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Assessing Pharmacies' Preparedness for Disasters and Emergencies: The Case of Tehran, Iran

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Abstract:

Large-scale disasters and emergencies can pose serious challenges to various aspects of social life. Pharmacies' preparedness further comes to the fore in these times. This study design and implement a model for assessing the disaster and emergency preparedness of pharmacies in Iran.

The study utilized qualitative and quantitative methods. An exploratory interview was conducted with experts to identify and select relevant indicators. A survey was then conducted to collect data from a sample of pharmacies from five geographical districts of Tehran, Iran's capital and largest and most populated city .

The developed preparedness assessment tool includes five dimensions and 67 indicators. Employing the tool on the study samples, it was found that only 27.5% of pharmacies were ready in terms of medicine supplies, 41.7% in terms of medical consumables, 55.8% in terms of physical facilities, 52% in terms of software, and 32.7% in terms of human resource training and management.

The level of preparedness for pharmaceutical services and medicine providing centers revealed serious deficiencies in all dimensions. Since these centers are not adequately prepared for disasters and emergencies, improving the level of preparedness for this important element of the health sector should be the government's immediate pressing concern.

Keywords: preparedness Assessment; crises; pharmaceutical services; medicine providing centers

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1. Introduction

Large-scale disasters and emergencies can disrupt various aspects of human life, including public health, real estate, the environment, people's livelihoods, and social services. They often cause death, injury, stress, disability, and displacement with significant public health impacts. They can increase demand for health services and overwhelm public health supplies and service systems [1,2]. To understand the distinction between the terms emergency and disaster, it is necessary to understand their definitions. An emergency is an event that can be responded to with existing resources and does not require outside assistance. A disaster is characterized by impacts that exceed the capacity of local responders and require resources that are not available locally. In other words, an event is declared a "disaster" only if outside assistance is required to address the consequences [3]. Major disaster events such as floods, earthquakes, pandemics, and chemical, microbial, and nuclear incidents can seriously disrupt the delivery of health services precisely when they are urgently needed [4]. Providing quality health services and ensuring equitable access to them are among the primary responsibilities of health systems [5]. Several macro-level methods have been developed for the readiness assessment of health systems. Based on the International Health Partnership and Related Initiatives (IHP), a general framework has been designed for accurate identification of the processes, assessment of process performance, and subsequent strengthening of health systems [6]. The Service Availability and

Readiness Assessment (SARA) model is another preparedness assessment tool. This tool can warn policymakers of the possible weaknesses and challenges of health systems in dealing with disasters by performing periodic monitoring. The SARA model tries to comprehensively monitor health services such as hospitals regularly [7]. few countries regularly assess their readiness for providing pharmaceutical services in disasters based on the existing guidelines and standards [8].

The role of pharmacies and pharmacists during emergencies has been examined in a number of studies and programs. For example, in the United States of America, the Joint Commission of Pharmacy Practitioners (JCPP) has conducted a study to determine the responsibilities of pharmacists in disasters [9]. In the United States, the Valley Drug model was developed to improve the delivery of pharmaceutical services where some pharmacies share their capacities in delivering better services in emergency conditions. The model covers important aspects such as immediate risk assessments, operation acceleration in emergency like the use of emergency kits, proper movement of medications and personnel, backing up data, establishing information and communication systems, and various tasks that personnel are supposed to undertake in disasters [10].

The existing literature on pharmacists in disaster settings focuses on their roles in two main areas: clinical and nonclinical. "Clinical" roles refer to pharmacists' ability to provide mobile services and administer pharmacotherapy during emergencies. In contrast, "nonclinical" roles refer to pharmacists' management skills to act as emergency managers (e.g., firefighters) [11]. In a study conducted to plan for the supply of chronic disease medications in Los Angeles, retail pharmacies were able to supply chronic disease medications for 60 to 100 days or longer, using computerized registration systems and a predetermined protocol [12].

The availability of storage space in pharmacies can be a determining factor in the amount of medicines that can be stocked for emergencies [13]. In addition, some drugs are not included in the list of emergency drugs because of their expiration date [14]. These medicines are stockpiled in pre-determined quantities in Automated Dispensing Cabinets (ADCs), and more supplies can be delivered to more affected regions depending on the needs of different regions. Studies also indicate that pharmacy staff should undergo a series of mandatory trainings to ensure that they can conduct pharmacy business during emergencies [15].

