SPECIAL ARTICLE

# Estimation and classification of potential severe earthquake victims in the metropolitan are of Granada

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None

**Objectives:** To predict the potential number of victims which caused by a hypothetical scale VIII earthquake VIII with the epicentre in Sierra Elvira (near Granada) and to classify the casualties based on of the location and severity of the injuries. These data were compared with those estimated for an other much less probable earthquake of scale IX in the same area.
**Methods:** An earthquake scenario simulator, SES 2002, and tables of human vulnerability proposed by Sopra and Schiavi were used.
**Results:** The expected estimates of damaged dwellings were 436 collapsed, 4787 heavily damaged and 21251 moderately damaged. The expected numbers of casualties were 313 deaths, 1865 people injured (of different categories) and 35113 people without home. Casualty triage was 73 of 1st category (very severe critical, red), 258 of 2nd category (moderate, yellow) and 1534 of 3rd category (walking wounded, green). The most frequent lesion locations were inferior limbs (26%) followed by polytraumatisms (23%), head injuries (19%), upper limbs (13%), thorax (10%), pelvis (6%) and spinal cord lesions (3%).
**Conclusions:** These estimates are critical to adjust the Healthcare Action Plan and indicate that healthcare attendance must be graded, with a minimum of 6 Advanced Healthcare Positions established in less than 2 hours for immediate medical intervention, and in less than 8 hours for Units of Prehospital Stabilization and Units of Surgical Rescue should be installed for stabilization of critical patients. A field hospital is also necessary in case of earthquake I-IX or a reduction in the operability of Granada hospitals. [Emergencias 2008;20:198-206]

**Key words:** Earthquake. Emergency Medical Services. Triage. Natural disaster. Rescue work. Mass casualty incidents.

## Introduction

Urgent medical care in seismic catastrophes with multiple victims is a challenge and necessity from a healthcare emergency point of view. Catastrophes always imply a health problem because of the simultaneous presence of deaths and a large number of severe and mild casualties requiring urgent care which may overwhelm the capacity of local emergency departments. To develop an effective Healthcare Action Plan in the event of an earthquake, scenarios of estimated seismic damage and the number and severity of the possible victims in each case should be taken into account.

According to the Spanish Norms of Seismoresistant Construction (NCSE-02), the depression of Granada is the area of greatest seismic danger in Spain with active faults which threaten the metropolitan area[1]. Historically damaging earthquakes of intensity (I) $\geq$ VIII of the European Macroseismic Scale (EMS) have occurred in this area such as the two in 1431 (I = IX-X) and in 1806 (I = VI-II-IX) with the epicentre in Pinos Puente. Another earthquake, with an epicentre in Arenas del Rey, took place in 1884 (I = IX) and was known as the Earthquake of Andalusia. This quake totally destroyed this town and numerous buildings collapsed and had severe structural damage in more

**Table 1.** Victims and damage due to seismic activity I=VIII with an epicentre in Sierra Elevada. Simulation performed with the SES 2002

| Name | I (EMS) | D | C | Homeless | Total population | Collapss | Ver serious damage | Serious damage | Moderate damage | Slight damage |
|---|---|---|---|---|---|---|---|---|---|---|
| Pinos Puente | VIII | 67 | 403 | 3,264 | 13,524 | 91 | 539 | 1,394 | 1,882 | 1,182 |
| Atarfe | VIII | 32 | 190 | 1,912 | 11,220 | 45 | 309 | 923 | 1,500 | 1,293 |
| Chauchina | VIII | 13 | 75 | 736 | 4,138 | 18 | 121 | 358 | 572 | 472 |
| Fuente Vaq, | VIII | 18 | 106 | 877 | 4,038 | 23 | 137 | 365 | 518 | 370 |
| Santa Fé | VIII | 43 | 257 | 2,307 | 12,740 | 64 | 400 | 1,144 | 1,787 | 1,523 |
| Albolote | VIII | 32 | 191 | 1,897 | 12,916 | 46 | 302 | 950 | 1,650 | 1,636 |
| Cijuela | VIII | 6 | 35 | 286 | 1,522 | 8 | 46 | 129 | 198 | 165 |
| Maracena | VIII | 38 | 226 | 2,214 | 14,331 | 56 | 368 | 1,129 | 1,908 | 1,814 |
| Peligros | VIII | 19 | 112 | 1,112 | 7,380 | 28 | 184 | 576 | 992 | 966 |
| Vegasl Genil | VIII | 6 | 36 | 370 | 2,791 | 9 | 60 | 197 | 361 | 390 |
| Láchar | VIII | 11 | 65 | 540 | 2,477 | 10 | 60 | 161 | 229 | 163 |
| Calicasas | VIII | 2 | 15 | 123 | 599 | 3 | 17 | 49 | 73 | 54 |
| Cúllar Vega | VIII | 7 | 43 | 406 | 3,171 | 11 | 68 | 216 | 386 | 419 |
| Pulianas | VIII | 10 | 58 | 535 | 3,835 | 14 | 85 | 268 | 471 | 493 |
| Güevéjar | VIII | 5 | 29 | 277 | 1,507 | 5 | 34 | 96 | 151 | 127 |
| Jun | VIII | 4 | 24 | 262 | 1,724 | 5 | 36 | 113 | 194 | 187 |
| Granada | VII | 0 | 0 | 10,982 | 244,767 | 0 | 1,222 | 8,348 | 24,524 | 38,959 |
| Others | VI-VII | 0 | 0 | 7,033 | 286,159 | 0 | 799 | 4,835 | 17,146 | 34,133 |
| **Total** | **VI-VIII** | **313** | **1,865** | **35,133** | **628,839** | **436** | **4,787** | **21,251** | **54,542** | **84,346** |

