

## Systematic Review

# Mortality and Injuries among Iranians in Iraq-Iran War: A Systematic Review

Payman Salamati MD MPH<sup>1</sup>, Seyed Mansour Razavi MD<sup>2\*</sup>, Farhad Shokraneh MD<sup>3</sup>, Saman Mohazzab Torabi MSc<sup>4</sup>, Marjan Laal MD<sup>1</sup>, Gholamreza Hadjati MD<sup>5</sup>, Ali Khaji MD<sup>1</sup>, Vafa Rahimi Movaghar MD MPH<sup>6</sup>

## Abstract

**Background:** The Iraq-Iran war was one of the longest conflicts in the twentieth century. The aim of our research was to review the incidence of mortality and injuries of the war.

**Methods:** A search strategy was designed and run in Medline, EMBASE, Scopus, and Iranian databases including Scientific Information Database (SID), IranMedex, and Magiran. Also, searching grey literature, checking references, tracking citations, hand-searching of focused journals, and websites were utilized for retrieval of related studies. All of articles which studied epidemiology of mortality or injuries of the war were included. The excluding criteria were case reports, case series, laboratory researches, and nonoriginal studies.

**Results:** Fourteen articles out of 1751 primary results were selected to be included in the study. During the war (1980 – 1988), 188,015 to 217,489 Iranians were killed (about 70 people per day). The mean age of mortality was 23 years. Six thousand four hundred twenty-seven (2.9 %) of those who died during the war were females. One thousand five chemical warfare victims died between 1983 and 1994. From 1985 through 1998, 82 veterans had successful suicides too. At the end of war, we had 398, 587 veterans who needed follow-up. Among them, there were 52,000 chemical warfare victims. Between 1988 and 2003, 1400 people died and 2313 injured due to landmines and unexploded ordnances in five border provinces.

**Conclusion:** The war caused a lot of mortalities and morbidities in our country. Now, 24 years after the war, many physically, mentally, and chemically injured victims have remained. We suggest other studies about indirect impacts of the war on societies, families, friends, and affiliates of the victims.

**Keywords:** Iran, mortality, review, war, wounds and injuries

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## Introduction

War is an ominous human-made event that causes both opponents great losses which cannot be calculated. Defunct people in some wars were as follows: sixty-five to 75 million in the second World War, 4.5 million in Korean War, and around 2.4 million in Vietnamese War. In general, from the end of second World War (i.e., 1945) up to 2000, 41 million human beings died during the wars.<sup>1</sup> War-induced injuries need long care with great expenses. War has indirect impacts on societies too.<sup>2</sup>

WHO reported war and conflict as the ninth disability-adjusted life years in the Eastern Mediterranean region.<sup>3</sup> During the recent

decades, people of the world have witnessed several wars. On 22<sup>nd</sup> September 1980, Iraqi army attacked Iran.<sup>4,5</sup> This invasion was one of the longest conflicts in the 20<sup>th</sup> century, resulting in deaths and injuries of many military and nonmilitary people. Iraq extensively used chemical weapons during the war.<sup>6-10</sup> Mine-laid deaths and casualties have been occurring in the frontier localities yet. Despite passing 24 years after the ceasefire, the injured people are one of the main health challenges in both countries and we occasionally see deaths among them due to their illnesses. To overcome such important health challenges, we need great information. Thus, systematic reviews are some of the best solutions for solving our ambiguity.

There are a few articles about mortalities and injuries among Iranians during the Iraq-Iran war. Despite many published papers about injured people up to now, there has been no comprehensive review about the mortality and injuries of the war. This study was an attempt to present a valid research, through a systematic review of related resources to determine the incidence of died and injured Iranians and their demographic characteristics in the Iraq-Iran war. We reviewed the war-induced injuries within three groups which were physical, chemical, and psychologic ones.

**Authors' affiliations:** <sup>1</sup>Sina Trauma and Surgery Research Center, Tehran University of Medical Sciences, Tehran, Iran, <sup>2</sup>Department of Community Medicine, Faculty of Medicine, Tehran University of Medical Sciences, Tehran, Iran, <sup>3</sup>Research Center for Pharmaceutical Nanotechnology, Iranian Center for Evidence-based Medicine, Tabriz University of Medical Sciences, Tabriz, Iran, <sup>4</sup>Students Research Committee, Baqiyatallah University of Medical Sciences, Tehran, Iran, <sup>5</sup>Aerospace Medical Faculty, Artesh University of Medical Sciences, Tehran, Iran, <sup>6</sup>Department of Neurosurgery, Sina Trauma and Surgery Research Center, Tehran University of Medical Sciences, Tehran, Iran.

**Corresponding author and reprints:** Seyed Mansour Razavi MD, Department of Community Medicine, Tehran University of Medical Sciences, Tehran, Iran. Tel: +9821-64053306, Fax: +9821-88962357, E-mail: razavi@tums.ac.ir.

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## Materials and Methods

### Information resources

IranMedex, Scientific Information Database (SID), and Magiran as main Iranian databases were selected for searching papers published in Iranian journals. Besides, Medline via Ovid SP, EM-BASE via Ovid SP, PubMed, Scopus, ProQuest dissertations database, OpenSIGLE, Grey Matters, and Google Scholar and Web of Science (WOS) were searched for inclusion of papers published in international journals.

### Search strategies

In the current systematic review, an experienced clinical librarian afforded all parts of search protocol including compiling search strategy, running the strategy in different sources, and full text retrieval of papers. The search strategy for Medline via Ovid SP (Appendix 1) adjusted for other resources too. The priority of search strategy was to be as sensitive as possible. For inclusion of grey literature, ProQuest dissertations database, OpenSIGLE and Grey Matters, as well as Google Scholar were considered to provide a comprehensive collection of related papers.

Hand-searching was applied for Military Medicine Journal, Veterans' Medicine Journal, Journal of Army University of Medical Sciences, Journal of Shahed University, and Kowsar Medical Journal which had focus on war-related topics. Also, we utilized Google Scholar, Scopus, as well as WOS for citation tracking for newer researches and we checked references of related papers for possible older studies. There was no language preference for search; however, we limited the search result to the start year of the war (1980). All of the search process was updated on September 10, 2011.

