

# An evaluation of civilian aviation accidents in Turkey from 1955 to 2004

Türkiye'de 1955-2004 arası sivil havacılık kazalarının değerlendirilmesi

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## BACKGROUND

Documentation and analysis of aviation accidents is very important to improve aviation safety and post-accident survival. In this study we aimed to evaluate the civilian aviation accidents between 1955 and 2003 in Turkey to identify the risk factors for fatal and non-fatal injuries.

## METHODS

Records of Civilian Aviation Office of The Turkish Ministry of Transportation were retrospectively analyzed.

## RESULTS

A total of 562 aviation accidents occurred within the boundaries of Turkey in the 48-year study period. There was at least one casualty in 237 of these accidents. There were 27 major accidents with more than 5 casualties. There were more major accidents with survivors than without survivors. Major accidents occurred more frequently within the near vicinity of an airport. There are significantly more accidents with survivors in the accidents occurring near the airports. The mean number of accidents with more than 50 casualties is 0.167 (8/48) per year.

## CONCLUSION

Accidents occurring near the airports have a more chance of having survivors. Emergency disaster preparedness plans should be on hand and drills with no more than 50 injured should be regularly exercised in all airports.

**Keywords:** Aviation, accidents, disaster preparedness plan

## AMAÇ

Sivil havacılık kazalarının kaza sonrası yaralanma ve ölümler açısından analizi, havacılık güvenliğinin artırılması ve mortalite ve morbiditenin azaltılması için son derece önemlidir. Bu çalışmanın amacı 1955-2003 arası kapsayan dönemde Türkiye'de oluşan sivil hava kazalarının incelenerek mortalite ve surviyi etkileyen faktörlerin belirlenmesidir.

## GEREÇ VE YÖNTEM

Türkiye Cumhuriyeti Ulaştırma Bakanlığı Sivil Havacılık Genel Müdürlüğü'nden elde edilen kaza verileri retrospektif olarak incelendi.

## BULGULAR

Çalışmaya alınan 48 yıllık süre boyunca Türkiye hava sahası içinde toplam 562 sivil hava kazası meydana gelmiştir. Bu kazaların 237'sinde en az bir ölüm ya da yaralanma oluşmuştur. Kazaların 27'si beşten fazla insanın öldüğü ya da yaralandığı büyük kazalardır. Kurtulanların olduğu büyük kazaların sayısı, hiç yaşayan olmayan kazalardan daha fazladır. Büyük uçak kazaları daha çok hava alanı yakınlarında oluşmuştur ve havaalanlarına yakın mesafelerde gerçekleşen kazalarda daha fazla hayatta kalan olmaktadır. İncelenen zaman diliminde 50'den fazla ölü ya da yaralı içeren uçak kazalarının yıllık görülme hızı 0.167 (8/48) olarak gerçekleşmiştir.

## SONUÇ

Hava alanı yakınlarında oluşan kazalarda hayatta kalma oranı daha yüksektir. Tüm hava alanlarında afet hazırlık planları ve 50 yaralıdan fazlasını içermesi gerekmeyen tatbikatlar düzenli olarak yapılmalıdır.

**Anahtar sözcükler:** havacılık, kaza, afet hazırlık planı

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## INTRODUCTION

One of the most important requirements to improve aviation safety and post-accident survival involves the documentation and analysis of aviation accidents. Several studies describe the incidence and severity of injuries and medical aspects of the air crashes.<sup>[1-3]</sup> but cumulative analysis of accidents that occurred in a defined region is rare in the literature. There have been only two studies evaluating the medical aspects of the same aircraft crash from Turkey<sup>[4,5]</sup> In this study we aimed to evaluate the available data to identify the risk factors for fatal and non-fatal injuries in civilian aviation accidents between 1955 and 2003 in Turkey.

## METHOD

The data obtained from the records of The Turkish Ministry of Transportation were retrospectively analyzed. These included dates and locations of the accidents, intends of flights and the numbers of casualties. *Chi-square* test was applied to compare the data when it was appropriate.

## RESULTS

The data from the Civilian Aviation Office<sup>[6]</sup> documented a total of 562 aviation accidents occurred within the boundaries of Turkey in the 48-year study period. Accidents included motorized aircrafts, wide-bodied jets, helicopters and gliders. At

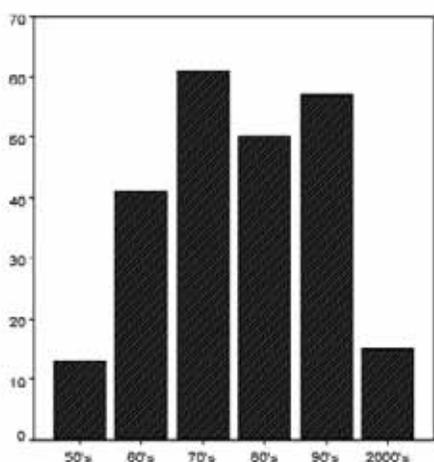


Figure 1: Number of aviation accidents in every decade between 1955 and 2003 in Turkey