Estimated number of deaths (D), Casualties (C), homeless, total population, collapse, very serious damage, moderate damage, and slight damage.

than 20 villages of Granada and Málaga, with more than 1,300 deaths and around 1,500 seriously injured[2].

This study is centred on the scenario of the most probable seismic damage which an earthquake with a maximum I = VIII (corresponding to an "occasional" earthquake, according to Eurocode 8[3] with an approximate possibility of 50% in 50 years) and an epicentre in the Sierra Elevada could cause the city of Granada, Spain and its metropolitan area. The number of victims with trauma in each of the damaged populations around the epicentre has been estimated and the injuries have been classified by localisation and priority of medical treatment. The results obtained were compared with those estimated for an earthquake of I = IX in the same source area.

The characteristics of each population as well as their geographical location are shown in Table 1 and Figure 1, respectively.

## Methods

Studies on seismic danger[4,5] and the Spanish seismic code (NCSE-02) consider that the most probable case of an earthquake producing serious damage in the metropolitan area of Granada would have an intensity of VIII with an epicentre between Atarfe and Pinos Puente in the Sierra Elvira fault.

To determine the characteristics of this hypothetical scenario, the SES 2002[6] simulator of seismic scenarios was used. The classification of the victims by types and categories was performed using the tables of human vulnerability developed by Di Sopra and Schiavi[7] using data from the Friuli (Italy) earthquake in 1976.

The SES 2002 is a computer application developed by the General Administration of Civil Protection and the National Geographic Institute to estimate the possible effects which hypothetical earthquakes would produce in Spain. It is oriented towards the prevention and the preparation of seismic emergencies. The calculations are made from focal parameters, attenuation laws, construction vulnerability and the population in each town affected. The results are presented for each municipality (minimum territorial unit of calculation) in tables and graphs using the Geographic Information System (GIS). Distribution of seismic intensity, dwelling damage (organised and quantified by different levels of damage) and the number of potential victims (dead, injured and homeless) are obtained for each earthquake.

The earthquake of I = VIII studied has been situated at approximately 37.24 N, 3.73 W, with a depth of 10 Km and an estimated magnitude $M_w \geq 6.8$. The case of an earthquake of I = IX of low probability of occurrence ("rare" earthquake according to Eurocode 8), with a 10% probability in 50 years, has been located at the same foci with an estimated magnitude of $M_w \geq 6.8$. Simulations with the four models available in the SES 2002 were made for each case: maximum SES, minimum SED, Irpinia and ATC. The first and second are specific proposals by the working group for Spain and are based on studies of vulnerability of constructions which consider each as the worst and the best behaviour of the buildings towards