### Study selection

A community medicine specialist, a surgeon, and a general practitioner screened search results and references of screened papers for related studies. All of articles which studied epidemiology or frequency of mortality or injuries of Iraq-Iran war were included. There were no limitations for age, gender, and race. The exclusion criteria were studies designed as case reports, case series, laboratory researches, and nonoriginal studies. After the final assessment, 14 articles out of 1751 primary results were selected to be included in the study.

## Results

Screening steps of papers are shown in Figure 1 according to PRISMA 2009.<sup>11</sup> Eleven studies were regarded original articles. Two of them were letter to editor, and the other one was a brief report.<sup>12-25</sup> Table 1 shows the details of our included studies. The Iraq-Iran war started on 22<sup>nd</sup> of September of 1980 and ended on 20<sup>th</sup> of August 1988 and it took 2887 days. Karimi Poor, et al. stated that the total number of deaths was 188,015 among Iranian people.<sup>12</sup> Zargar, et al. reported that the number was 218,867.<sup>13</sup> They also added that 42,875 of victims were prisoners of war.<sup>13</sup> Based on the International Red Cross registration, Khaji, et al. reported that 564 Iranian prisoners of war died in Iraqi detention camps.<sup>15</sup> Tawallaee and Holisaz stated that from 1985 to 1998, there were 82 Iranian injured veterans who had successful suicide<sup>16</sup> after Iraq-Iran war too. According to our included studies, Table 2 describes the number of mortality and injuries due

to mines and unexploded ordnance (UXO) among Iranians after Iraq-Iran war.

Figure 2 shows the frequency of deaths among Iranians during eight years of war based on their age groups. The mean age of mortality was 23 years.<sup>13</sup> Soroush, et al. reported that 41.8 % of the killed victims and 41.1 % of the amputated ones who were injured by mines and UXO were younger than 18 years old.<sup>17,19</sup> Ghorbani, et al. mentioned that 193 (28.5 %) of those who were killed by mines and UXO were between 16 to 20 years old.<sup>20</sup> Afshar, et al. stated that 89 (20.2 %) of those who were injured by mines and UXO were younger than 15 years old.<sup>23</sup> Khaji, et al. reported that the mean, standard deviation, and median age of Iranian prisoner victims were  $25 \pm 11.7$  and 21 years at the time of captivity. These measures for Iranian prisoner victims were  $26.4 \pm 13$  and 22 years at the time of their death, respectively. The mean ages of civilians and military personnel were 45.3 versus 23.7 ( $P = 0.0001$ ).<sup>15</sup> The mean and standard deviation of age of successful suicide among injured veterans was  $32 \pm 8.73$  years.<sup>16</sup>

Six thousand four hundred twenty-seven (2.9 %) of those who died during eight years of war were females.<sup>12</sup> Khaji, et al. stated that only one (0.2 %) of Iranian prisoners who died in Iraqi detention camps was a female.<sup>15</sup>

Figure 3 shows the frequency of death among the Iranians during eight years of war based on different provinces.<sup>12</sup> Fars Province with 14 (17.1 %) and Hamedan Province with 10 (12.2 %) had the most number of successful suicide among the injured veterans among all.<sup>16</sup>

Thirty-three thousand four hundred thirty (15 %) of those who died among Iranians during the eight years of war were civilians.<sup>12</sup> Two thousand three hundred twelve (6.9 %) of them were killed by ballistic missile attacks. Eleven thousand six hundred twenty-five people were injured by ballistic missile attacks during that time too.<sup>13</sup> Khaji, et al. reported that 35 (6.2 %) of Iranian prisoners who died in Iraqi detention camps were civilians.<sup>15</sup>

Khateri, et al. reported that there were 34,000 mustard gas injured veterans based on their inclusion and exclusion criteria in the year 2000.<sup>24</sup> Ghanei, et al. mentioned that from 1983 through 1999, 1005 of chemically injured veterans died; 12.1 % of deaths was due to chemical agents.<sup>25</sup> Zargar, et al. stated that there were 398,587 veterans who needed long-term follow-up during the war; 52,195 of them (13 %) were chemically injured.<sup>13</sup>

The limitations of the included studies:

Karimi Poor, et al.<sup>12</sup> study: Some of the results did not match. For instance, in the sixth line of page 267 they reported "There was a high proportion of child martyrs, i.e., 1503 (2.1 %) of the deaths", yet based on other results mentioned in the article, it had to have been 3948.

Zargar, et al.<sup>13</sup> study: The article was a letter to editor.

Khaji, et al.<sup>14</sup> study: They extracted the data from military resources with limitations on declaring the data or possibility of nonrecorded attacks. In addition, their study did not include the injured people's data, as they had no access to patients' hospital information.

Khaji, et al.<sup>15</sup> study: Their study was based on death certificates which had been delivered by International Committee of the Red Cross (ICIR). The researcher mentioned that many signs denoted that Iranian prisoners' deaths were much higher than what was documented by ICIR.

Tawallaee, et al.<sup>16</sup> study: The data were retrospectively extracted from the documents of the Janbazan Affairs Organization.

Soroush, et al.<sup>17-19</sup> studies: The source of the data was provincial governor and they hadn't stated the details of offices.

Soroush, et al.<sup>17</sup> study: They have no access to smugglers', bootleggers', and trespassers' data. In addition, the information about the military personnel and the pilgrims who had traveled to Iraqi religious sites, through the borderline provinces, was not completely gathered.

Also, Soroush, et al.<sup>18</sup> study: They excluded the events of the military exercises and demining activities. The researchers had reported that some victims' data were not completely registered.

Ghorbani, et al.<sup>20</sup> study: They excluded victims who had accidents in the military sites or their documents were not available.

Jahanlu, et al.<sup>21</sup> study: The source of data was Ilam Province Welfare Office which did not completely own the documents. In addition, nomads who comprised a large population of Ilam Province had biannual migration. It seems their data had not been completely gathered during their migration.

