Pattern of Drug Prescription and Utilization among Bam Residents during the First Six Months after the 2003 Bam Earthquake

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Abstract

Introduction: It is important to identify what kinds of drugs are required by disaster-affected populations so that appropriate donations are allocated. On 26 December 2003, an earthquake with an amplitude of 6.3 on the Richter scale struck southeastern Iran, decimating the city of Bam. In this study, the most frequently utilized and prescribed drugs for Bam outpatients during the first six months after the Bam Earthquake were investigated.

Methods: In this descriptive, cross-sectional study, the data were collected randomly from 3,000 prescriptions of Bam outpatients who were examined by general practitioners from Emergency Medical Assistance Teams in 12 healthcare centers during the first six months after the Bam Earthquake. The data were analyzed for: (1) patient sex; (2) number of drugs/prescriptions; (3) drug category; (4) drug name (generic or brand); (5) route of administration; (6) percent of visits where the most frequent drug categories were prescribed; and (7) the 25 most frequently prescribed drugs, using World Health Organization (WHO) indicators of drug use in health facilities.

Results: Male patients represented 47.4% and females 52.6% of the total number of outpatients. The mean number of drugs/prescriptions was 3.5 per outpatient. Oral administration was the most frequent method of administration (81.7%), followed by injections (10.9%). Respiratory drugs were the most frequently used drugs (14.2%), followed by analgesics/non-steroidal anti-inflammatory drugs (NSAIDs) (11.3%), antibacterials (11.2%), gastrointestinal (GI) drugs (9.6%), and central nervous system drugs (7%). Penicillins (6.8%), cold preparations (8%), and systemic anti-acids (ranitidine and omeprazole) were among the 25 most frequently used drugs by outpatients and inhabitants of Bam during the first six months after the Bam Earthquake.

Conclusion: Respiratory, analgesic, antibacterial, GI, and psychiatric medications were among the most commonly prescribed pharmaceuticals after the catastrophic Bam Earthquake. The results of this study may help to predict the needs of patients during future disasters and prevent unnecessary donations of medicine.

Introduction

On the morning of 26 December 2003, an earthquake with a magnitude of 6.3 on the Richter scale struck southeastern Iran. The epicenter of earthquake was in Bam, a town of historical importance and a popular tourist destination, located 160 km from Kerman, the center of Kerman Province (Figure 1).

The event resulted in 43,000 deaths and injured 30,000 persons. About 100,000 people lost their property, homes, etc. Arge-Bam, the 4,000-year-old clay castle, was destroyed completely.[1] All of the medical facilities, including two hospitals and many healthcare centers, were damaged severely, and many medical personnel either were dead, injured, or chose to care for their relatives instead of working at hospitals or medical centers. Therefore, nearly all of the seriously injured patients were transferred to other parts of the country, but many of them returned to Bam after they were discharged.
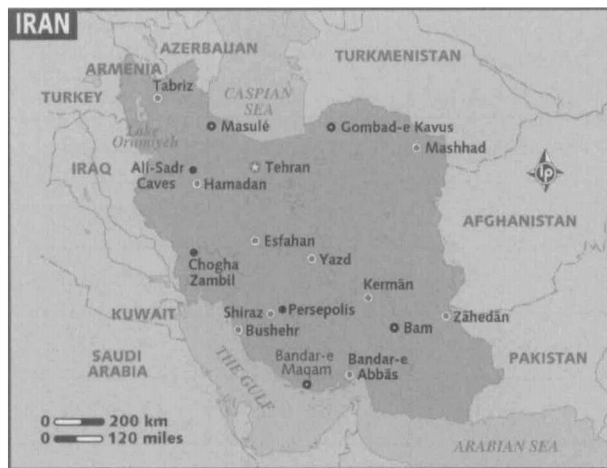
Figure 1—Map of Iran
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Other studies have demonstrated that earthquakes have a great impact on the pattern of distribution of prescription medications and health aids.[2–6] Preventing acute renal failure in crush victims by early fluid resuscitation and the management of fractures are priorities immediately after an earthquake, but the prevention of infectious diseases and psychiatric disorders are important later during the disaster.[5,7–12] The pattern of drug utilization in disaster situations such as earthquakes, floods, storms, and explosions varies.[2,3,7,10] Medical studies on the effects of earthquakes often are conducted on mental health situations, epidemiology, illness, deaths, drug abuse, and the social consequences of the disaster.[9,11–16] Few reports considering the patterns of drug utilization and most frequently prescribed drugs among survivors of an earthquake exist.[7,10] Currently, no reports exist about the drug utilization and prescription pattern after the Bam Earthquake. Severe earthquakes frequently occur in Iran. In recent years, these earthquakes have caused thousands of deaths. After each event, large amounts of drug donations were sent to the affected areas through humanitarian aid. However, the needs of these earthquake-prone regions for the type of drug donations has not been studied. This study was performed to determine these needs and identify the type of drug categories that were utilized and prescribed most frequently for Bam inhabitants during the first six months after the 2003 Bam Earthquake.