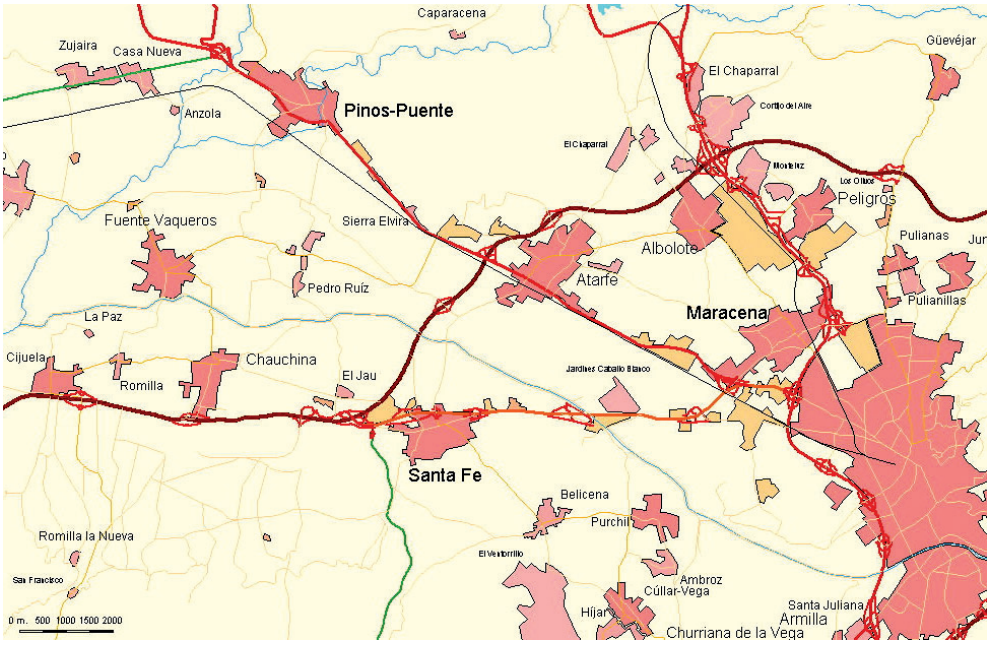


**Figure 1.** Geographical localization of Granada and the northern metropolitan area of the Sierra Elvira epicentre of the hypothetical earthquake.

seismic shaking, respectively. The Irpinia model uses the matrixes of probability of damage obtained by Chávez[8] with the Italian earthquake of November 23, 1980 for constructions of vulnerability similar to those in Spain. The ATC model[9] is that used by the FEMA (Federal Emergency Management Agency) in the simulator programme of HAZUS scenarios[10] with data of vulnerability of American constructions. The maximum SES damage and victim model were what was finally used in this study.

The vulnerability of the human body against different critical situations provoked by earthquakes (collapse of buildings, falling of objects and materials, etc.) can also be measured with studies carried out with the data collected from patients admitted to hospitals after a seismic catastrophe. After analysing the studies available for the classification of victims (among which those performed in 1983[7], 1985[9,11], 1994[12-14], 1996[15], 1997[16], 1999[17,18] are of note), the methodology used by Di Sopra and Schiavi[7] for the two earthquake types considered in this study were used. This methodology was used because of the recommendations of other authors[19] and, in addition, because the construction typology of the buildings and the magnitude of the earthquake were similar to those studied herein. These authors described the localisation and the percentage of casualties produced by the earthquake in Friuli on May 5, 1976 with a magnitude (M) 0 6.4 (Table 2) in 1,000 patients admitted to the Hospital Civil in Udine. Of all the victims, 27% were deaths and 73% casualties. Among the latter, 80% had traumatisms and 20% different medical problems.

Likewise, a study was undertaken in 1990 for Granada[20] in which the damage and number of victims produced by an earthquake with an epicentre near the city of Granada were taken into account (Table 3). This study also included a classification of the casualties by categories (corresponding to the classical triage categories) based on the severity of the victims and aimed at predicting which patients most required assistance and the resources necessary for their evacuation. The mean radios of seismic attenuation for the zones of intensity IX, VIII and VII (MSK) were 15, 26 and 40 Km, respectively.

The cases of medical problems studied in the present report corresponded to trauma lesions directy produced by the earthquake since the estimations of the number of victims made by the SES 2002 take into account the injuries provoked by construction damage. This means that, according to the study of the Fruili earthquake, which has been confirmed by other studies of victims of other relevant earthquakes[11,15,16,18], the number of victims may be 20% higher if non traumatological medical problems (cardio-circulatory, obstetric, anxiety, stress, etc.) are taken into account.