Table 1: Distribution of accidents by the number of casualties

| Number of casualties | Number of accidents | Percentage | Cumulative percentage |
|----------------------|---------------------|------------|-----------------------|
| 1-4                  | 210                 | 88,6       | 88,6                  |
| 5-19                 | 12                  | 5,1        | 93,7                  |
| 20-49                | 7                   | 3,0        | 96,6                  |
| 50-99                | 7                   | 3,0        | 99,6                  |
| 100+                 | 1                   | 0,4        | 100,0                 |
| Total                | 237                 | 100,0      |                       |

least one casualty occurred in 237 of these accidents and the remaining 325 did not cause any fatality or injury and were not evaluated in this study. The following analysis is based on these 237 accidents. One hundred and twenty four accidents led to the death of at least one person. A total of 1018 persons died and 361 were injured in the accidents.

In the second half of the century aviation in Turkey developed rapidly. The accident rate followed a parallel increase reaching the maximum at 70's (Figure 1). Four decades of Turkish aviation had similar accident rates, presuming the 2000's to have a similar rate also.

### Total casualties

The selection of the grouping numbers is biased according to the assumption that these intervals would indicate the size and severity of the incident. Each number interval would practically figure out the required emergency response level in

Table 2: Distribution of accidents by the number of fatalities

| Number of fatalities | Number of accidents | Percentage | Cumulative Percentage |
|----------------------|---------------------|------------|-----------------------|
| 0                    | 113                 | 47,7       | 47,7                  |
| 1-4                  | 103                 | 43,5       | 91,1                  |
| 5-19                 | 10                  | 4,2        | 95,4                  |
| 20-49                | 6                   | 2,5        | 97,9                  |
| 50-100               | 4                   | 1,7        | 99,6                  |
| 100+                 | 1                   | ,4         | 100,0                 |
| Total                | 237                 | 100,0      |                       |

**Table 3:** Distribution of accidents by the number of survivors

| Number of survivors | Number of accidents | Percentage | Cumulative Percentage |
|---------------------|---------------------|------------|-----------------------|
| 0                   | 106                 | 44,7       | 44,7                  |
| 1-4                 | 118                 | 49,8       | 94,5                  |
| 5-19                | 8                   | 3,4        | 97,9                  |
| 20-49               | 4                   | 1,7        | 99,6                  |
| 50-99               | 1                   | ,4         | 100,0                 |
| Total               | 237                 | 100,0      |                       |

the reader's mind although this might be a controversial issue. These numbers were used in a similar analysis before.<sup>[3]</sup> The "Casualties" means total number of victims killed or injured.

The incidents with more than five casualties constitute only 11.4 % (n=27) of the total cases with casualties. Only one accident occurred with over 100 casualties and 7 accidents with 50-99 casualties. Because these numbers represent the figures of 48 years, the mean number of accidents with more than 50 casualties is 0.167 (8/48) per year (Table 1).

#### Fatalities

Table 2 shows the distribution of the number of fatalities in 237 accidents with casualties. Only 124 of these accidents led to the death of at least one person. There were more than 5 deaths in only 8.9%

of the accidents. The mean annual rate of accidents with more than 50 fatalities is 0.104 per year.

#### Survivors

The distribution of the number of accidents according to the number of survivors (Table 3) indicates that since 1955 only 13 (5.5%) aviation accidents had more than 5 survivors.

#### Intends of flights

The intends of flights were agricultural, transportation and training in the majority of the accidents with casualties (Table 4) and fatalities. The agricultural flights, mainly by single-engine aircrafts, constitute most of the accidents, whereas, accidents during the transportation flights are responsible for the majority of the fatalities and injuries (Table 4, 5).

#### Accidents near or away from the airport

Civilian Aviation Office records have not classified the accidents as near or away from the airport. Moreover, for some of the incidents, it has not been stated where the incident has occurred. Fortunately the places of the accidents have been recorded for the majority of the cases, especially for the major accidents. We classified the cases as "near" or "away from" the airport depending on the location of the accident occurred.

