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Reverse Triage to Increase the Hospital Surge Capacity in Disaster Response

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Abstract

Introduction: Successful and effective management of large-scale disasters and epidemics requires pre-established systematic plans to minimize the damage and control the situation. With an increasing number of people in need of urgent medical care, hospitals must improve their response capacity, being at the forefront of responding to disasters and incidents. One way to develop the hospital capacity in disaster response is by reverse triage (RT).

Objective: The current study was conducted to investigate the role of RT to create additional hospital surge capacity in one of the major referral academic hospitals of Isfahan, Iran.

Method: This cross-sectional study was conducted in 2015 at Al-Zahra Subspecialty Hospital, Isfahan, Iran. The ten most common diseases leading to hospitalization in each ward of the hospital in 2014 were reviewed and, based on the prevalence, sorted and listed. Academic instructions for making a decision and possibility of early discharge was written and approved by an expert panel. On a day that was not set previously, the pre-selected in-charge person of each department was asked to run the RT following the instructions, and the number and percentage of those who were eligible for discharge via RT were determined.

Results: The total BOR in Al-Zahra Hospital in 2014 was about 80%, so it was estimated that almost 140 out of 700 beds are vacant. The results showed that by using RT, 108 (20%) hospitalized cases could be discharged, and considering the bed occupancy rate of about 80% and 140 vacant beds, a total of 248 beds could be provided following RT.

Conclusion: Running RT in 41 wards and units of Isfahan Al-Zahra Hospital, on average, added 108 beds to the hospital capacity. This increment is not the same in all wards, as the role of intensive care units in RT for surge capacity is insignificant.

Key words: Disasters; Hospital bed capacity; Patient care; Surge capacity; Triage

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INTRODUCTION

Floods and landslides, drought, storms, volcanic eruptions, earthquake, and tsunami are commonly known as natural disasters (1). Based on the Center for Research on the Epidemiology of Disasters (CRED) report, 331 natural disaster events had been registered during 2015 all around the world, resulting in more than 22 thousand deaths and affecting 90 million people (2). China, the United States, the Philippines, India, and Indonesia were the countries that were most frequently affected by natural disasters from 2000 until 2010 (3). The Islamic Republic of Iran is also one of the most natural disaster-prone countries in the world (4). Around 181 disasters in Iran, between 1900–2007, had led to 155811 deaths, injuring 168217 injured and affecting more than 44 million people (5). On the other hand, the strategic geographic location of the middle east which is involved with ongoing wars and multiple terrorist attacks exposed the country to a higher risk of non-natural mass casualties (6, 7).

After any disaster and mass casualty event, medical needs rise quickly; so the local healthcare system services should be increased in response. The increasing medical needs is a major challenge for the healthcare system (8). Available records verify that in time of disasters, these are the hospitals that bear the main burden of care of the injured patients (9) and, in such circumstances, are expected to be able to manage their own needs up to 96 hours without outside help (10). Developing the capacity and capability to handle such a situation, impacting the healthcare community, has become known as the medical surge. As defined, surge capacity is the

maximum potential delivery of required resources either through augmentation or modification of resource management and allocation (8, 10). Accordingly, finding a system whereby the capacity for new hospitalizations could be increased is necessary, without an increase in resources and workforce. One of these systems is the reverse triage (RT). In short, RT is discharging current low-risk patients and allocating the hospital resources for those who are in dire need of medical services (9-13).

Effective management of large-scale disasters requires pre-established systematic plans to minimize the damage and control the situation (14). Therefore, assessing the possibility of performing RT to achieve the objectives of strengthening resources, reducing the need, and redistribution of resources would be advantageous. Considering the large number of potential disasters threatening Iran, preparing healthcare systems, especially hospitals, to meet the needs and care for a large number of victims in these events is essential. The current study was conducted to investigate the role of RT to create additional hospital surge capacity in one of the major referral academic hospitals of Isfahan, Iran.

METHODS

Study design

This cross-sectional study was conducted in 2015 at Al-Zahra Subspecialty Hospital, Isfahan, Iran. The protocol of the study was approved by the ethics committee of Isfahan University of Medical Sciences and the code ir.mui.res.1393.3.465 was assigned. The required coordination with all the hospital department heads and head of the center was carried out.

Definition

Isfahan Al-Zahra Hospital is the largest, most active, and the main referral center for patients from different parts of the province and the neighboring provinces. The number of approved hospital beds is 950 among which 800 beds are active. A monthly average of 4,700 people visit the emergency department of the hospital, and about 2,300 of them are hospitalized.