**Table 2.** Localisation and type of trauma lesions found in 1,000 patients injured in the Fruili earthquake

| Localization | Type of trauma | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Contusion | | Injury | | Dislocation | Fracture | | Open | Amputation | Total ‰ injured | % traumatised |
| | | | | | | Closed | | | | | |
| | Total ‰ injured | % contusions | Total ‰ injured | % injured | | ‰ | % fractures | | | | |
| Cranio-facial | 18 | – | 86 | 40.5 | 4 | 14 | – | 8 | – | 130 | 19 |
| Spinal | – | – | – | – | – | 20 | 10 | 2 | – | 24 | 3.5 |
| UE | 2 | – | 14 | – | 6 | 56 | 22.9 | 4 | 6 | 88 | 12.9 |
| Thorax | 6 | – | – | – | – | 64 | – | 2 | – | 72 | 10.6 |
| Pelvis | 2 | – | 20 | – | 16 | – | – | – | – | 38 | 5.6 |
| ML | 12 | – | 40 | 18.8 | 6 | 106 | 37.8 | 8 | 6 | 178 | 26.1 |
| Polycontusion | 54 | 70 | 52 | 24.5 | – | 4 | – | 2 | – | 152 | 22.3 |
| **Total** | **34** | **100** | **212** | **100** | **16** | **280** | **100** | **22** | **12** | **682** | **100** |

UE: upper extremities; LE: lower extremities.

**Table 3.** Quantification of victims by triage categories according to the localisation of the traumatism

| Localisation | Total nº | 1st category | 2nd category | 3rd category |
|---|---|---|---|---|
| CET | 1,859 | 125 | 257 | 1,457 |
| Spinal injury | 342 | 28 | 14 | 300 |
| UE trauma | 1,285 | 85 | 80 | 1,120 |
| Thoracic trauma | 1,028 | 30 | 85 | 913 |
| Pelvic injury | 542 | 6 | 71 | 465 |
| LE trauma | 2,570 | 114 | 570 | 1,886 |
| Polycontusion | 2,376 | – | 311 | 2,065 |
| **Total** | **9,982** | **388** | **1,388** | **8,206** |

CET: cranioencephalic trauma, UE: upper extremity; LE: lower extremity.

The following results were obtained on applying the percentages of the injuries and the categories established to the estimation of the victims obtained with the seismic scenario simulator SES 2002.

## Results

It was estimated that for the case of an earthquake with I = VIII (EMS) there would be 313 mortal victims and 1,865 casualties of different consideration. The classification of the casualties by categories based on the severity of the injuries was of around 4% of very severe injuries (1st category), approximately 14% of moderate casualties and 82% with slight injury. The most frequent localisation of the lesions was the lower extremities (26%), followed by polycontusions (23%), head trauma (19%), the upper extremities (13%), thorax (10%), pelvis (6%) and lastly, spinal injury (3%).

Table 1 shows the estimation of the victims and construction damage for each municipality. In addition to the previously mentioned victims, it is of note that 35,113 would become homeless, with a total of 165,362 homes being damaged, 436 homes would collapse and another 4,787 would be very seriously damaged.

Table 4 shows the results of the estimation of the victims, classified according to the localisation of the injuries for the cases of earthquakes with intensities VIII and IX and an epicentre in Sierra Elevada (Granada). In the first case, the 1,865 estimated victims were classified as (Figure 2) 73 casualties of the 1st category (red), 258 in the 2nd category (yellow) and 1,534 casualties in the 3rd category (green). These values are 11-fold greater in the second case (earthquake with I = IX) increasing from 1,865 casualties in the first case to 21,289 in the second. Similarly, the number of victims in each category was also multiplied by 11 (Figure 3).

**Table 4.** Victims by categories according to the localisation of the injuries, in an earthquake of intensity (I) VIII and IX and an epicentre in Sierra Elevada (Granada)

| | Total nº | | 1st category | | 2nd category | | 3rd category | |
|---|---|---|---|---|---|---|---|---|
| Localisation | I = VIII | I = IX | I + VIII | I = IX | I = VIII | I = IX | I = VIII | I = IX |
| Head | 352 | 4.024 | 13 | 156 | 49 | 559 | 290 | 3.309 |
| Spinal injury | 65 | 745 | 3 | 29 | 9 | 103 | 53 | 613 |
| UE | 237 | 2.704 | 9 | 105 | 33 | 375 | 195 | 2.224 |
| Thorax | 196 | 2.235 | 8 | 87 | 27 | 310 | 161 | 1.838 |
| Pelvis | 103 | 1.171 | 4 | 45 | 14 | 163 | 85 | 963 |
| LE | 483 | 5.514 | 19 | 214 | 67 | 765 | 397 | 4.535 |
| Polycontusions | 429 | 4.896 | 17 | 190 | 59 | 680 | 353 | 4.026 |
| **Total** | **1.865** | **21.289** | **73** | **826** | **258** | **2.955** | **1.534** | **17.508** |

UE: Upper extremities. LE: Lower extremities.