Following the Earthquake, Bam was divided into 12 zones, each with one healthcare center responsible for providing health services for the inhabitants of that particular zone. Bam inhabitants and outpatients were visited by general practitioners (GPs) of emergency medical assistance teams from Iran and other countries such as Russia, India, France, Italy, Saudi Arabia, the United Kingdom, and the United States.

Methods
To determine the effects of the Bam Earthquake on the pattern of drug utilization, a survey was conducted on the drugs most frequently utilized and prescribed to the affected population during the first six months after the Earthquake. A total of 3,000 prescriptions from the Bam outpatients who were evaluated by GPs during the first six months were selected randomly. The prescriptions were taken from 12 healthcare centers (250 prescriptions from each center), and analyzed using World Health Organization (WHO) indicators of drug use in health facilities.[17]

The following characteristics were determined: (1) the sex of the patients; (2) the number of drugs/prescriptions/outpatient; (3) the drug category; (4) the drug names (generic or brand); and (5) the percentage of encounters where the most frequent drug categories were prescribed. The percentage of injected drugs and the 25 most frequently prescribed drugs were determined. The data were transferred to a common database questionnaire format to simplify data entry into a personal computer. The percentage of drug utilization and the percentage of patients that received them were calculated.

Results
Male patients represented 47.4% and females 52.6% of the total number of outpatients evaluated by GPs in healthcare centers during the first six months after the Earthquake. A total of 10,500 drugs were prescribed by GPs for Bam outpatients and the mean value for the number of drugs/prescriptions per outpatient was 3.5. The majority of prescriptions (79.1%) had complete documentation, including drug name, dose, and route of administration. However, 21.9% of prescribed drugs did not include directions for patient use. Most of the drugs (95.1%) were prescribed by a generic name. Oral administration was the most frequent means of administration (81.7%), followed by injections (10.9%) (Figure 2).

Respiratory drugs (14.2%) were the most commonly utilized drugs, followed by analgesics (11.3%), antibacterials (11.2%), gastrointestinal (GI) (9.6%), and central nervous system (CNS) drugs (7%) (Table 1). A total of 81% of the outpatients received at least one type of respiratory drug. Cold preparations were the most frequently used (8%) type of respiratory drugs, and 45% of patients received at least one cold preparation drug. Analgesics/non-steroidal anti-inflammatory drugs, including non-opioids (8.6%) and opioids (2.7%), were the second most frequently used drugs, which were prescribed for 63.8% of the Bam outpatients (Tables 1 and 2).