Instruction preparation

An expert panel consisting of all departments of the hospital was formed. The ten most common diseases leading to hospitalization in each ward of the hospital in 2014 were reviewed and, based on the prevalence, sorted and listed. For example, in table 1, the ten most common causes of hospitalization in the urology department ward are presented. Then, based on Handbooks of Emergency Medicine (15), considering no significant risk will threaten the patients in the next 96 hours, academic instructions for making a decision and the possibility of early discharge were written and approved by the expert panel. For example, the guidelines for the disposition of the patients hospitalized in the urology ward, using RT method, are presented in table 2.

Data gathering

Table 1: Ten common causes of hospitalization in the urology ward of Isfahan Al-Zahra Hospital in 2014

Cause of hospitalization	Number (%) of hospitalized cases
Ureter stone	134 (25.9)
Renal stone	110 (21.3)
Urinary apparatus consolidation	59 (11.4)
Benign prostatic hypertrophy	48 (9.3)
Bladder malignancy	36 (7.0)
Kidney transplantation	36 (7.0)
Urethral stricture	28 (5.4)
Prostate malignancy	27 (5.2)
Scrotal varicocele	21 (4.1)
Ureteral stricture	18 (3.5)

Table 2: Instructions for the disposition of the patients hospitalized in the urology department using reverse triage method

Urinary stones: If the pain is severe, the patient is monitored till the pain diminishes and is tolerable. In the case of fever and impaired renal function, the patient is hospitalized. Otherwise, patient is treated on an outpatient basis. Be more careful in the case of patients having only one kidney, transplanted kidney, and renal failure.
Benign prostatic hypertrophy: In the absence of pyelonephritis, acute urinary retention, and renal failure, the patient can be treated on an outpatient basis.
Varicocele: Treatment can be done on an outpatient treatment.
Prostate cancer: The diagnostic measures can be suspended for a few days.
Narrowing of the urinary tract: In the absence of acute hydronephrosis, treatment can be suspended or done on an outpatient basis.
Kidney transplantation: It is not an emergency procedure and can be postponed.

On a day that was not set previously, the pre-selected in-charge person of each department was asked to run the RT following the instructions, and the number and percentage of those who were eligible for discharge via RT were determined.

Statistical analysis

Data were analyzed using the Excel software 2010 and the results presented with descriptive statistics.

RESULTS

At the time of the study, the hospital had 712 registered beds in 41 wards. The highest and lowest number of beds, respectively, were in the elective surgery ward with 37 beds and the neonatal surgery and neonatal intensive care unit (NICU) with only 5 beds. Table 3 shows the total number of admissions, hospitalization for ten common causes, and the mean bed occupancy rate (BOR) in different wards of the hospital during 2014. As the findings show, the highest BOR was seen in acute surgery (108%), acute internal medicine (100%), central ICU 2 (100%), central ICU 1 (99%), neuro ICU (98%), NICU (98%), and VIP ICU (96%). As seen, critical wards and units had the highest BOR. Conversely, the lowest BOR was seen in neonatal surgery (53%), post CCU (60%), pediatric surgery (63%), obstetrics and gynecology (65%), vascular surgery (66%), ENT (66%), and plastic surgery (68%). It is noteworthy that in no wards of Al-Zahra Hospital the BOR was less than 50%.

Table 3: Admission rate in various wards of Al-Zahra Hospital and the mean bed occupancy rate during 2014

Ward	Total admissions (Number)	Admission rate based on ten common causes (Number)	Bed occupancy rate (%)
Lung	280	238	90
Male Orthopedic	621	438	80
Female Orthopedic	200	141	84
Urology	646	517	65
Acute Surgery	414	356	108
Acute Internal Medicine	319	236	100
Neurology ICU	17	11	98
NICU	38	28	98
Central ICU	38	28	99
Central ICU 2	41	30	100
Central ICU 3	12	10	93
VIP ICU	24	14	96
Post CCU	71	61	60
Dermatology	87	65	83
Pediatric Surgery	360	271	63
Plastic Surgery	650	525	68
Thoracic Surgery	348	229	77
Female Surgery	456	348	80
Vascular Surgery	366	301	66
Male Surgery	462	360	70
Elective Surgery	462	360	70
Neonatal Surgery	59	46	53
Hematology	38	28	93
Internal Medicine 1	274	176	80
Neurology	579	463	86
Internal Medicine 2	96	76	89
Internal Ward	275	253	74
Neurosurgery	539	402	86
Psychiatry	147	134	87
Rheumatology	70	57	85
Obstetrics and Gynecology	1108	869	65
Emergency (Subacute)	72	45	95
CCU	175	152	82
Infectious Diseases	265	212	93
Endocrinology	77	62	83
Oral and Maxillofacial	325	279	67
Cardiology	277	230	85
Gastroenterology	430	315	89
ENT	323	266	66
Nephrology	269	125	90