Astraki, et al.<sup>22</sup> study: The data were retrospectively extracted from the documents of Ilam Province Forensic Office.

Afshar, et al.<sup>23</sup> study: Some victims were not probably registered because of transferring to the neighboring countries or being far from help.

Khateri, et al.<sup>24</sup> study: Many chemically injured patients had been excluded. Excluding criteria were as follows: smokers, having another respiratory disease with nonchemical etiology, having another dermatologic disease with nonchemical etiology, and having another ophthalmologic disease with nonchemical etiology. Based on the time of study, the patients had the history of at least 15 years of disease.

Ghanei, et al.<sup>25</sup> study: The researchers didn't study some kinds of deaths including those in time of exposure, before hospitalization, in first days of exposure, and women deaths.

## Discussion

In the 2887 days of war, 188,015 to 217,489 Iranians were killed (about 70 people per day) based on two different studies. Although the source of data was the same, the results of two studies were not consistent. After war ceasefire, many people died due to mines and UXO in border provinces. The exact number of people who were killed by these incidents after 2003 wasn't clear. Chemical injuries and successful suicides were some other causes of veterans' deaths. However, the exact number of these deaths that happened after the war were not mentioned in the articles.

In Burnham, et al.'s study, the number of those killed in the US war against Iraq from March 2003 through September 2004 was 654,965 people (2.5 % of the Iraq's population).<sup>26</sup> Burkle and colleagues stated that according to the British Polling Agency Opinion Research Business's reports, the number of those killed during the US attack to Iraq from March 20<sup>th</sup> 2003 through August 15<sup>th</sup> 2007 was 1,220,580 people. This study was conducted on 1499 families in 15 provinces of Iraq. In this report, the number of deaths was 759 per day.<sup>27</sup> Kang, et al. studied the seven-year mortality rate of American soldiers in the Persian Gulf War. They estimated that out of 631,902 soldiers who participated in war, 4,506 were killed due to different causes; 194 of them were females too.<sup>28</sup>

Depoortere and colleagues studied the number of people killed in Democratic Republic of Congo's War between 1998 and 2004. They estimated that about 3.5 million people were killed during

this war. Their study was conducted on 750 groups that included 19,500 families. In this report, it was stated that most of the children's mortality was due to lack of primary care.<sup>29</sup>

In addition, during the US war against Vietnam, about three million civilians were killed.<sup>30</sup> Since 2003, during the 31 months of Darfur's war, about 200,000 people were killed.<sup>31</sup>

Tawallaee, et al. reported that 82 veterans had died from suicide between 1985 and 1998.<sup>16</sup> Kang and colleagues studied 631,902 American soldiers for seven years after the Persian Gulf War and reported that 711 men and 24 women had committed suicide.<sup>28</sup> Keeping in mind that suicide normally increases during crises such as war, a comparison of Iranian and American soldiers showed that the incidence of suicide was lower in Iranians and this may be due to their religious beliefs that suicide is strongly forbidden in the Islamic culture.

Ghanei and colleagues stated in their study that about 1005 chemical warfare victims died between 1983 (the start of Iraq's chemical attacks against Iran) and 1999.<sup>25</sup> Of course, the chemically injured people who had died during the first 15 days of their diseases and women as well, were not included in the study.

Bullman, et al. compared 100,487 American soldiers who were probably exposed to chemical agents in Khamis area with 224,000 American soldiers without such exposure during the Persian Gulf War in 1991 based on incidence and causes of deaths.<sup>32</sup> The incidence of deaths was similar in both groups. However, the risk of brain cancer had increased significantly in the first group (relative risk = 1.94; 95 % CI = 1.12 – 3.34).

As mentioned above, some studies evaluated the number of deaths that occurred after the Iraq-Iran war due to mines and UXO. Despite the fact that more than 90 % of the mines and UXO injured people were males, 21.8 % of those who were killed were females. The reason might be that female injuries mostly occurred outside military or rural areas so the victims didn't have appropriate access to necessary treatment facilities.

Bilukha and colleagues studied victims of mines and UXO in Afghanistan between 1997 and 2002. They reported that only 8 % of the deaths were females.<sup>33</sup> This difference may be due to the differences in the cultural issues of the two countries. Soroush, et al. reported that out of all deaths of landmines, 10.28 % were military personnel and 88.82 % were civilians,<sup>17</sup> and in Ghorbani, et al.'s study, 245 deaths (36.2 %) were military personnel and the rest were civilians.<sup>20</sup> Bulikha and colleagues reported that only 13 % of the injuries and deaths were military personnel.<sup>33</sup> Although the reported statistics are not equal, it is clear that the high mortality rate of Iranian and Afghan civilians is due to mines and UXO located in grounds such as agricultural and animal husbandry areas that were used by civilians.

Soroush, et al. reported that 41.8 % of deaths due to mines and UXO were under 18 years old.<sup>17</sup> Bilukha and colleagues also evaluated 5,471 victims of mines and UXO between the years 2002 and 2006 in Afghanistan and reported that 49 % of deaths were children under 18 years old.<sup>34</sup> By comparing the two studies, it seems that both countries had similar number of children's victims. This may be due to extensive nonmilitary involved areas in the countries.

