence, which indicates the moderate resilience of the medical tourism supply chain in Iran after risk occurrence.

5. Discussion

The present study aimed to investigate the risks occurring in the supply chain of Iranian medical tourism and suggest coping and recovery strategies for preventing their occurrence and improving the current situation. Regarding RQ_1, the participants referred to 75 risks, 36 of which had not been addressed in past research. Some of the risks found in this study were also reported in previous studies: delay in supply (Jaberidoost et al., 2013; Silva et al., 2020), poor skills and inadequate knowledge (Benazzouz et al., 2018; Wasswa & Namulindwa, 2020) and natural disasters (Kumar et al., 2019; Raja Sreedharan et al., 2019). However, risks including, but not limited to, demanding customers, high-risk patients, customer unawareness, inability to adapt with competitive conditions, different qualities of medical items, lack of coordination among different components of the supply chain, and negative news on the media have been highlighted in the present study.

As for RQ_2, the results showed that 75 risks were identified and classified in five major categories: supply, demand, internal, external and supply chain management risks. The proposed classification of risks in this study could be considered as comprehensive as it includes those which were not recognized in past research. For example, a recent study by Vishwakarma et al. (2016) categorized risks related to the health tourism supply chain in India into six groups: supply and supplier, strategic, logistics and network, government, and market and financial, while paying almost no attention to those concerning customers and their demands, human resources, environment, and medicine and medical equipment. Azizi Usefvand et al.'s (2017) study also failed to take into account external, internal, demand and supply chain management risks and only referred to those of supplier, producer, distributor and final customer.

Based on the findings, environmental risks, in comparison to others, had higher RPNs, which indicates their utmost importance in supply chains and this finding is in line with past studies highlighting their crucial importance (Wang et al., 2013; Zamora et al., 2013). The economic structure of developing countries like Iran is highly susceptible to undesirable environmental factors such as severe economic sanctions. Under such circumstances, businesses as well as factors relating to production and manufacturing are adversely affected. Hence, the efficient management of supply chain risks and sufficient support provided by governments can substantially promote the performance of private-sector companies which could consequently play a crucial role in the development and growth of those countries.

Regarding RQ_3, the results yielded several key coping strategies such as having minimum necessary documents for clearance, creating support campaigns in cyber space, providing some services in cash, offering special suggestions to customers and applying for tax exemptions. These were not found in past research. In line with previous studies (e.g. Lambaino, 2019; Tukamuhabwa Rwakira, 2015), other risks such as considering additional suppliers, depot inventory, redundancy in the workforce and knowledge management for equipping employees and increasing their awareness were also identified. Coping strategies are very effective as managers frequently encounter the undesirable impacts of uncertainties, risks and accidents in their supply chains. Therefore, significant measures in response to risks should be taken, i.e. they should have adequate resilience for reducing the risks and maintaining optimal performance before risk occurrence. A large number of the coping strategies found in this study were related to the categories of internal and supply risks, which were also reported by Tukamuhabwa et al. (2017). This finding indicates that these risks should be tightly controlled by businesses and prevented through reducing uncertainty. In addition, some coping strategies concerned environmental risks, i.e. those which cannot be controlled or prevented by supply chains. Therefore, it is essential to pay especial attention to the determining roles of policies, planning and the cooperation of governmental organizations.

As for RQ_4, the results of calculations indicated that the resilience number for the medical tourism supply chain was 0.4 before risk occurrence which indicates the moderate resilience of the Iranian medical tourism supply chain. Quantifying resilience helps monitor the supply chain at specific time intervals and evaluates the effectiveness of resilience strategies. In addition, assigning a resilience number to the supply chain of medical tourism in Iran may facilitate its comparison with supply chains in other countries.