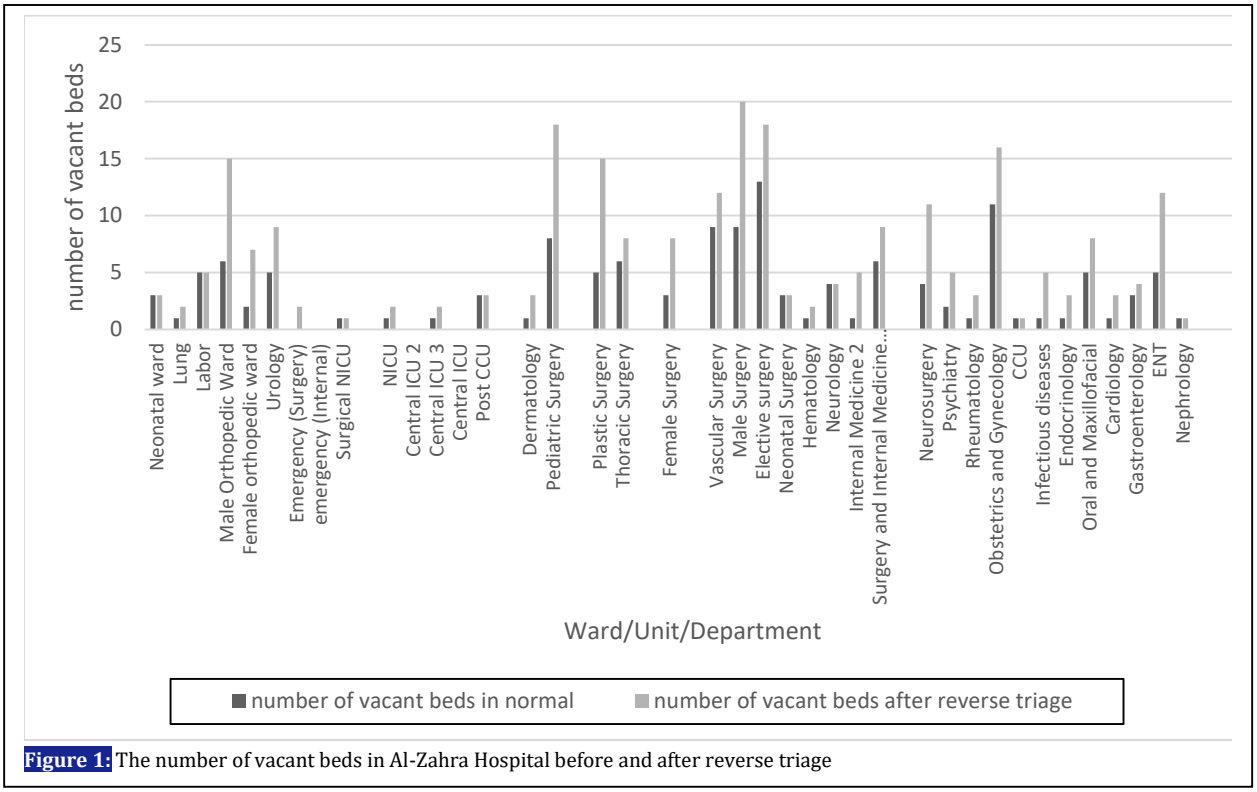

Figure 1: The number of vacant beds in Al-Zahra Hospital before and after reverse triage

Using RT, the greatest reductions in the BOR was obtained in plastic surgery (65%), ENT (44%), male surgery (35%), dermatology (33%), endocrinology (33%), pediatric surgery (27%), and male orthopedic ward (25%). A decreasing trend was seen in other wards and units with the exception of acute wards like acute internal medicine ward and ICU.