Many national and international articles reviewed the clinical status of chemically injured victims.<sup>35-39</sup> However, none of them had given accurate estimates of the total number of deaths due to chemical agents. Most of these studies had stated that Iraq used chemical weapons against Iranian military personnel, civilians



(such as people of Sardasht),<sup>40-42</sup> and Iraqi civilians (such as people of Halabche and Iraqi Kurds).<sup>43,44</sup>

Khateri, et al. stated the number of chemical injuries and deaths of the Iraqi chemical attacks against Iran in their book without

**Attachment 1.** The search strategy for our resources was as follows:

<p><b>I - Population: Iran</b></p> <ol style="list-style-type: none"> <li>exp Iran/</li> <li>Iran\$. tw, ot.</li> <li>or/1-2</li> </ol> <p><b>II - Problem: Wounds and Injuries</b></p> <ol style="list-style-type: none"> <li>exp veterans/</li> <li>wounds and injuries/</li> <li>exp abdominal injuries/</li> <li>exp amputation, traumatic/</li> <li>exp arm injuries/</li> <li>exp asphyxia/</li> <li>exp back injuries/</li> <li>burns/</li> <li>exp burns, chemical/</li> <li>exp burns, inhalation/</li> <li>exp eye burns/</li> <li>exp contrecoup injury/</li> <li>exp contusions/</li> <li>exp craniocerebral trauma/</li> <li>dislocations/</li> <li>exp hip dislocation/</li> <li>exp knee dislocation/</li> <li>exp patellar dislocation/</li> <li>exp shoulder dislocation/</li> <li>foreign bodies/</li> <li>exp eye foreign bodies/</li> <li>exp foreign-body migration/</li> <li>exp foreign-body reaction/</li> <li>exp fractures, bone/</li> <li>exp fractures, cartilage/</li> <li>exp hand injuries/</li> <li>exp heat stress disorders/</li> <li>exp hip injuries/</li> <li>exp lacerations/</li> <li>exp leg injuries/</li> <li>exp multiple trauma/</li> <li>exp neck injuries/</li> <li>exp radiation injuries/</li> <li>exp retropneumoperitoneum/</li> <li>exp rupture/</li> <li>exp shock, traumatic/</li> <li>exp soft tissue injuries/</li> <li>exp spinal cord injuries/</li> <li>exp spinal injuries/</li> <li>exp sprains and strains/</li> <li>exp tendon injuries/</li> <li>exp thoracic injuries/</li> <li>exp tooth injuries/</li> <li>exp trauma, nervous system/</li> <li>exp tympanic membrane perforation/</li> <li>exp vascular system injuries/</li> <li>exp wound infection/</li> <li>exp wounds, nonpenetrating/</li> <li>exp wounds, penetrating/</li> <li>(veteran? or martyr?).tw,ot.</li> <li>(trauma\$ or wound? or injur \$ or rupture? or ampute\$ or fracture? or (broken or break) adj (bone? or cartilage?) or dislocat\$ or subluxat\$ or asphyxia? or suffocat\$ or burn\$ or (inhal\$ adj6 chemical\$) or (smok\$ adj6 injur\$) or contusion? or bruise? or laceration? or concuss\$ or otorrhea? or rhinorrhea? or seizure? or convuls\$ or avuls\$ or transaction or perforation or hematom\$ or hemorrhage\$ or foreign adj1 (body or bodies)).tw,ot.</li> <li>(heatstroke? or sunstroke? or (sun adj stroke?) or (heat adj (stress or cramp? or exhaust\$ or postrat\$ or collaps\$ or stroke?)) or radiat\$ or (crush adj syndrome) or gunshot\$).tw,ot.</li> <li>or/5-55</li> </ol>	<p><b>III - Setting: War</b></p> <ol style="list-style-type: none"> <li>exp hospitals, veterans/</li> <li>exp veterans health/</li> <li>exp veterans disability claims/</li> <li>exp war/</li> <li>(veteran? or martyr?).tw,ot.</li> <li>((hospital or medic\$ or care?) adj99 veteran?).tw,ot.</li> <li>((health or physical or mental) adj99 veteran?).w,ot.</li> <li>(veteran? adj3 disabilit\$ adj3 claim\$).tw,ot.</li> <li>(war or wars or warfare? or conflict).tw,ot.</li> <li>exp biological warfare/</li> <li>exp chemical warfare/</li> <li>exp psychological warfare/</li> <li>((biolog\$ or bacter\$) adj6 (war or wars or arfare?)).tw,ot.</li> <li>((chemical or (incendiary adj3 mixture?) or smoke? or ((irritant or burning or asphyxiating) adj6 (gas or gases))) adj6 (war or wars or warfare?)).tw,ot.</li> <li>((psych\$ or moral\$ or mental\$) adj6 (war or wars or warfare?)).tw,ot.</li> <li>or/58-71</li> </ol> <p><b>IV - Study Design</b></p> <ol style="list-style-type: none"> <li>exp epidemiology/</li> <li>exp incidence/</li> <li>exp cohort studies/</li> <li>exp longitudinal studies/</li> <li>exp follow-up studies/</li> <li>exp prospective studies/</li> <li>exp retrospective studies/</li> <li>exp mortality/</li> <li>exp hospital mortality/</li> <li>exp fatal outcome/</li> <li>exp cause of death/</li> <li>exp death/</li> <li>exp survival/</li> <li>exp survival analysis/</li> <li>exp survival rate/</li> <li>exp disease-free survival/</li> <li>exp kaplan-meier estimate/</li> <li>exp proportional hazards models/</li> <li>exp morbidity/</li> <li>exp causality/</li> <li>exp precipitating factors/</li> <li>exp risk factors/</li> <li>(epidem\$ or frequenc\$ or surveillance or occurrence or outbreak? or endem\$).tw,ot.</li> <li>(daly or (disability?adjusted life years) or (years of life lost) or yll or (years lived with disability) or yld or (years of potential life lost or ypll or (potential years of life lost) or pyll or burden)).tw,ot.</li> <li>(incidence? or cohort or concurrent or longitudinal or follow-up or prospective or retrospective).tw,ot.</li> <li>(death or mortalit\$ or (case adj3 fatality) or (fatal outcome?)).tw,ot.</li> <li>(survival or survivorship or Kaplan-Meier or (product-limit method?) or ((hazard? or cox) adj6 model?)).tw,ot.</li> <li>morbidity\$.tw,ot.</li> <li>(causalit\$ or causation? or ((reinforcing or enabling or predisposing or precipitating or risk) adj3 factor?) or etiology).tw,ot.</li> <li>or/74-101</li> </ol> <p><b>V - I and II and III and IV</b></p> <ol style="list-style-type: none"> <li>3 and 56 and 72 and 102</li> <li>exp animals/ not humans.sh.</li> <li>103 not 104</li> </ol> <p><b>VI - Time: 1980 to Present</b></p> <ol style="list-style-type: none"> <li>Limit 105 to yr=1980 -current"</li> </ol>
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**Table 1.** Characteristics of the included studies in our review.