In response to RQ_5, the participants referred to several different recovery strategies including using field equipment, establishing effective campaigns in cyberspace, obtaining tax exemptions and using a temporary workforce, which have not been reported in previous research. Additionally, they stated other strategies which existed in previous studies: cooperating with competitors (Tukamuhabwa et al., 2017), using supporting capacities (Carvalho et al., 2012), using supply management policies (e.g. flexible capacity and inventory), and using demand management policies (commercial promotions and proportional pricing) (Lambaino, 2019; Tukamuhabwa Rwakira, 2015). In this study, while most recovery strategies after risk occurrence were related to the categories of internal and demand risks, only a limited number concerned environmental risks. As environmental risks (e.g. those relating to politics and the economy) require national, comprehensive solutions, it is very important to take them into account, and this can help medical tourism

supply chains adapt to the existing conditions and mitigate their undesirable effects.

Regarding RQ_6, the results of calculations showed that the resilience number of the Iranian medical tourism supply chain was moderate after risk occurrence (RI = 0.5). In fact, little attention has been paid to such risks as they require spending considerable time and a large budget to develop and use recovery strategies.

6. Conclusions

This study investigated the existing risks in the supply chain for Iranian medical tourism and suggested several coping and recovery strategies in order to prevent them and improve the current situation. A total of 75 risks along with their importance were identified. The findings indicated that resilience in the supply chain could be improved by examining how risks are created in organizations and could affect the behavior of the supply chain. Based on the findings, it is suggested that a risk management system be established to identify uncertainties which may directly or indirectly have resulted in their creation. In addition, significant measures could be taken to enhance patients' satisfaction with service quality. For example, surveys may be conducted to investigate and possibly accommodate patients' demands and preferences. Furthermore, the services provided to patients can be monitored on a regular basis to evaluate several factors such as service quality, average treatment time, patient recovery rate and customers' feedback.

Furthermore, using the coping and recovery strategies reported in this study can help prevent risks in the supply chain for medical tourism and play an important role in adapting to current conditions. These strategies could be useful for various components of the supply chain. For instance, suppliers can enhance resilience by ensuring efficient distribution, promoting inter- and intra-organization cooperation and managing inventories. Moreover, hospitals, as a major center for providing patients with medical services, can improve their infrastructure, manage receivable accounts, and increase the monitoring of their different parts, which may help enhance the resilience of the supply chain. Furthermore, regarding financial strategies, the government can provide subsidies for hospitals in both private and public sectors to decrease the costs of medical centers and suppliers, and this can encourage decision makers in supply chains to greater efficiency and enhance their income.

Given that tourists in medical tourism aim to find the best destination for receiving treatment services, it is highly recommended to consider the risks reported in this study and elsewhere (e.g. Jaberidoost et al., 2013; Silva et al., 2020) and take significant measures to overcome them, and this can in turn increase the number of tourists. For example, regarding human resources, it is recommended to employ qualified staff by administering recruitment exams and carefully considering the applicants' résumés, which can significantly help employ more competent personnel. In this vein, different factors relating to applicants' behavior, personality and competence could be evaluated by using psychological tests. Further, it is suggested that supply chain managers make comprehensive plans for human resources, introduce current employees to new ones, and establish objective evaluation criteria.

Since some of the suggested strategies (e.g. improving cooperation, assigning trucks by companies) are not widely adopted in the supply chain, future research could investigate not only the challenges and barriers to implementing these strategies but also their potential benefits. In doing so, further research could assess the impact of the risks identified in this study on performance.

This study has some limitations. First, only some members of the medical tourism supply chain in Iran (i.e. five out of nine components: hospitals, pharmaceutical companies, medical equipment companies, hotels and international facilitator companies) were involved. Thus, it is suggested that future studies focus on a larger number, or possibly all, of the supply chain components to achieve a greater in-depth understanding in medical tourism. Second, given the utmost importance of environmental risks, it is recommended that further research pays more attention to these risks by examining their undesirable effects on the whole chain.

The data in this study were collected via semi-structured interviews and questionnaires. To build upon this, future research could use other data collection techniques such as observation, life history narratives and ethnography to gather more detailed information about the risks. Last but not the least, care should be taken in generalizing the findings since the current study was performed in Iran, a country with its own unique political, social and economic features.