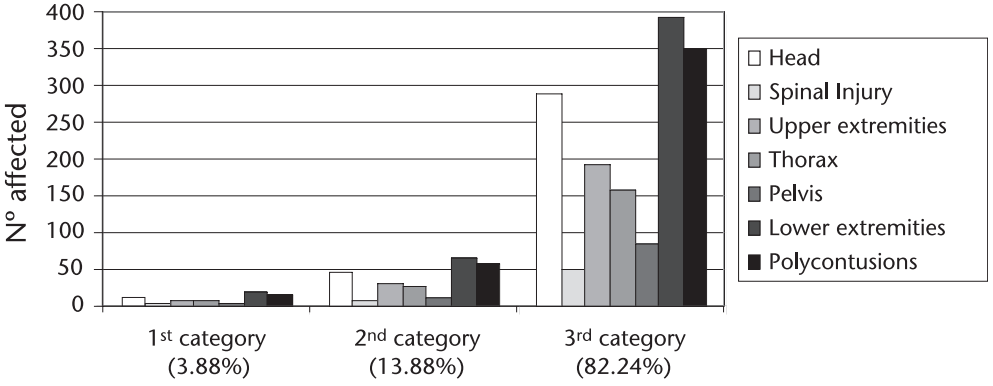


**Figure 2.** Graphic representation of the most frequent localisations of injuries and their severity (category) for the case of an earthquake with an intensity VIII and an epicentre in Sierra Elevada (Granada).

In seismic disasters the survival of the victims depends on the time until rescue, triage and emergency treatment, with the first 24 hours being critical. Following the initial triage of the victims, the first treatment and stabilisation of the critical patients is urgent as is the transfer of the casualties (according to the classification) by the evacuation chain.

Taking into account the estimation of the probable victims in earthquakes with an epicentre in Sierra Elevado, it was proposed that the Advanced Care Posts (ACP) and the healthcare centres send the "red" patients to the hospitals of Granada within the first 8 hours of the crisis. This area has two third level hospitals, the Complejo Hospitalario Universitario Virgen de la Nieves and the Hospital Clínico San Cecilio, each with 1,062 and 699 beds, respectively. In addition, the Hospital San Juan de Dios, which belongs to the Healthcare Council and the Hospital San Rafael of the Hermanos de San Juan de DIos under the Andaluz Ministry of Health, as well as the private clinics La Inmaculada and Nuestra Señora de la Salud would provide support after having previously performed rapid inspection of their operability. The Units of Prehospital Stabilisation (UPS) and the Units of Surgical Rescue (USR) would also be located at the airport of the capital for the Military Healthcare team where a field hospital would also be set up if required. The "yellow" patients would go to hospital outside the city of Granada according to their disease, hospital proximity and availability. The "green" patients would be derived to nearer healthcare centres. The hospitals would accept all the red patients and only direct yellow according to the hospital availability.

The seismic vulnerability study of some hospital installations of Granada has shown that rapid post-earthquake inspection of the safety and operability of the hospitals is essential, particularly in the case of an I = IX. The support hospitals and especially the county hospitals of Baza and Motril, as well as the Andalusian reference hospitals must

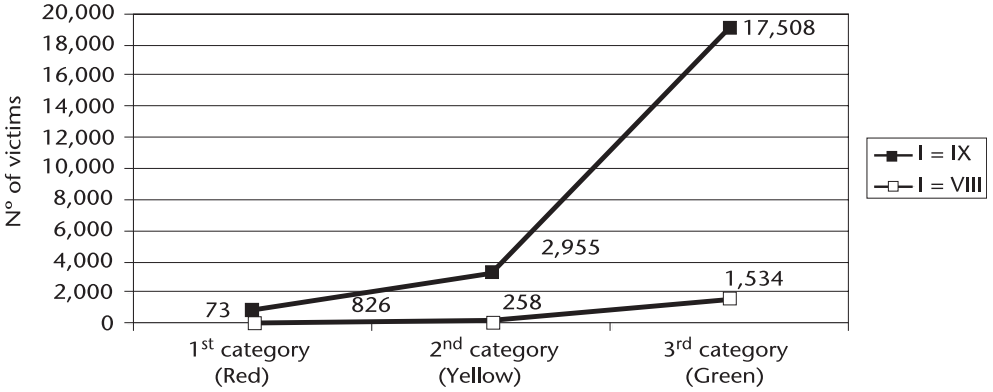


**Figure 3.** Graph comparing the number of victims classified by categories for the cases of Intensity (I) = VIII and I = IX in Sierra Elevada (Granada).