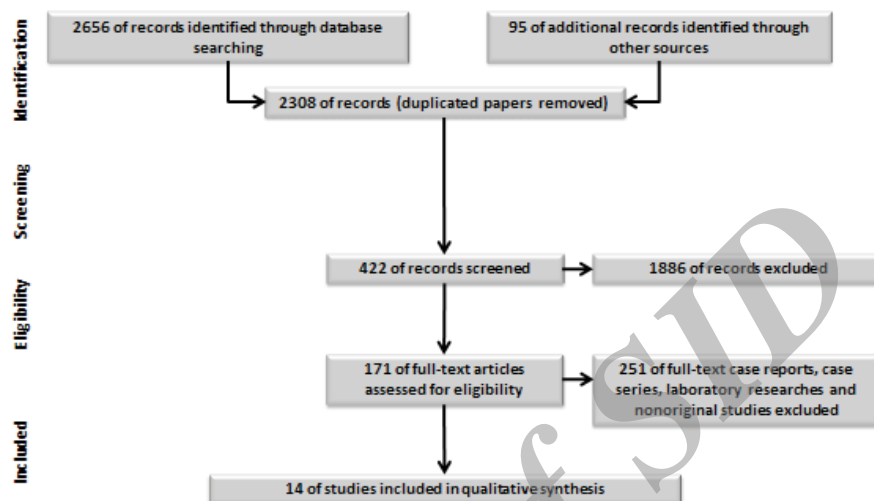
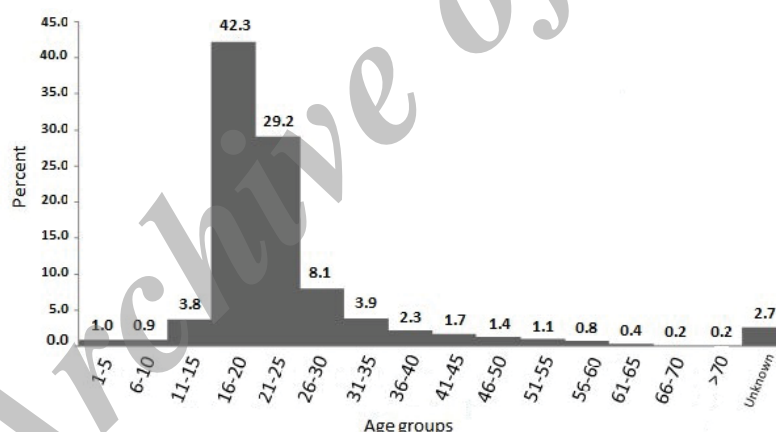
First author	Subject	Journal	Type of article	Publication year	Language	Source of data	Target population	Study interval
<b>Karimi Poor</b>	Martyrs of the war	Geographical Research	Original article	2002	Persian	The Foundation of Martyrs Affairs	Iranians	1980–1988
<b>Zargar</b>	Iranian casualties of the war	Rev Saude Publica	Letter to editor	2010	English	The Foundation of Martyrs Affairs and The Janbazan Affairs Organization	Iranians	1980–1988
<b>Khaji</b>	Civilian casualties of Iranian cities by ballistic missiles	Chinese Journal of Traumatology	Original article	2010	English	Iranian army units	Iranians	1980–1988
<b>Khaji</b>	Mortality of the Iranian ex-prisoners of the war	Archives of Iranian Medicine	Original article	2009	English	International Committee of the Red Cross	Iranian ex-prisoners	1980–1990
<b>Tawallae</b>	Successful suicides among veterans	Kowsar Medical Journal	Original article	2000	Persian	The Janbazan Affairs Organization	Veterans	1985–1998
<b>Soroush</b>	Injuries associated with mines and UXO	Iranian Red Crescent Medical Journal	Original article	2010	English	Provincial governor	Civilians of five borderline provinces	1988–2003
<b>Soroush</b>	Amputations due to mines and UXO	Archives of Iranian Medicine	Original article	2008	English	Provincial governor	Civilians of five borderline provinces	1988–2003
<b>Soroush</b>	Women victims of mines and UXO	Iranian Journal of Public Health	Original article	2010	English	Provincial governor	Civilians of five borderline provinces	1988–2003
<b>Ghorbani</b>	Epidemiology of injuries and deaths from mines and UXO	Journal of Forensic Medicine	Original article	2009	Persian	Forensic offices of five provinces	Civilians of five borderline provinces	1996–2007
<b>Jahunlue</b>	Mortality in landmine accidents	Prehospital and Disaster Medicine	Brief report	2002	English	Ilam Province Governor's Office for Social Welfare	Civilians of Ilam Province	1989–1999
<b>Astraki</b>	Killed persons by forgotten mine explosion	Journal of Army University of Medical Sciences of the I. R. Iran	Original article	2008	Persian	Forensic Office of Ilam Province	Civilians of Ilam Province	1996–2006
<b>Afshar</b>	Landmine injuries	Archives of Iranian Medicine	Letter to editor	2006	English	Janbazan Affairs Organization of West Azarbaijan Province	Civilians of West Azarbaijan Province	1988–2005
<b>Khateri</b>	Late complications of mustard gas in 34000 Iranians	Journal of Occupational and Environmental Medicine	Original article	2003	English	Janbazan Organization	Chemically injured veterans	1997–2000
<b>Ghanei</b>	Delayed mortality in veterans exposed to chemical warfare agents	Journal of Military Medicine	Original article	2003	Persian	Janbazan Organization	Chemically injured veterans	1983–1999

**Table 2.** Mortality and Injuries due to mines and UXO among Iranians after Iraq – Iran war based on published articles.