This study aims to develop a model for assessing the preparedness level of pharmacies in disasters in terms of their ability to continue providing medical and pharmaceutical services during major disasters. Therefore, this paper contributes to the existing literature on this area by exploring the first of its kind. Secondly, the checklist developed in this study is designed in a way that can be easily adapted and used by researchers in other countries for similar purposes. Developing and using this tool can help policymakers assess the strengths and weaknesses of pharmacies during periodic reviews of public and private sectors to ensure they are adequately prepared for major emergencies.

2. Materials & Methods

The design of this study was inspired by the SARA plan [7]. Since the model presented in the SARA plan is a model for the health sector, it was necessary to modify and adapt the model with regard to the specific requirements of the medical sector; it was also necessary to develop some indicators to measure the different dimensions of the model. Therefore, this study includes qualitative and quantitative methods. The qualitative method is used to develop the research instruments, while the quantitative method is used to measure the indicators.

2.1. The qualitative phase: developing the preparedness indicators

In our literature review, we thoroughly reviewed the main emergency preparedness dimensions and indicators and pinned down a number of key dimensions to assess pharmacies' preparedness level. These dimensions include the requirements for 1) medicines, 2) medical consumables, 3) the physical facilities of the pharmacies, 4) documentation, software and computer equipment, and 5) human resource planning, training, and management. In the first dimension, availability of lists related to medicines have been evaluated based on different criteria. medical consumables as second dimension are equipment usable in the community or hospital pharmacy, such as syringes, needles, clips, packaging, tubing, catheters, medical gloves, gowns, masks, and the like, that are required in a disaster. Third dimension is the physical facilities of a place that affects the quality of pharmacy structure [16].

Nine experts were then identified and recruited for interview through purposive sampling, including two representatives from the Iranian Pharmacists Association, three representatives from the Iranian Food and Drug Administration, two representatives from the Scientific Council for Disaster Management, and one representative from the Ministry of Health and Municipality. Semi-structured interviews were conducted with them from January to March 2020. Overall, most interviewees had over 10 years' experience in the field. Interviews continued until no new comment was added to the previous ones, and saturation was achieved. Upon the completion of the interviews, the audio files were converted into texts, and the 'thematic analysis' method was used to analyze the qualitative data. Thematic analysis is a method for analyzing and categorizing available patterns in qualitative data [17]. The coding process was done by two experts independently, and in case of a disagreement a third expert was invited to resolve it [18].

2.2. The quantitative phase: measuring the preparedness level

For the quantitative part of the study, a sample of pharmacies in Tehran was selected using a complete list of outpatient and inpatient service centers from the private and public sectors. To draw the sample, the city was divided into five geographical regions, namely northern, southern, eastern, western and central districts. Based on the municipal division, each of the regions in the city have different areas. For this reason, we chose cluster samples in five regions of Tehran and the sample size was calculated based on the proportional distribution in different regions and the type of pharmacy. According to Lohelin [19] and Harlow& Lisa [20], 200 pharmacies were included in the sample, which constituted about 10 percent of the pharmacies operating in the city. The pharmacies were also categorized based on the type of pharmaceutical services and the type of medicine providing centers, including private daily, private 24-hr, private inpatient, public outpatient, and public inpatient centers. The target pharmacies were identified, using systematic random sampling. Table 1 shows the sample size for types of pharmacies in different regions of Tehran. The emergency preparedness assessment tool was completed by the sample pharmacies. Necessary training was provided to respondents to ensure they understood the tool. Then, Data were collected from June to October 2020 and analyzed using the SPSS-24 software.

Table 1. Sample size for types of pharmacies in different regions.

Region \ Type of pharmacies	private daily	private 24-hr	private inpatient	public outpatient	public inpatient	total
Center	42	2	3	5	4	56
South	18	2	1	1	1	23
North	35	3	2	3	3	46
East	38	3	1	2	1	45
West	24	3	1	1	1	30
Total	157	13	8	12	10	200

3. Results

3.1. Emergency preparedness dimensions and indicators

The qualitative phase of the study identified dimensions and indicators of pharmacy emergency preparedness. After analyzing expert opinions, five dimensions with 67 indicators were identified. The emergency preparedness assessment checklist was designed based on the identified dimensions and indicators, which are presented in Table 2.

Table 2. Designed checklist based on five dimensions and 67 indicators.