be prepared to receive and provide assistance to the victims referred thereto from the ACP and the hospitals and private clinics of Granada when their operating limit has been reached.

## Discussion

The results of the application of the SES 2002 using the maximum SES model for the earthquakes studied have provided figures for victims based on the different levels of damage (structural and non structural) to the buildings. The maximum SES model of damage and victims was chosen because the matrixes of vulnerability most closely match those of the constructions in the study area, while the minimum SES considers less than real vulnerability. The Iripina model provides greater damage and, consequently, victims than the first but may be a reference for constructions to areas prior to 1980. The ATC model is similar to the maximum SES model but reports a greater number of casualties, probably for considering higher central values of magnitude for each intensity than those estimated herein. This approach to damage and victims is realistic since it is supported by the Irpinia and ATC data corresponding to areas of greater and lesser construction vulnerability, respectively. Nonetheless, it should be taken into account that the results are general and should be considered as mean indicators very close to a hypothetical reality, since, despite having updated the databases to reduce the margin or error of the results obtained, some factors may modify these values.

The limitations are due to:

– The distribution of the intensity largely depends on local conditions or ground effects (topography, lithology, water content) which were not taken into account for lack of inclusion in the SES 2002.

– From a statistical point of view, data on Spanish earthquakes are not sufficiently significant to determine the functions of vulnerability (damage.). Thus, data of earthquakes and constructions of similar characteristics (damage in the earthquake in Irpinia, Italy in 1980) were used.

– To estimate the real vulnerability of the constructions, in depth studies must be carried out in the populations in question, since a priori, small construction faults may represent a large increase in vulnerability and, consequently, an increase in the estimation of damage and the number of victims. In this study the mean vulnerability was estimated based on the typology and the state of the constructions.

– The SES does not consider the temporal distribution of the population, and thus, does not evaluate the differences in the damage caused by the same earthquake at different times of the year or at different times of the day. Nonetheless, variations with respect to the mean have been estimated and hourly intervals have been taken into account with approximately 20% more victims in the case of an earthquake during the night.

– The SES only calculates the damage provoked in housing buildings. However, there are also other numerous types of damage caused in other constructions or triggered by secondary dangers (fires, tsunamis, liquefaction, land slides, etc.) and important indirect damage not quantified, although an approximate estimate may be made with an in depth study of the placement of the constructions and installations.

In general, almost all the analyses on seismic risk in some zone of Spain have been carried out in depth. These include those made in Alcoy[21], Lorca[22], Alicante[23] and Barcelona[24], among others. This carries a certain economic cost which is in contrast to the social relaxation with respect to earthquakes which may be explained by the fact that the last catastrophic earthquake in Spain took place in 1884, more than 120 years ago. Moreover, the studies performed have been focused on analysing seismic danger and the methodology used considerably varies. Few cases[25-28] have studied vulnerability and damage calculation in depth such as in the cases of Adra[29,30], Granada[28,31], Catalonia and Barcelona[32]. This is similar in other countries including the United States[19], Portugal, Italy, Turkey, Colombia, etc. To make these assessments Geographical Information Systems (GIS) with commercial applications are required: ArcView™, Map Info™, Arc-Gis™, etc.

The estimation of human victims due to an earthquake is a complex problem[11]. Definition of the number of casualties determines the initial demand of the healthcare system. Different models have been proposed for the estimation of human victims produced by an earthquake[34], with those of Coburn and Spence[35,36] and the ATC-13 (1985)[9] being of note. The first established the use of an analytical expression adjusted from the analysis of more than 1,000 important earthquakes. This relation is specific for collapsed buildings and, among other parameters, considers the population per building and occupation according to the time of the day.

The methodology proposed by the ATC establishes percentages of people affected (slight injuries, severe injuries and deaths) based on the

different levels of damage (structural and non structural) to the buildings, deduced by a group of experts according to earthquakes which have occurred in the USA, and those with grade 3, 4, and 5 damage are the most decisive.