	Mean (SD)	Sex (%)		Type of attendance (%)		Province (%)				Total (%)		
		Age (years)	Male	Female	Military personnel	Civilians	West Azerbaijan	Ilam	Kermanshah		Khuzestan	Kordestan
Soroush, et al. <sup>17</sup>	Mortality	-----	1095 (78.2)	305 (21.8)	144 (10.28)	1256 (88.82)	-----	-----	-----	-----	-----	1400 (37.3)
	Injuries	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2313 (62.3)
	Total	24.2 (14.7)	3461 (93.2)	252 (6.8)	-----	-----	494 (13.3)	596 (16.1)	1273 (34.3)	451 (12.9)	889 (23.9)	3713 (100)
Soroush, et al. <sup>18</sup>	Amputations	23 (13)	1379 (92)	120 (8)	-----	-----	297 (19.8)	226 (15.1)	333 (22.2)	148 (9.9)	495 (33.1)	1499
Soroush, et al. <sup>19</sup>	Women (mortality and injuries)	19.04 (14.26)	-----	-----	-----	252 (100)	39 (15.5)	34 (13.5)	67 (26.6)	40 (15.9)	72 (28.6)	252 (100)
Ghorbani, et al. <sup>20</sup>	Mortality	-----	648 (95.7)	29 (4.3)	245 (36.2)	432 (63.8)	-----	231 (34.1)	-----	-----	27 (4)	677
	Mortality	-----	360 (91.4)	34 (8.6)	-----	-----	-----	394 (36.4)	-----	-----	-----	394 (36.4)
Jahanlu, et al. <sup>21</sup>	Injuries	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	688 (63.6)
	Total	23.5 (15.7)	-----	-----	-----	-----	-----	-----	-----	-----	-----	1082 (100)
Astraki, et al. <sup>22</sup>	Mortality	-----	203 (97.3)	6 (2.7)	57 (27.3)	152 (72.7)	-----	209 (100)	-----	-----	-----	209 (100)
	Mortality	-----	---	-----	-----	-----	-----	-----	-----	-----	-----	110 (20.0)
Afshar, et al. <sup>23</sup>	Injuries	-----	403 (91.4)	38 (8.6)	-----	-----	-----	-----	-----	-----	-----	441 (80.0)
	Total	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	551 (100)

**Table 3.** An estimate of the number of chemical injuries and deaths during the war:<sup>40</sup>

Number of Iranians disposed to chemical weapons	1,000,000 people
Number of Iranians who received medical care during their heavy exposures to chemical gases	100,000 people
Iranians killed by immediate effects of chemical agents	5,500 (3,500 people by nerve agents and 2,000 people by mustard gas)
Iranians injured by chronic effects of chemical agents (registered)	70,000 people
Iranians injured by chronic effects of chemical agents (not registered)	40,000 people
Iranian civilians injured by chronic effects of chemical agents (registered and not registered)	35,000 people

**Figure 1.** Screening of studies based on PRISMA statement.**Figure 2.** Relative frequency of Iranian martyrs of Iraq- Iran war based on age groups.

referencing to source of data as mentioned in Table 3. They didn't evaluate many chemically injured people in their article too.<sup>45</sup>

Psychiatric disorders are other complications of wars that occur among soldiers and civilians and cannot be estimated well. There was no published study about the incidence of such disorders in the war and further research might be necessary.

Vafaei and colleagues showed that 71 % of the veterans and 36 % of the control group had depression. The relative frequency of depression was 92 % among chemical warfare victims and 57 % among other veterans ( $P < 0.001$ ). The frequency of severe depression had significant differences between groups ( $P < 0.05$ ).<sup>46</sup>

In another study, Vafaei and Seidy showed that the frequency of depression in chemically injured victims was two times more than physically injured victims. Also, depression was two times more frequent in physically injured victims than the control group.<sup>47</sup> Fa-

thi Ashtiani, et al. conducted a study on 134 chemically injured veterans and showed that about 76 % of them had anxiety symptoms.<sup>48</sup>

Similar studies on chemical victims conducted in other countries showed the same results. A study on the chemical victims of World War II showed that 83 % of them had lower mental health than the control group.<sup>49</sup>

A study in the USA that was conducted on the chemical victims of mustard gas showed that mood disorders (long-term depression) and anxiety disorders were the most common mental disorders.<sup>50</sup>

Some studies evaluated mental disorders of prisoners of war. Karaminia, et al. assessed the frequency of depression among 129 prisoners of war of Isfahan Province and reported a 26 % rate. This study stated that about half of the prisoners of war



Figure 3. Relative frequency of Iranian martyrs of Iraq-Iran war based on different provinces.

complained of mental disorders.<sup>51</sup> Nourbala and colleagues studied the mental complications of Iranian prisoners of war. They showed that 48.3 % of them had adjustment disorders, 22 % had mood disorders, and 9.9 % had anxiety disorders in their first six months of freedom. The most common psychiatric disorder was post-traumatic stress disorder (PTSD).<sup>52</sup>

Tavallaei, et al. studied Iraqi prisoners of war in Iran and declared that depression was the most common mental disorder.<sup>53</sup> Generally, it can be concluded that psychiatric disorders are more common in prisoners of war than the general population. Speed and colleagues showed that prisoners of war had depression and some other psychiatric disorders at the time of freedom and their problems would gradually increase.<sup>54</sup>

The number of deaths and injuries had been estimated indirectly via our included papers by some other articles. As they were non-original, we excluded them.<sup>55-56</sup> This study is the first systematic review that assessed war mortality and injuries in Iran. In this review, we reported only direct human damages caused by war. During war, many human damages including the impacts on societies, families, friends, and affiliates of the victims were not assessable. In addition, because of the high spirituality of Iranians, some damages were not reported and registered during the war. The most important limitation of this study was the variety of reports of different organizations, which sometimes had dramatic differences. Therefore, no statistical analysis was performed and data were only described. In other words, since the medical recording system during war was far from ideal, the results should be interpreted cautiously.

In conclusion, the Iraqi war against Iran caused a lot of mortalities and morbidities in our country. During almost eight years of war, about 70 Iranians were killed daily. Also, 24 years after the end of war, many physically, mentally, and chemically injured veterans have remained. We suggest other studies about indirect impacts of the war on societies, families, friends, and affiliates of

the victims.