1. Medicine requirements
1.1- Availability of an essential medicine list in pharmacies
1.2- Availability of an emergency medicine list in pharmacies
1.3- Availability of an essential personal care product and supplement list in pharmacies
1.4- Availability of a CBRNE medicine list in pharmacies
1.5- Availability of disinfectant and cleaning products in pharmacies
1.6- Possibility of medicine procurement from several distributing companies
1.7- Networking among pharmacies for notification about medicines shortages
1.8- Using alternative medicines in collaboration with physicians in times of medicine shortage
1.9- The number of services provided per capita in a month.
2. Medical consumables requirements
2.10- Pharmacy is responsible for supply of medical consumables for clinic or hospital related to it.
2.11- Possibility of medical consumables provision from multi company or store of distribution
2.12- Availability of link between the pharmacy with other pharmacies for notification of medical consumables deficiencies
2.13- Availability of first aid box in pharmacies
2.14- Availability of defined items for the first aid box in pharmacies
3. Physical facilities requirements
3.15- Measuring and confirm of pharmacies construction Resistance
3.16- Measuring and confirm of pharmacies non-construction Resistance
3.17- Availability of suitable place for pharmacies and medicine storeroom
3.18- Availability of more than a door for entrance in pharmacies
3.19- Availability of emergency power in pharmacies
3.20- Assign safe place for refrigerator of pharmacies
3.21- Refrigerator connection to emergency power
3.22- Availability of dry ice in pharmacies
3.23- Assign safe place for computer equipment of pharmacies
3.24- Assign safe place for communication tools of pharmacies
3.25- Assign safe place for power and gas meter of pharmacies
3.26- The principles of safe arrangement for medicines in pharmacies shelf
3.27- Availability of deep and edging shelfs in pharmacies
3.28- Protection of medicines based on Good Storage Practice
3.29- How much is interval between pharmacy storeroom and pharmacies?
3.30- Suitable principles of location and kind of pharmacies heating devices
3.31- Availability of equipment for fire fight in pharmacies
3.23- Availability of equipment for fire fight in pharmacies storeroom
3.33- Safe line for water plumbing and sewerage in pharmacies
3.34- Correct principle of pharmacies waste separation and disposal
3.35- Suitable floor covering of pharmacies for prevention of gliding
3.36- Availability of cables and interfaces required disaster conditions in pharmacies
3.37- Availability of suitable safety in pharmacies installation
3.38- Location of toilet in inside of pharmacy
3.39- Availability of good ventilation system in pharmacies
3.40- Non-use of glass in pharmacy
3.41- Safety of used ladder in pharmacies
3.42- Availability of emergency light in pharmacies
3.43- Availability of radio in pharmacies
3.44- Availability of battery with different sizes in pharmacies
3.45- Availability of Spirit lamp in pharmacies
3.46- Availability of Proper water source in pharmacies
3.47- opening of Pharmacy's door on the outside
3.48- Availability of alarm system in the pharmacy

Table 2 (continued). Designed checklist based on five dimensions and 67 indicators.

4. Software requirement
4.49- Availability of access to the pharmacy's computer data in cloud space
4.50- Collection of medical documentation for chronic patients in the pharmacies
4.51- Availability of Backup and update of the pharmacy system
4.52- Availability of variety of hardware for connect to internet in the pharmacy
4.53- Availability of management dashboards for control vital and essential medicines in pharmacy
4.54- Using software with good performance and speed
4.55- Using CCTV with full coverage of area in pharmacies
4.56- Maintenance of medical records of patients based on privacy principles
5. Training and HRM requirement
5.57- Planning to participate the pharmacy staffs in disaster management training courses and maneuvers
5.58- Determination of pharmacy staffs' duties and their activities time in disaster
5.59- Determination of core manager for crisis in pharmacy
5.60- Determination of Command hierarchy in disaster condition
5.61- Staffs education for handling of essential medical consumables
5.62- Consciousness of all pharmacy staffs from location of Fire extinguisher, main valves for gas and water
5.63- Staffs education for handling of safety devices
5.64- Necessary training to control staffs stress in disaster condition
5.65- The pharmacy staffs' education for using of first aid devices
5.66- The pharmacy staffs' education for performing of CPR
5.67- Number of educated staffs for delivering of medicine services

3.2. Emergency preparedness assessment of pharmacies

The five dimensions of readiness are presented in Table 3. The mean score for each dimension indicates the readiness level of a pharmacy with respect to the relevant dimension.

Table 3. Descriptive Statistics of the pharmacies' readiness level in five dimensions.

	Medicine	Medical consumables	Physical facilities	Software Requirement	Training and HRM
Mean	27.6%	41.7%	55.8%	52.0%	32.7%
Median	21.4%	37.5%	54.8%	50.0%	27.3%
Std. Deviation	18.5	22.3	18.8	18.3	21.7
Skewness	1.5	0.75	0.08	-0.18	1.3
Kurtosis	2.4	0.62	-0.93	-0.26	1.6
Minimum	0.0	0.0	17.2	0.0	0.0
Maximum	100	100	93.9	90.9	100

According to these findings, the preparedness levels of the pharmacies in different dimensions was 27.6% for medicines, 41.7% for medical consumables, 55.8% for physical facilities, 52% for software, and 32.7% for human resource training and management.