Overall, antibacterials constituted 11.2% of the total drugs utilized. The pattern of antibacterial prescriptions showed that penicillin consisted of 6.8% of the total number of drugs utilized, followed by cephalosporines (2%). Antibacterials were prescribed for 63.3% of the outpatients during the first six months following the Earthquake, and 38.5% of the patients received penicillins, followed by cephalosporines (11.2%), sulfonamides (6.8%), and macrolide antibiotics (4.8%) (Table 3). Amoxicillin (oral suspension), penicillin G benzathine (injection) and cephalexin were the most frequent utilized antibacterials, followed by cotrimoxazole (Table 4). Gastrointestinal drugs also were used frequently by Bam outpatients (9.6%). Systemic anti-acids (ranitidine and omeprazole) and antispasmodics (hyoscine) were the most frequently prescribed GI drugs (Table 4), 45% of the Bam outpatients received them.
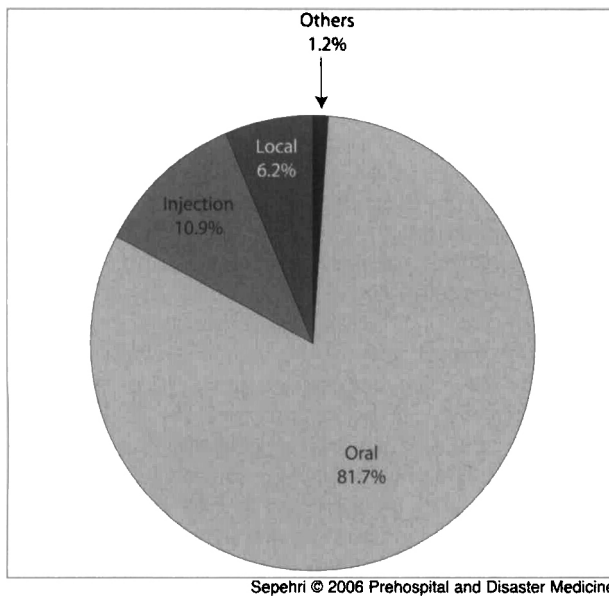
Figure 2—Route of drug administration for Bam outpatients during the first six months after the Earthquake

Drugs	Number of drug utilized (%)	Number of patients who received drugs (%)
Analgesics	1,187 (11.3)	1,914 (63.8)
Antibacterials	1,176 (11.2)	1,899 (63.3)
CNS	735 (7)	1,203 (40.1)
Cardiovascular	535 (5.1)	813 (27.1)
Gastrointestinal	1,008 (9.6)	1,566 (52.2)
Respiratory	1,491 (14.2)	2,430 (81.0)
Others	4,368 (41.6)	---

Table 1—Percentage of the most utilized drug categories and percentage of patients received drugs among Bam residents during the first six months after the Earthquake (CNS = central nervous system)

Central nervous system medications, including sedatives/hypnotics and psychotherapeutic drugs (antidepressants and antipsychotics), constituted 7% of the drugs utilized, which were prescribed for 40.1% of the outpatients. Sedative hypnotics (3.8%), followed by antidepressants (3%), were the most utilized CNS drugs (21.5% of the outpatients received sedative hypnotics and 17.4% received antidepressants) (Table 2). Alprazolam and clonazepam were the most utilized sedative hypnotics and fluoxetine was the most frequently utilized antidepressant, followed by nortryptyline, imipramine, and amitriptyline. The most frequently prescribed antipsychotics were trifluoperazine, followed by chlorpromazine and perphenazine. Cardiovascular drugs constituted 5.1% of total utilized drugs and were prescribed for 27.1% of the Bam residents.

The 25 most frequently utilized and prescribed drugs during the first six months after the Earthquake are shown in Table 4. Acetaminophen codeine (which contains 325 mg acetaminophen and 20 mg of codeine) was the drug most frequently utilized, which constituted 4.8% of the total utilized drugs. Acetaminophen (4.7%) was the most widely used non-opioid analgesics among the Bam outpatients. Other frequently utilized drugs include non-steroidal anti-inflammatory drugs (NSAIDs) (ibuprofen and diclofenac), cold preparations (diphenhydramine compound, adult cold tablet, expectorant elixir, antihistamine-decongestant tablet, dextrometorphan syrup), antibiotics (amoxicillin, penicillin G benzathine, cephalexin, penicillin G 6:3:3, ciprofloxacin, and co-trimoxazole), and GI drugs (ranitidine, omeprazole, and hyoscine).

Antibiotics constituted 11.2% of the total utilized drugs and overall, 63.3% of the patients received an antimicrobial drug. Penicillins, cephalosporins, fluoroquinolones, and cotrimoxazoles were the most frequently used antibacterials among Bam inhabitants. The 10 most frequently used antibacterials in Bam were: (1) amoxicillin capsule; (2) amox-

icillin suspension; (3) penicillin G benzathine; (4) cephalexin capsule; (5) cephalexin suspension; (6) penicillin G. 6:3:3; (7) ciprofloxacin; (8) co-trimoxazole tablet; (9) co-trimoxazole suspension; and (10) erythromycin.