As stated above, only 27 accidents with more than 5 casualties occurred in Turkey between 1955 and 2003, which can be classified as major acci-

**Table 4:** Distribution of casualties by intends of flights

| Intend of the flights | 1-4 | 5-19 | 20-49 | 50-99 | 100+ | Total number of accidents | Percentage |
|-----------------------|-----|------|-------|-------|------|---------------------------|------------|
| Rescue                | 5   |      |       |       |      | 5                         | 2.1        |
| Training              | 29  |      |       |       |      | 29                        | 12.2       |
| Air show              | 4   |      |       |       |      | 4                         | 1.7        |
| Air Taxi              | 6   |      |       |       |      | 6                         | 2.5        |
| Agricultural          | 127 |      | 1     |       |      | 128                       | 54.0       |
| Transportation        | 19  | 8    | 6     | 7     | 1    | 41                        | 17.3       |
| Private               | 16  | 2    |       |       |      | 18                        | 7.6        |
| Advertisement         | 2   | 2    |       |       |      | 4                         | 1.7        |
| Competition           | 2   |      |       |       |      | 2                         | 0.8        |
| Total                 | 210 | 12   | 7     | 7     | 1    | 237                       | 100.0      |

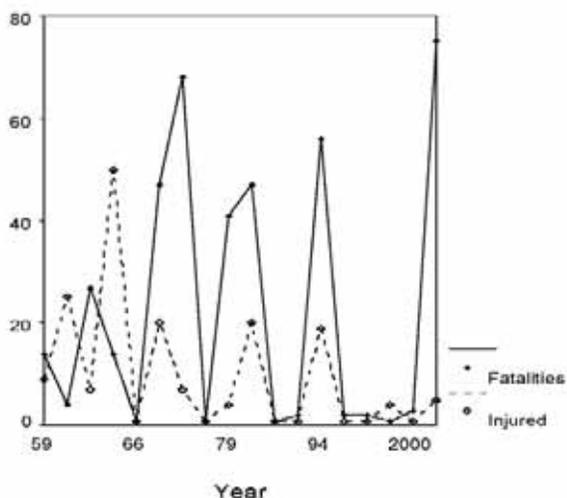


Figure 2: Annual number of fatalities and injured between 1955 and 2003 in Turkey

dents. Table 6 shows the cross-tabulation of the number of these major accidents near and away from airports versus the number of accidents with and without survivors. There are more major accidents near the airports than away from the airports and more with survivors than without survivors. There are significantly ( $p=0.049$ ) more accidents with survivors near the airports than away from. Thirteen of the 19 accidents near the airports had survivors, whereas only two of the eight accidents away from the airport had survivors.

### Casualty trends

Figure 2 shows the graphics of the number of fatalities and injured. One or two major accidents with large number of fatalities have occurred in approximately every ten years between 1955 and 2003.

### DISCUSSION

Evaluating the records of civilian aviation accidents in Turkey over 49-year period (1955-2003), missing data limited the ability to analyze statistically the data for the risk factors affecting mortality and casualty.

Given the large number and variety of variables affecting the fatality and survival in aviation accidents, it is very hard to determine the independent risk factors. In spite of these facts, our findings confirm and expand previous studies. Improvement in on-board survival is dependent on factors mainly related to the aviation engineering technology, aviation safety and human factor. Post-crash survival, on the other hand, might be affected by and largely dependent on accident site characteristics and emergency medical service provided.

In a study analyzing 473 air crashes throughout the world during the period of 1977-86<sup>[6, 7]</sup> it was found that air disasters generally took place away from the airports. Surprisingly, it was reported in the same study that there were survivors in one-third of these "off airport" accidents, and if only crashes with survivors were considered, more such crashes occurred off airport than on. Our findings are different in this regard. There are more

Table 5: Distribution of fatalities by intends of flights

| Intend of the flights | 0   | 1-4 | 5-19 | 20-49 | 50-99 | 100+ | Total |
|-----------------------|-----|-----|------|-------|-------|------|-------|
| Rescue                | 4   | 1   |      |       |       |      | 5     |
| Training              | 9   | 20  |      |       |       |      | 29    |
| Air show              | 3   | 1   |      |       |       |      | 4     |
| Air taxi              | 3   | 3   |      |       |       |      | 6     |
| Agricultural          | 79  | 48  |      | 1     |       |      | 128   |
| Transportation        | 9   | 15  | 7    | 5     | 4     | 1    | 41    |
| Private               | 5   | 12  | 1    |       |       |      | 18    |
| Advertisement         |     | 2   | 2    |       |       |      | 4     |
| Competition           | 1   | 1   |      |       |       |      | 2     |
| Total                 | 113 | 103 | 10   | 6     | 4     | 1    | 237   |

**Table 6:** Cross-table of survival and location of the accidents as near or away from the airports, p=0.049

| Location of the accidents | No survivors | Survivors | Total |
|---------------------------|--------------|-----------|-------|
| Near                      | 6            | 13        | 19    |
| Away                      | 6            | 2         | 8     |
| Total                     | 12           | 15        | 27    |

major accidents near the airports (70.4%) than away from the airports in Turkey. Also, there are significantly more accidents with survivors near airports (68.4%) than away from (25%). One of the lessons which should be driven from these statistics is that near-airport accidents are relatively common and that they will likely have survivors once they occur. Our Emergency Services should be prepared and carry out drills for possible accidents near the airports, as such accidents do have a trend to occur one or two times per every decade in Turkey and there is not any evidence suggesting a change in this trend.