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### References

- Leitenberg, M. Deaths in wars and conflicts of the 20th century. 3rd edition. *Cornell University Peace Studies Program Occasional*; 2006: 6 – 16.
- Zwi AB, Banatvala N. Public health and humanitarian intervention: developing the evidence base. *BMJ*. 2000; **321**: 101 – 105.
- World Health Organization. The global burden of disease: 2004 Update. *Geneva*: WHO Press. 2008.
- United Nations Security Council, Document S 23273. "Further report of the secretary –general on the implementation of security council resolution 598(1987)" 9December 1991, New York, U. S. A.
- Javier Pérez de Cuellar. Pilgrimage for peace: a secretary-general's memoirs. New York: Palgrave Macmillan, 2006: 124 – 126.
- United Nations Security Council, Document S 16433. "Report of the specialists appointed by the secretary general to investigate allegations by the Islamic Republic of Iran" 26 March 1984, New York, U. S. A.
- Dunn P. "The chemical war: journey to Iran". *Nuclear, Biological, and Chemical Defense and Technology International*. 1986; **1(1)**: 29 – 30.
- Salamati P, Karbakhsh M, Sadeghian S, Togha M, Rostami R, Sadeghi M. Health status in Iran. *The Maghreb Review*. 2009; **34**: 4 – 17.
- Evison D, Hinsley D, Rice P. Chemical weapons. *BMJ*. 2002; **324**: 332 – 335.
- Marshal E. Iraq's chemical warfare: case proved. *Science*. 1984; **224**: 130 – 132.
- Moher D, Liberati A, Tetzlaff J, Altman DG. The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med*. 2009; **6(7)**: e1000097. doi:10.1371/journal.pmed1000097.
- Karimi-Poor Y, Kamran HA. Statistical analysis about martyrs of war (in Persian). *Geographical Research*. Winter-Spring. 2002; **4**: 259 – 269.