Discussion

The results of this study indicate that respiratory, analgesic, antibacterial, GI, and psychotherapeutic drugs were among the most frequently prescribed and utilized drugs among outpatients and inhabitants of Bam during the first six months after the Bam Earthquake. Although these results correlate with previously published studies about drug utilization patterns in disaster situations,[2,3,6-8] these data contradict the previously published data about the pattern of drug prescription during the pre-earthquake period in 2002 in the same area, which showed that antibiotics (37.4%), sedative hypnotics (20.2%), NSAIDs (13.7%), and corticosteroids (9.8%) were the most frequently prescribed drugs.[18] The average number of drugs/prescriptions and the rate of prescriptions with complete documentations (e.g., drug name, drug dosage, and route of administration) were similar to other studies in Iran.[18,19] The pattern of drug utilization during disasters will vary, and infectious diseases, psychiatric disorders, such as post-traumatic stress disorder, and depression are common among survivors.[3,4,14,16,20] The reason for the widespread use of respiratory drugs could have been due to weather conditions in Bam during and after earthquake period. Because the Earthquake occurred during a very cold period in winter, 2003, and many of the displaced residents were living in tents, the cold weather was a main health threat following the Bam Earthquake, and most of the people complained of cold symptoms and upper respiratory tract infections.[21,22] Analgesics/NSAIDs, including non-opioids and opioids, were the second most frequently used drugs and were prescribed for

Drug Category	Drug Utilization (%)	Patient Received Drugs (%)	Prescriptions (contain >1 drug from each category) (%)
Analgesics/Antipyretics/NSAIDS			
Opiods	283 (2.7)	456 (15.2)	0
Non-Opiods	903 (8.6)	1,458 (48.6)	91
Sedative/Hypnotics			
Barbiturates	3 (0.03)	6 (0.2)	0
Benzodiazepines	126 (1.2)	192 (6.4)	12
Others	273 (2.6)	447 (14.9)	16
Antidepressants	-		
Tricylics	63 (0.6)	111 (3.7)	1
Others	252 (2.4)	51 (13.7)	1
Antipsychotics		.	
Phenothiazines	21 (0.2)	33 (1.1)	0
Others	2 (0.02)	3 (0.1)	0

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Table 2—Pattern of analgesics and central nervous system drugs utilization and prescription among Bam residents during the first six months after the Earthquake (NSAIDs = non-steroidal anti-inflammatory drugs)

Drug Category	Drug Category Utilization (%)	Patient Received Drugs (%)	Prescriptions (contain >1 drug from each category) (%)
Penicillins			
Penicillin G-related	220 (2.1)	342 (11.40)	20
Aminopenicillins	494 (4.7)	813 (27.1)	5
Cephalosporines			
1st Generation	136 (1.3)	225 (7.5)	0
3rd Generation	74 (0.7)	111 (3.7)	11
Macrolides	84 (0.8)	144 (4.8)	0
Tetracyclines	32 (0.3)	42 (1.4)	2
Aminoglycosides	11 (0.1)	12 (0.6)	0
Sulfonamides/Related	13 (1.2)	204 (6.8)	0
Total	118 (11.2)	1,809 (63.3)	43

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Table 3—Pattern of antibacterial drug utilization and prescription among Bam residents during the first six months after the Earthquake

Drug	Formulation	Percent Utilized (%)
Acetaminophen Codeine	Tab	504 (4.8)
Adult cold	Tab	494 (4.7)
Amoxicillin	Cap or Tab	410 (3.9)
Diphenhydramine Compound	Syrup	336 (3.2)
Acetaminophen	Tab	294 (2.8)
Diphenhydramine	Elixir	252 (2.4)
Dexamethasone Disodium Phosphate	Inj (Amp)	221 (2.1)
Acetaminophen	Susp	221 (2.1)
Pediatric Grippe	Syrup	189 (1.8)
Ranitidine	Tab	189 (1.8)
Amoxicillin	Susp	178 (1.7)
Penicillin G Benzathine (LA)	Inj (Vial)	168 (1.6)
Ibuprofen	Tab	157 (1.5)
Cephalexin	Cap or Tab	157 (1.5)
Expectorant	Syrup	105 (1.4)
Dextromethorphan	Syrup	105 (1.4)
Penicillin G 6-3-3	Inj (Vial)	136 (1.3)
Antihistimine-Decongestant	Tab	136 (1.3)
Diclofenac	EC Tab	126 (1.2)
Omeprazole	Cap	126 (1.2)
Hyoscine	SC Tab	115 (1.1)
Ciprofloxacin	Syrup	105 (1)
Promethazine	Syrup	105 (1)
Co-trimoxazole Adult	Tab	105 (1)