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Appendix A. Participants' demographic features

Participant No.	Gender	Age	Academic degree	Organizational position	Working area
P_1	Male	37	PhD	Manager	Hospital
P_2	Male	45	General practitioner	Manager	Hospital
P_3	Female	45	BA	Manager	Hospital
P_4	Female	40	MA	Expert	Hospital
P_5	Male	32	PhD	Technical director of the pharmacy	Hospital
P_6	Female	28	BA	Expert	Hospital
P_7	Male	40	BA	Manager	Hotel
P_8	Male	37	BA	Managing director	International facilitator company
P_9	Male	36	BA	Managing director	Pharmaceutical and medical equipment company
P_{10}	Male	34	BA	Branch manager	Pharmaceutical and medical equipment company
P_{11}	Male	37	MA	Manager	Hospital
P_{12}	Male	39	MA	Supply chain manager	Pharmaceutical and medical equipment company
P_{13}	Male	30	BA	Sales manager	Pharmaceutical and medical equipment company
P_{14}	Male	38	MA	Managing director	Medical equipment company
P_{15}	Female	26	BA	Sales expert	Pharmaceutical and medical equipment company
P_{16}	Female	43	BA	Supervisor	Hospital
P_{17}	Female	27	BA	Nurse	Hospital
P_{18}	Male	38	MA	Managing director	Pharmaceutical and medical equipment company

Appendix B. FMEA questionnaire

Dear participant,
Please kindly rate each risk in terms of its probability of occurrence, severity, and detection. Your answers will be completely confidential. Thank you very much for your beneficial cooperation.

Very poor	Poor	Medium	Good	Very good
1	2	3	4	5

Concept	Probability of occurrence	Severity	Detection
Demanding customers			
High-risk patients			
Fluctuations in exchange rates			

Concept	Probability of occurrence	Severity	Detection
Receivable accounts			
Problems related to working with suppliers			
Insufficient raw materials			
Ineffective supervision			
Maintenance			
Drug supply			
Pricing policies			
Problems in customs clearance			
Sanctions			
Inappropriate training of human resources			
Process interference			
Natural disasters			
Non-compliance with contracts			
Differences in doctors' prescriptions			
Inadequate human resources			
Recruitment of human resources			
Health and safety of human resources			
Transport			
Delays in supply			
Information system			
Government policies			
Poor skills and inadequate knowledge of human resources			
Services			
Terrorism			
Random fluctuations in demands			
Customers' ignorance about the services procedure			
Environmental issues			
Delays by the logistics staff			
Drug compatibility			
High taxes			
Mistakes made by human resources			
The essential equipment for production			
Cultural differences			
Suppliers' inability for adapting to competitive conditions			
Errors in allocating budget			
Lack of coordination between supply chain members			
Problems related to drug therapy			

Concept	Probability of occurrence	Severity	Detection
Inadequate welfare facilities			
Insufficient scientific research			
Information technology			
Decision making			
Competitors			
Adding to/changing one's needs			
Failing to identify customers' needs			
Partial perspective			
Black market			
Inadequate supply			
Differences in the quality of medical items			
Problems related to outsourcing			
Dissatisfaction of human resources			
Negative news by media			
Poor coordination among regulatory organizations			
Laws and regulations			
Urban security			
Violation of laws by human resources			
Seasonal demand			
Intellectual property			
Infrastructure			
Counterfeit medicine			
Behavioral problems in the supply chain			
Pharmaceutical recall			
Ineffective marketing			
Inventory corruption			
Dependence on a limited number of suppliers			
Lack of coordination within the organization			
Inventory shortage			
Accounting errors			
Warehousing			
Drug and equipment referral			
Dependence on a particular employee			
Cash purchase			
Product development			

Appendix C. Resilience number questionnaire

Dear participant,
Please kindly rate each risk in terms of its probability of occurrence, severity, and detection. Your answers will be completely confidential. Thank you very much for your beneficial cooperation.