The preparedness level was classified into 5 categories ranging from very low to very high. Accordingly, based on expert's comments the readiness level from zero to 20% was considered 'very low', and 20-40%, 40-60%, 60-80%, and 80-100% were considered 'low', 'moderate', 'high', and 'very high', respectively. Findings show that 83% of the pharmacies have a 'less-than-moderate' readiness level in terms of medicine requirements (Table 4). Also, 77% of the pharmacies have a moderate readiness level and higher in terms of physical facilities requirements.

Table 4. Distribution of pharmacies in different levels of readiness in percentage.

	Medicine	Medical consumables	Physical facilities	Software Requirement	Training and HRM
Very low	38.0	14.0	2.0	8.5	31.5
Low	45.0	47.5	21.0	20.0	42.5
Medium	9.0	21.0	35.5	38.5	16.5
High	5.5	10.0	29.5	26.0	3.5
Very high	2.5	7.5	12.0	7.0	6.0

This analysis was followed by analyzing each dimension based on geographic locations and types of pharmacies. Differences between pharmacies' preparedness level were examined against their geographic locations and types. The Kruskal-Wallis test was carried out to assess the effects of pharmacies' geographic locations on their preparedness level. According to the results, geographic locations did not have significant effects on the pharmacies' preparedness level. Therefore, the results of the pharmacies' readiness levels for all five dimensions can be quite safely (by a 95% confidence interval) extrapolated to all regions of the city.

We also evaluated the effect of the pharmacy type on the pharmacies' preparedness levels. According to the results of this test, the pharmacy type had a significant effect on the pharmacies' preparedness level in terms of medicine requirements and medical consumables requirements. As a result, different types of pharmacies differed in these two dimensions by a probability of 95%. Subsequently, the Mann-Whitney test compared the types of pharmacies in pairs, with the Bonferroni test applied to the obtained results.

According to the results of the Mann-Whitney test, there was a significant difference with a probability of 95% in

the preparedness levels of private daily pharmacies vis-à-vis public outpatient, public inpatient, and private inpatient pharmacies in both dimensions, and private daily pharmacies had lower preparedness than their public outpatient, public inpatient, and private inpatient counterparts. No significant difference was also observed between daily private and private 24-hr pharmacies.

The results of comparing the readiness levels of private 24-hr pharmacies with their public outpatient, public inpatient, and private inpatient counterparts in both dimensions showed that there was a significant difference of 95% probability, with the private 24-hr pharmacies having had a less readiness level than the public outpatient, public inpatient, and private inpatient pharmacies.

In comparing the readiness levels of public outpatient and private inpatient pharmacies, it turned out that there was a significant difference only in terms of medicine requirements. The results of this comparison showed that public outpatient pharmacies had a higher preparedness level than private inpatient pharmacies.

In addition, in comparing the preparedness levels of public inpatient and private inpatient pharmacies, it was found that there was a significant difference only in terms of medicine requirements. The results of this comparison showed that the public inpatient pharmacies had a higher preparedness level than the private inpatient pharmacies.

As already mentioned, this study was conducted to determine indicators and develop a model for the assessment of pharmacies' preparedness levels in providing medicine and medicine services during disasters. Most of the past studies in this area have explained only one dimension or only a few dimensions preparedness dimensions of pharmacies. For example, a study was conducted at the University of Omaha to design a practical checklist for pharmacies' preparedness in emergencies with a special focus on the requirements of documentation development as well as personnel planning and training [10]. However, our study focused on the examined dimensions in previous studies to develop new indicators.

This study also examined the relationships and cooperation between pharmacies in the exchange of medicines and the necessary equipment, as well as the relationships with physicians in the replacement of medicines. In the absence of an official network, most pharmacies used informal networks to communicate with each other about the exchange of drugs and equipment. However, in the United States, this task has been assigned to a number of pharmacies called Valley Drugs, and the official structure of exchanging drugs and equipment between pharmacies has helped to reduce the severity of potential accidents [10]. In the 2021 India survey, activation of Pharmacy Professionals (PPs) were evaluated in The COVID-19 pandemic. The results showed that PPs were actively involved in essential pharmacy services. In addition to, only 25% respondents had Collaboration with other pharmacies to procure medications and supplies [21].