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Table 4—List of the first 25 drugs prescribed during the first six months after the Bam earthquake (Tab = tablet, Cap = capsule; Inj = injection; Amp = ampule; EC = enteric coated; Susp = suspension)

63.8% of the Bam outpatients. This constitutes a remarkable increase as compared with the pre-earthquake period (NSAIDs were prescribed in 13.7% of prescriptions during the pre-earthquake period in Bam).[18] The need for adequate pain relief among injured patients could be the main reason for the widespread use of analgesics among the Bam outpatients during the first six months after the Earthquake.[7,23]

The pattern of antibiotic prescription and utilization may vary after disasters.[2,6–9] These data do not correlate completely with the reports from similar disaster situations. Vlahovic Placevski et al reported that metronidazole was the most frequently prescribed antibacterial during the war period in Croatia (1990–1994), and ampicillin, cephalexin, co-trimoxazole, amoxicillin + clavulanic acid, gentamicin, and cefuroxime were among the 10 most frequently prescribed antibiotics.[24] The differences in the pattern of antibiotic utilization could be due to different patterns of infectious diseases in the affected areas.[2,6,8,9] The most

common infectious diseases among Bam inhabitants has not been reported, but severe, community acquired-pneumonia and sepsis, fungal skin infections, late skin infections, and cholera have been reported during disaster situations in other affected areas.[2,6,8,9]

There was widespread use of psychotherapeutic medications by the study population in Bam. These data are in agreement with other reports, which described an increase in the use psychiatric medications after disaster situations.[3,4,14,17] Although the rate of sedative/hypnotic prescriptions in Bam outpatients is similar to pre-earthquake studies in Iran, there was a marked increase in the use of antidepressants and antipsychotic prescriptions during the first six months after the Bam Earthquake.[18,19]

Gastointestinal drugs also were among the most frequently prescribed drugs. Stressful conditions after disasters contribute to GI disease aggravation.[25] Widespread use of respiratory and GI drugs could be due to the following rea-

sons: (1) stressful situations; (2) inadequate shelter; (3) over-crowding; (4) lack of adequate nutrition; (5) inadequate quantity and/or quality of water; (6) poor sanitation; (7) insufficient supplies of soap; (8) poor personal hygiene; (9) poor healthcare services; (10) and low national immunization coverage.[25–28]

About one-third of the outpatients of Bam inhabitants who were visited by GPs during the first six months after the Earthquake received drugs via injection, which is similar to the value in 12 developing countries (36.8%), but less than the rate of injectable drugs in Bam city during the pre-earthquake period.[29] This demonstrates the inappropriate and over-abundant use of injectable drugs, but concords GPs prescription in many parts of the world.[29] Pharmacokinetics and clinical trials indicate that in most cases, oral forms of drugs are as effective as injections. Oral medications also are more cost-effective.

The choice of drug prescriptions during disasters could be affected by drug donations, but there are reports that drug donations to the affected-area were not in accordance with the actual health needs. Additionally, drugs were received in boxes of varying size, often without any indication of the contents, were not labeled, or were labeled in a language that was unfamiliar in the region. Some of these drugs were out-of-date or nearing their expiration date.[30,31] For these reasons, a considerable amount of all drugs provided by international aids had to be destroyed shortly after the disaster.[31]

Limitations
Drug utilization and prescription patterns were studied during the first six months after the Earthquake. There may be a variation in the utilization and prescription patterns for those patients who were prescribed drugs earlier in this period than those chosen months later. Also, the outpatients from Bam did not have any health record identification cards at this time. Therefore, the age of the outpatients was not recorded by the health professionals in the healthcare centers, which may have affected the results.

Conclusions
The results of this study showed that respiratory drugs, analgesics, antibacterials, GI drugs, and psychotherapeutic drugs are among the imminent pharmaceutical needs during disasters. These facts may be applicable for predicting the needs of patients for future disasters. The weather and local atmospheric conditions have an important impact on necessary medicines. Also, to prevent unnecessary medicine donations, drug packages must be readable in the target area. Psychotherapeutic drugs were among the real pharmaceutical needs in the aftermath of the Bam Earthquake.

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