Very poor	Poor	Medium	Good	Very good
1	2	3	4	5

Resilience parameters	Resilience strategy	1	2	3	4	5
Probability of occurrence	Designing VIP and private rooms for health tourists					
	Establishing a unit for respect					
	Assigning one particular host/hostess for each department					
	Providing communication facilities such as the internet, TV, and IPTV					
	Rejecting high-risk patients					
	Continuous management of resources and consumptions					
	Using enterprise resource planning (ERP) software					
	Securing appropriate agreement contracts					
	Supervision of the treatment manager and supervisors					
	Paying attention to rules and regulations of the supervisory agencies					
	Auditing and online assessing of activities					
	Knowledge management for equipping employees and increasing their awareness					
	Frequent and regular training					
	Implementing PDP system (ISO 1015)					
	Having a minimum number of documents for clearance					
	Selecting and working with companies specialized in import					
	Cooperating with government for importing medical items					
	Purchasing high-quality products with guarantee					
	Maintenance					
	Promoting cooperation in the supply chain					
	Running workshops for managers					
	Promoting relations with suppliers					
	Using treatment protocols of the Health Ministry					
	Adapting the hospital medicine handbook with medical items approved by doctors					
	Having a succession plan					
	Redundancy in workforce					
	Establishing and maintaining relationships with universities and institutions and securing contracts					
	Recruiting workforce via exams					
	Using personal protective equipment					
	Providing a suitable place for human resources to relax					

Resilience parameters	Resilience strategy	1	2	3	4	5
Probability of occurrence	Securing contracts with reliable and committed couriers					
	Using roofed vehicles and equipped					
	Assigning trucks by companies					
	Improving transportation conditions					
	Careful and ongoing monitoring of transportation of cargo, equipment, and patients					
Risk intensity	Increasing flexibility in hoteling services					
	Obtaining informed consent before operation					
	Having alternative plans					
	Inexpensive workforce					
	Accepting cash for some services					
	Having alternative plans in case of problems with the supplier					
	Securing international contracts to claim damages					
	Considering additional suppliers					
	Depoting inventory					
	Securing appropriate agreement contracts					
	Supplying products from the local market					
	Using similar products					
	Forming drug and treatment committees					
	Providing services with different prices for various customer groups					
	Setting prices in proportion to increasing costs					
	Promoting collaborations with the Board of Trustees in Foreign Exchange Savings to Treat Patients					
	Cooperating with friendly countries					
	Predicting epidemics, pandemics, and nuclear threats					
	Performing maneuvers for improving preparedness					
	Receiving guarantees					
	Determining damages in case of non-fulfillment of obligations					
	Organizing clinical committees in hospitals					
	Applying professional mobility for human sources					
	Providing human resources with insurance					
	Insuring cargos and patients					
	Securing long-term and legal contracts					
	Promoting the supply chain accountability					
Recognition power	Providing physical and mental health records					
	Having alternative plans					
	Using a black and white list					
	Tracking deficiencies					
	Assessing the effectiveness of training courses					

Resilience parameters	Resilience strategy	1	2	3	4	5
Recognition power (cont.)	Implementing PDP system (ISO 1015)					
	Running training and internship courses					
	Annual examination of human resources					
	Developing a framework for examining the current and future health conditions of human resources					
	Monitoring occupational risks (ISO 18000)					

Source: authors.

Appendix D. FAAO questionnaire

Dear participant,
Please kindly rate each risk in terms of its time, cost, and quality of recovery. Your answers will be completely confidential. Thank you very much for your beneficial cooperation.

Very poor	Poor	Medium	Good	Very good
1	2	3	4	5

Concept	Time of recovery	Cost of recovery	Quality of recovery
Infrastructure			
Inappropriate training of human resources			
Negative news by media			
Demanding customers			
Services			
Competitors			
Poor skills and inadequate knowledge of human resources			
Health and safety of human resources			
High taxes			
Maintenance			
Differences in the quality of medical items			
Mistakes made by human resources			
Natural disasters			
Pricing policies			
Random fluctuations in demands			
Drug supply			
Drug compatibility			
Receivable accounts			
Problems related to outsourcing			
Fluctuations in exchange rates			