13. Zargar M, Araghizadeh H, Soroush MR, Khaji A. Iranian casualties during the eight years of Iraq-Iran conflict. *Rev Saude Publica*. 2007; **41**: 1065 – 1066.
14. Khaji A, Fallahdoost S, Soroush MR. Civilian casualties of Iranian cities by ballistic missile attacks during the Iraq-Iran war (1980 – 1988). *Chin J Traumatol*. 2010; **13**: 87 – 90.
15. Khaji A. Mortality of the Iranian ex-prisoners of war in Iraqi detention camps (1980 – 1990). *Arch Iran Med*. 2009; **12**: 140 – 144.
16. Tawallaee SA, Holisaz MT. A generalized research on successful suicides among veterans (in Persian). *Kowsar Medical Journal*. 2000; **1**: 37 – 40.
17. Soroush AR, Flahati F, Zargar M, Soroush MR, Araghizadeh H, Khateri Sh, et al. Injuries associated with landmines and unexploded ordnances in Iran. *Iranian Red Crescent Medical Journal*. 2010; **12**: 384 – 387.
18. Soroush AR, Flahati F, Zargar M, Khateri Sh, Khaji A. Amputations due to landmine and unexploded ordnances in post-war Iran. *Arch Iran Med*. 2008; **11**(6): 595 – 597.
19. Soroush AR, Flahati F, Zargar M, Khateri SH, Khaji A. Women pose innocent against landmines in postwar Iran. *Iranian J Publ Health*. 2010; **39**: 32 – 35.
20. Ghorbani A, Abedi M, Barzegar A, Tareman F. Epidemiology of injuries and deaths from landmines and unexploded ordnance remained of Iraq against Iran war (the imposed war) from 1996 to 2007 in five border provinces of Islamic Republic of Iran (in Persian). *Journal of Forensic Medicine*. 2009; **15**: 182 – 188.
21. Jahunlu HR, Husum H, Wisborg T. Mortality in landmine accidents in Iran. *Prehosp Disaster Med*. 2002; **17**: 107 – 109.
22. Astraki P, Ahmadi M. Studying of main characteristic's of killed persons by forgotten mine explosion in Ilam Province during April 1995-April 2007 (in Persian). *Journal of Army University of Medical Sciences of the I. R. Iran*. 2008; **3**(6): 171 – 175.
23. Afshar AR, Mirzadoloui F. Landmine injuries: experience in the West Azarbaijan Province. *Arch Iran Med*. 2006; **9**: 188 – 189.
24. Khateri S, Ghanei M, Keshavarz S, Soroush M, Haines D. Incidence of lung, eye, and skin lesions as late complications in 34,000 Iranians with wartime exposure to mustard agent. *J Occup Environ Med*. 2003; **45**: 1136 – 1143.
25. Ghanei M, Assari Sh, Alaeddini F, Tavallaei SA. Pattern of delayed mortality in IR. Iran veterans exposed to chemical warfare agents (in Persian). *Journal of Military Medicine*. 2005; **4**(6): 233 – 239.
26. Burnham G, Lafta R, Doocy S, Roberts L. Mortality after the 2003 invasion of Iraq: a cross-sectional cluster sample survey. *Lancet*. 2006; **368**: 1418 – 1421.
27. Tapp C, Burkle FM, Wilson K, Takaro T, Guyatt GH, Amad H, et al. Iraq war mortality estimates: a systematic review. *Conflict and Health*. 2008; **2**: 1 – 13.
28. Kang HK, Bullman TA. Mortality among US veterans of the Persian Gulf war: A 7-year follow-up. *Am J Epidemiol*. 2001; **154**: 399 – 405.
29. Depoortere E, Checchi F. Pre-emptive war epidemiology: lessons from the Democratic Republic of Congo. *Lancet*. 2006; **367**: 7 – 9.
30. Allukian M, Atwood PL. Public health and the Vietnam war. In: Levy BS, Sidel VW, eds. *War and Public Health*. Washington, DC: American Public Health Association; 2000: 215 – 217.
31. Hagan J, Palloni A. Death in Darfur. *Science*. 2006; **313**: 1578 – 1579.
32. Bullman TA, Mahan CM, Kang HK, Page WF. Mortality in US Army Gulf War veterans exposed to 1991 Khamisiyah chemical munitions destruction. *Am J Public Health*. 2005; **95**: 1382 – 1383.
33. Bilukha OO, Brennan M. Injuries and deaths caused by unexploded ordnance in Afghanistan: review of surveillance data, 1997 – 2002. *BMJ*. 2005; **330**: 127 – 128.
34. Bilukha OO, Brennan M, Anderson M. The lasting legacy of war: epidemiology of injuries from landmines and unexploded ordnance in Afghanistan, 2002 – 2006. *Prehosp Disaster Med*. 2008; **23**: 493 – 499.
35. Razavi SM, Salamati P, Saghaforia M, Abdollahi M. A review on delayed toxic effects of sulfur mustard in Iranian veterans. *DARU*. 2012; **20**: 2 – 8.
36. Razavi SM, Salamati P, Feizi S, Javadi MA. Mustard gas-induced ocular injuries: a review of manifestations and managements. *Iranian Journal of Ophthalmology*. 2012; **24**: 11 – 18.
37. Razavi SM, Salamati p, Amini Harandi A, Ghanei M. Prevention and treatment of respiratory consequences induced by sulfur mustard in Iranian casualties: a review. *International Journal of Preventive Medicine*. 2013; **4**: 383 – 389.
38. Razavi SM, Salamati p, Karbaksh M. Preventive measures against the mustard gas: a review. *Medical Journal of Islamic Republic of Iran*. 2013; **27**: 83 – 90.
39. Razavi SM, Ghanei M, Salamati P, Safiabadi M. Long-term effects of mustard gas on respiratory system of Iranian veterans after Iraq-Iran war: a review. *Chinese Journal of Traumatology*. 2013; **16**: 163 – 168.
40. Ghanei M, Aslani J, Khateri S, Hamadanizadeh K. Public health status of the civil population of Sardasht 15 years following large-scale wartime exposure to sulfur mustard. *J Burns Surg Wound Care*. 2003; **2**: 7 – 9.
41. Ghazanfari T, Faghihzadeh S, Araghizadeh H, Soroush MR, Yaraee R, Mohammad Hassan Z, et al. Sardasht, Iran, cohort study of chemical warfare victims: design and methods. *Arch Iran Med*. 2009; **12**: 5 – 14.
42. Berahmani G, Abed Saeidi J, Kheiri AA. Quality of life in chemical warfare victims in Sardasht, Iran. *Medical Journal of Tabriz University of Medical Sciences and Health Services*. 1383; **62**: 9 – 13.
43. Poursaleh Z, Ghanei M, Naderi M, Amini Harandi A. Chronic pulmonary complications in Iraq-Kurdistan chemical weapons victims. *Iranian. Journal of Military Medicine*. 2011; **13**: 37 – 42.
44. Dworkin J, Prescott M, Jamal R, Hardawan S, Abdullah A, Galea S. The long- term psychosocial impact of a surprise chemical weapons attack on civilians in Halabja, Iraqi Kurdistan. *Journal of Nervous and Mental Disease*. 2008; **196**: 772 – 775.
45. Khateri S, Janati Moheb A. Iraq's use of chemical weapons against Iran: UN documents 1984 – 1988. Tehran: Sarir; 2nd edition. 2010: 13 – 18.
46. Vafaei B, Seidy A. Study of the prevalence and intensity of depression in 100 devotees with chemical and non-chemical war injuries (30% – 70%) of imposed war in Tabriz (in Persian). *Journal of Military Medicine*. 2003; **2**: 105 – 110.
47. Vafaei B, Seidy A. Prevalence of depression among physically- disabled veterans in northwestern Iran. *Iranian Journal of Medical Sciences (IJMS)*. 2004; **29**: 43 – 44.
48. Fathi Ashtiani A, Tavallai A, Azizabadi Farahani, Moghani Lankarani M. Association of psychological symptoms and self esteem in chemical warfare agents- exposed veterans (in Persian). *Journal of Military Medicine*. 2008; **4**: 273 – 282.
49. Schnurr PP, Friedman MJ, Green BL. Posttraumatic stress disorder among World War II mustard gas test participants. *Mil Med*. 1996; **161**: 131 – 136.
50. Pechura CM, Rall DP. Veterans at Risk: the health effects of mustard gas and lewisite. 1<sup>st</sup> ed. Washington DC: National Academies Press; 1993: 207 – 208.
51. Karaminia R, Salimi SH, Majdian M. Depression in prisons of war in Iraq-Iran imposed war (in Persian). *Journal of Military Medicine*. 2007; **3**: 179 – 187.
52. Nourbala A, Mohammadi M. A survey of common prevalent psychiatric disorders among a group of Iranian repatriated prisoners of war (in Persian). *The Journal of Tehran Faculty of Medicine*. 1995; **1**: 24 – 30.
53. Tavallaei SA, Firooz Abadi A, Khadem M. Psychiatric symptoms in Iraqi prisoners of war (in Persian). *Journal of Military Medicine*. 2004; **1**: 39 – 43.
54. Speed N, Engdahl BE, Schwartz J, Eberly R. Posttraumatic stress disorder as a consequence of prisoner of war experience. *Journal of Nervous and Mental Disease*. 1989; **177**: 147 – 153.
55. Saadat S, Javadi M, Divshali BS, Tavakoli AH, Ghodsi SM, Montazeri A, et al. Health-related quality of life among individuals with long-standing spinal cord injury: a comparative study of veterans and non-veterans. *BMC Public Health*. 2010; **10**: 1 – 7.
56. Rahimi-Movaghar V, Jazayeri SB, Alimi M, Abbassioun K, Amirjamshidi A. Lessons learned from war: A comprehensive review of the published experiences of the Iranian neurosurgeons during Iraq-Iran conflict and review of the related literature. *World Neurosurg*. 2012; **25**. [Epub ahead of print]