Other alternatives[37] contemplate the possibility of directly adjusting a correlation or law of intensity-casualties for each seismic scenario which will allow determination of the percentage of casualties of each population affected and the response of a regional hospital network for each value of macroseismic intensity.

## Conclusions

The most probable destructor earthquake which may be expected in the city of Granada (located within the area of greatest seismic danger in Spain) is that with an epicentre in Sierra Elvira with a maximum intensity of grade VIII. The most destructive which could occur in this zone would be I = IX which would produce a very high number of deaths (3,548) and casualties (21,289) multiplying the number of victims with respect to I = VIII by 11. The quantity of populations with damage, and the very high number of casualties of different categories in the case of I = IX would make this earthquake of national interest, thereby requiring the participation of many organisms and implying a different and specific study of this grade of intensity. For the case of intensity VIII, a total of 313 deaths and 1,865 casualties of different severity requiring healthcare assistance was estimated, with around 4% of very severe injuries (1st category), approximately 14% of moderate severity (2nd category) and 82% of slight injuries (3rd category).

The most frequent localisation of lesions estimated was in the lower extremities (26%) followed by polycontusions (23%), head injuries (19%), upper extremities (13%), thorax (10%), pelvis (6%) and lastly, spinal injury (3%).

The municipalities which would receive the most damage by this seismic movement would be Pinos Puente, Atarfe, Santa Fé, Albolote and Maracena. The number of victims would subsequently be higher in these towns and healthcare efforts would initially be concentrated in these towns with ACPs at each site.

These estimations are fundamental for adjusting the healthcare action plan. They indicate that healthcare assistance must be staggered. A minimum of 6 ACP must be established in less than 2 hours for immediate medial intervention and the unit of prehospital stay (UPS) and the unit of surgical rescue (USR) must be set up in less than 8 hours to stabilise critical patients. In an I = IX earthquake or in the case of reduction of operability of Granada hospitals, a field hospital would also be necessary.

Taking the results obtained into account a healthcare action plan against a destructive earthquake in the province of Granada must be developed. This plan must provide approaches to attend the victims from a structured, organised base leaving improvisation aside as far as possible with the aim of increasing the survival of the victims, activating an emergency medical assistance team with the necessary logistic support and infrastructure.

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## Estimación y clasificación de las víctimas potenciales de un terremoto dañino en el área metropolitana de Granada

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**Objetivos:** Estimar el número potencial de víctimas en un hipotético terremoto de intensidad de grado VIII (EMS), con epicentro en Sierra Elvira (cercano a Granada) y clasificar los heridos en función de la localización y gravedad de sus lesiones. Estos datos se comparan con los estimados para otro terremoto de intensidad IX, mucho menos probable, ubicado en la misma zona.
**Método:** Se ha utilizado el simulador de escenarios sísmicos SES 2002 y las tablas de vulnerabilidad humana propuestas por Di Sopra y Schiavi.
**Resultados:** Los daños esperados en viviendas son: 436 colapsadas, 4.787 con daños muy graves y 21.251 con daños graves. Las víctimas ocasionadas son: 313 muertos, 1.865 heridos (de distinta consideración) y 35.113 personas sin hogar. La clasificación de los heridos por categorías: 73 de 1ª (muy graves, rojos), 258 de 2ª (moderados, amarillos) y 1.534 de 3ª (leves, verdes). La localización más frecuente de las lesiones es en: miembros inferiores (26%), policontusiones (23%), cabeza (19%), miembros superiores (13%), tórax (10%), pelvis (6%) y en último lugar en médula espinal (3%).
**Conclusiones:** Estas estimaciones son fundamentales para ajustar el Plan de Actuación Sanitaria. Indican que la asistencia sanitaria ha de ser escalonada, que necesita establecer en menos de 2 horas un mínimo de 6 Puestos Sanitarios Avanzados para la intervención médica inmediata, y desplegar en menos de 8 horas Unidades de Estabilización Prehospitalaria y Unidades de Rescate Quirúrgico, para estabilización de pacientes críticos. En un terremoto de intensidad IX o en el caso de disminución de operatividad de los hospitales granadinos es también necesario un Hospital de Campaña. [Emergencias 2008;20:198-206]

**Palabras clave:** Terremotos. Emergencia. *Triaje.* Catástrofes. Desastres. Rescate. Asistencia sanitaria. Víctimas.