Concept	Time of recovery	Cost of recovery	Quality of recovery
Non-compliance with contracts			
Differences in doctors' prescriptions			
Sanctions			
Environmental issues			
Inadequate welfare facilities			
Cash purchase			
Government policies			
Ineffective marketing			
Black market			
Adding to/changing one's needs			
Terrorism			
Drug and equipment referral			
Lack of coordination within the organization			
Delays in supply			
Recruitment of human resources			
Inadequate human resources			
Errors in allocating budget			
Decision making			
Laws and regulations			
Dependence on a limited number of suppliers			
Transport			
Pharmaceutical recall			
Inadequate supply			
Product development			
The essential equipment for production			
Delays by the logistics staff			
Partial perspective			
Seasonal demand			
Suppliers' inability for adapting to competitive conditions			
Problems in customs clearance			
Process interference			
Counterfeit medicine			
Intellectual property			
Dissatisfaction of human resources			
Dependence on a particular employee			
Insufficient raw materials			
Problems related to working with suppliers			
Warehousing			

Concept	Time of recovery	Cost of recovery	Quality of recovery
Inventory shortage			
Information technology			
Cultural differences			
Ineffective supervision			
Information system			
Customers' ignorance about the services procedure			
High-risk patients			
Behavioral problems in the supply chain			
Lack of coordination between supply chain members			
Problems related to drug therapy			
Insufficient scientific research			
Inventory corruption			
Violation of laws by human resources			
Urban security			
Failing to identify customers' needs			
Accounting errors			
Poor coordination among regulatory organizations			

Appendix E. Resilience number questionnaire

Dear participant,
Please kindly rate each strategy in terms of its appropriateness and effectiveness. Your answers will be completely confidential. Thank you very much for your beneficial cooperation.

Very poor	Poor	Medium	Good	Very good
1	2	3	4	5

Resilience parameters	Resilience strategy	1	2	3	4	5
Recovery time	Holding in-service training classes					
	Establishing effective campaigns in cyberspace					
	Increasing awareness about customers' wants by using survey forms					
	Detecting and solving problems					
	Providing patients with free and immediate treatments					
	Holding weekly meetings with the patients' physicians					
	Using temporary workforce					
	Using supporting capacities					

Resilience parameters	Resilience strategy	1	2	3	4	5
Recovery time	Using alternative drugs					
	Not directly cooperating with hospitals and working with intermediaries					
	Barter					
	Using additional outsourcing					
	Working with supporting suppliers					
Recovery cost	Getting loans and bank facilities					
	Reducing costs					
	Training safety rules					
	Obtaining tax exemptions					
	Using warnings, reprimands, and dismissals					
	Seeking feedback from customers, followed by mass production					
	Conducting initial tests and then using the drug					
	Using other buildings (e.g., mosques and schools)					
	Providing some services in cash					
	Offering profitable ancillary services					
	Providing complementary services					
	Using legal capacities					
	Converting cash into properties					
	Planning for customers at different levels					
	Considering the average exchange rate and providing service packages					
Recovery quality	Using donors' support for expanding services and facilities					
	Using field equipment					
	Improving the quality of training courses					
	Transparency in sharing negative news					
	Sharing positive news relating to the subject					
	Establishing effective campaigns in cyberspace					
	Improving responsiveness to customers' needs by using supporting services					
	Detecting and solving problems					
	Offering special suggestions to customers					
	Letting customers pay over an extended time period					
	Cooperating with competitors					
	Running theoretical training courses					
	Organizing practical workshops					
	Using overtime to compensate for the injured workforce					
	Postponing the related services					
	Outsourcing services for a limited time					
	Identifying and analyzing errors					
	Forming crisis management teams					

Resilience parameters	Resilience strategy	1	2	3	4	5
Recovery quality (cont.)	Establishing field hospitals					
	Using demand management policies (e.g., flexible capacity and inventory)					
	Using demand management policies (commercial promotions and proportional pricing)					
	Purchasing from the black market					
	Analyzing patients' conditions					
	Managing financial resources to compensate for budget shortages					
	Securing flexible contracts					
	Cooperating with friendly countries					
	Using cheaper foreign exchange provided by the government					
	Forming clinical committees in hospitals for analyzing prescriptions					