The size of the exercises to be carried out should be founded on a logical basis such as the number of casualties and survivors. Previous studies on airport disaster planning<sup>[8, 9]</sup> proposed disaster plans and drills including several hundreds of patients. During the past 49 years only 11.4% of the accidents had more than 5 casualties and 5.5% had more than 5 survivors in Turkey. Moreover, there were only one accident with over 100 survivors and only four in which 50 to 99 persons survived. Depending on these figures, it could be suggested that aviation disaster plans and drills in Turkey need not to involve more than 50 injured. An above mentioned study<sup>[7]</sup> also suggested the same number of injured in planning airport disaster exercises.

The agricultural flights, mainly by single-engine, single seated aircrafts, constitute most of the accidents (298 of 562, 53%) in Turkey. A hundred and twenty eight accidents caused casualties and 48 of them led to the death of at least one person. Majority of these accidents took place in rural areas away from the airports, where emergency services are usually unavailable. Any specific precaution for such accidents would be very hard to take and only better pilot training and improved tech-

nical measures might decrease the fatality rate.

The rare occurrence of aviation accidents, especially major ones, usually results in a common misconception of security in the public and even in professionals. Making and carrying out preparedness plans for such disasters are often complicated by this common apathy. Airport and emergency disaster preparedness are usually insufficient in developing countries and prepared mass casualty plans and simulations do not function effectively.<sup>[1, 10]</sup> Even developed countries with organized emergency medical and trauma services may suffer from disorganization, chaos and triage mistakes.<sup>[11, 12]</sup> Authorities must be aware of these facts and ensure the disaster plans to be exercised on a regular basis.

Pre-hospital emergency medical care is not well developed especially in rural and suburban areas of Turkey. Emergency care has deficiencies and shortcomings even for limited disasters occurring near airports (1). Attempts have been devoted by the government to construct an efficient Nationwide Emergency Medical Service recently.

## CONCLUSION

Aviation accidents and especially those involving large number of passengers will continue to occur. Most of the major accidents are located near the airports and they likely have survivors. Reasonable disaster preparedness plans should be on hand and drills with no more than 50 injured should be regularly exercised in all airports. The airports should be connected to the nation-wide Emergency Medical Service through these plans.

## REFERENCES

1. Coad NR, Jones MJ, Byrne AJ, Pepperman MI. The M1 air crash. *Anaesthesia*. 1989; 44:851-854
2. Rowles JM, Robertson CS, Roberts SN. General surgical injuries in survivors of the M1 Kegworth air crash. *Ann R Coll Surg Engl*. 1990; 72:378-381
3. Chalmers DJ, O'Hare DPA, McBride DI. The incidence, nature and severity of injuries in New Zealand Civil Aviation. *Aviat Spave Environ Med*. 2000; 71:388-395
4. Agalar F, Cakmakci M, Akcakanat A, Sayek I. Evaluation of trauma care in a developing country highlighted by a major aircraft accident. *Eur J Em Med*, 1997; 4:97-102
5. Yalcinkaya I, Dilek ON, Tosun N. Van uçak kazası. *Ulus Travma Dergisi*. 1998; 4:185-187

6. Aviation accident statistics of Civilian Aviation Office of The Turkish Ministry of Transportation, 2004
7. Rutherford WH. An analysis of civil air crash statistics 1977-86 for the purposes of planning disaster exercises. *Injury*. 1988; 19:384-388
8. Barbash GL, Yoeli N, Ruskin SM, Moeller DW. Airport preparedness for mass disaster: a proposed schematic plan. *Aviat space Environ Med*. 1986; 57:77-81
9. Eisner ME, Waxman K, Mason GR. Evaluation of possible patient survival in a mock airplane disaster. *Am J Surg*. 1985; 150:321-323
10. Lee WH, Chiu TF, Ng CJ, Chen JC. Emergency medical preparedness and response to a Singapore airliner crash. *Acad Emerg Med*. 2002;9:194-198
11. Van Amerongen RH, Fine JS, Tunik MG, Young GM, Foulton GL. The Avianca plane crash: an emergency medical system's response to pediatric survivors of the disaster. *Pediatrics*. 1993;92:105-110.
12. Malone WD. Lessons to be learned from the major disaster following the civil airliner crash at Kegworth in January 1989. *Injury*. 1990;21:49-57