The number of vacant beds before and after the RT at the time of the study is shown in figure 1. Total BOR in Al-Zahra Hospital in 2014 was about 80%, so it was estimated that almost 140 out of 700 beds are vacant.

The results showed that by using RT, 108 (20%) hospitalized cases can be discharged, and considering the BOR of about 80% and 140 vacant beds, a total of 248 beds could be provided following RT.

Discussion

This study showed that, in response to a disaster, 248 beds could be provided using RT in Al-Zahra Hospital. As the findings show, all wards, units, and departments do not have the same capabilities for RT and additional hospital surge capacity. Wards such as orthopedics, urology, pediatric surgery, plastic surgery, male surgical ward, neurosurgery, and ENT have the greatest potential for RT and surge capacity. The wards such as ICU, labor, neonatal surgery, and NICU have the highest risk of early discharge, but patients cannot be discharged earlier than necessary.

Isfahan city is a referral center for critically ill patients from all over the Isfahan province and also the neighboring provinces. For this reason, the number of critically ill patients in this hospital is significant, and applying RT in other hospitals may result in discharging a greater percentage of patients.

Kelen et al. prospectively studied elective wards of three hospitals for a period of 19 weeks. In this study, severe and life-threatening disease score was 10, and by reducing the severity of illness, it fell to 3. The results showed that the percentage of patients who could be discharged early in an academic hospital was 40%, in a teaching hospital was 47%, and in a non-educational community hospital was 59%. It should be noted that in the study by Kelen et al., early discharge was more frequent, with those without the need for emergency intervention or management over the next 4 days counted as eligible to be discharged (10). But in the current study, the precautionary measure were fully respected; for instance, in the treatment of gastrointestinal bleeding or asthma, the disease was considered severe, and the patients could not be discharged. Some of these patients

could be discharged after stabilization if there was a need for surge capacity in response to a disaster. Looking for a plan to create surge capacity in the Royal Darwin Hospital for admitting the blast injury cases from a boat carrying asylum seekers in 2009, 56 beds (16% of capacity) were added to the hospital with a capacity of 350 beds. It was done by early discharge, suspending the usual elective activities, and discharging 19 patients at least one day earlier than planned. Notably, RT resulted in no increase in clinical risk with only one patient who was discharged early returning for further treatment (16).

However, the implementation of RT does not necessarily result in significant surge capacity. Seeking to increase the number of admissions for a flu pandemic on November 4, 2009, Seattle Children's Hospital managed to activate its surge capacity plan, and with early discharge during 16 hours, could release 20% of the total capacity of 250 beds for acute admissions. However, the results showed that the hospital essentially discharged the same number of patients when the surge plan was not activated. In other words, RT is unlikely to represent an effective solution to surge outside of a disaster setting because of its requirement for centralized decision making (17).

The fact must be taken into consideration that since in various studies the risk stratification for early release is not the same, RT gives different results for surge capacity. Moreover, this topic points out the importance of classification systems for early discharge since most wards of the hospital are often working with high BOR, even more than its capacity. For this reason, it seems that taking steps to increase the hospital capacity in disasters needs more attention. However, in this context, all hospitals from large to small should be planned for RT and carry out the necessary studies. Quantifying such risk will be a handy guide to experts in the decision-making process for early discharge when needed. In any case, this is the first study done in the context of the impact of RT in increasing the hospital capacity in Iran. The results of the current study can be a basis for future studies on the one hand and be a handy guide on the other hand to experts and decision-makers to formulate well-functioning incident management. In times of crisis, RT along with other plans can play a great role to increase the hospital admissions.

Limitations

The study was done in a single teaching hospital with adequate resources, workforce, and staff; hence, it is necessary to study further a greater number of public and private hospitals with adequate and/or inadequate resources. Furthermore, it was assumed in this study that hospitals will continue to work during disasters and will not be affected by it. But if the hospital and its staff and resources are to be the target of sabotage or terrorist operations, the hospital cannot perform its functions as usual. Also, this study does not deal with the quantitative data of early discharge.

CONCLUSIONS

Running RT in 41 wards and units of Isfahan Al-Zahra Hospital, on average, added 20% (108 beds) to the hospital capacity. This increment is not the same in all wards, as the role of intensive care units in RT for surge capacity is insignificant.

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AUTHORS' CONTRIBUTION

All the authors met the standards of authorship based on the recommendations of the International Committee of Medical Journal Editors.

CONFLICT OF INTEREST

None declared.

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