As this study has been inspired by SARA's study, and considering the implementation of this study in six countries across three continents, the results showed that readiness in essential medicines and commodities was commonly weak in all countries [22].

Our study has examined the availability of a list of essential medicines and equipment as well as their minimum necessary inventory. The availability of medication for patients with chronic diseases at pharmacies has also been examined. The importance of examining such cases could be observed in other studies. For example, in a study conducted to examine access to essential medicines for chronic illnesses in Los Angeles, the existence of chronic medicine cases at pharmacies and the availability of necessary medicines for 30 days for patients in post-crisis conditions have been examined [12]. Besides, regarding the development of a list of essential medicines in critical situations and their supply management, in another study focusing on an earthquake that struck Pakistan in 2005, essential medicines were determined based on treatment categories [23].

This study assessed the requirements for Human Resource planning, training, and management, as well as necessary operation capabilities for pharmacists and pharmacy personnel in crises. These capabilities included performing CPR, the proper use of essential medical supplies such as barometers, glucometers, thermometers, syringes, and oxygen capsules, as well as using safety devices such as fire extinguishers. The importance of such training has also been stressed in other studies. For example, pharmacists' activities at pharmacies in critical situations and their participation levels have been prioritized, whereby medicine preparation, medicine distribution, and patient training take the highest priority. Moreover, newer activities, including primary care, vaccine administration, and provision of services by mobile teams, were delineated in the next step. Pharmacists need to be trained for each one of these steps [9]. Based on research of the hospital pharmacies' preparedness and pharmacist roles during disasters in Saudi Arabia, hospitals had a consensus about maintain effective distribution and control, collaborate on medication management, and develop and maintain first-aid skills. in addition to, the type and quantities of stocked medications, as well as pharmacist roles, are not well recognized [24].

This study examined the requirements of documentation, software, and computer equipment, from among which one can refer to the existence of cable and electrical interfaces needed in critical situations. Furthermore, the presence of various types of hardware for Internet connections and data backup at pharmacies to save computerized documentation are among readiness

indicators in crises. FIP has referred to the maintenance of health records, the existence of various communication channels, the protection of communication cables against possible damage, and the existence of alternative communication methods in case of the failure of landlines as requirements for preparedness in critical situations for hospital and community pharmacies [25].

Lastly, the difference in the readiness levels of various types of pharmacies, such as daily private, private 24-hr, public outpatient, public inpatient, and private outpatient pharmacies, was one of the evaluation aspects in this study. This study found no difference between daily and 24-hr pharmacies in terms of their readiness level, but the readiness level of daily and 24-hr pharmacies was lower than that of other pharmacies only in terms of medical supply and medical consumable requirements. This difference bears witness to the fact that familiarity with the crisis literature and planning to deal with crises are more common in public and hospital pharmacies than in community pharmacies. Public inpatient pharmacies had the highest readiness level among other sectors in providing pharmaceutical services; hence, from this perspective, better planning could be done to enhance the capabilities of these pharmacies in critical situations and mitigate the consequences of incidents. Although the readiness level of hospital pharmacies was higher in the two mentioned dimensions than that of community pharmacies, it had no significant difference in the other three dimensions, pointing to the necessity of planning to enhance these dimensions more than ever.

4. Conclusion

The results of this study indicated that the preparedness level of medicine service centers in the selected statistical population was weak in all aspects and that pharmacies were not prepared to deal with major disasters and events. These findings show that policymakers should set greater store by improving the capabilities of pharmacies to deal with crises. It was found that medicine supply had the lowest preparedness level and the physical facilities and pharmacy infrastructures had the highest preparedness level. In this respect, necessary and comprehensive planning must be done in all dimensions to improve the readiness level of medicine-services providing centers, and in particular, in terms of medicine supply and staff training, effective measures must be adopted. Therefore, it is recommended that the major findings of this study, as a requirement of the establishment and activities of pharmacies, be included in the regulations and evaluation system of pharmacies.

Study limitations

The study was limited to civilian pharmacies and could not include those belonging to military institutions. In addition, because there is no list of essential medicines in the country, the study could only assess the existence of this list by the standard of the centers providing medicines and could not measure the available medicines.

List of abbreviation

SARA: Service Availability and Readiness Assessment
IHP: International Health Partnership and Related Initiatives
JCPP: Joint Commission of Pharmacy Practitioners
ADCs: Automated Dispensing Cabinets
FIP: International Pharmaceutical Federation
SOPs: Standard Operation Practices
PPs: Pharmacy Professionals

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Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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