

Evaluation of the Patients Admitted to the Emergency Room due to Poisoning in terms of Clinical Characteristics and Costs

Zehirlenme Nedeniyle Acil Servise Başvuran Hastaların Klinik Özellikler ve Maliyet Açısından Değerlendirilmesi

Hakan Hakkoymaz¹, Ali İhsan Kilci¹, Özlem Güler¹, Fatih Nazmi Yaman²,
Ramazan Azim Okyay³

¹ Kahramanmaraş Sütçü İmam University, Faculty of Medicine, Department of Emergency Medicine, Kahramanmaraş, Turkey

² Istanbul Medipol University, Faculty of Medicine, Department of Emergency Medicine, Istanbul, Turkey

³ Kahramanmaraş Sütçü İmam University, Faculty of Medicine, Department of Public Health, Kahramanmaraş, Turkey

Yazışma Adresi / Correspondence:

Hakan Hakkoymaz

Kahramanmaraş Sütçü İmam University, Faculty of Medicine, Department of Emergency Medicine, Kahramanmaraş, Turkey

T: +90 538 401 67 72 E-mail: : hhhkymz@gmail.com

Geliş Tarihi / Received : 20.03.2019 Kabul Tarihi / Accepted : 08.07.2019

Orcid :

Hakan Hakkoymaz: <https://orcid.org/0000-0002-8568-8283>

Ali İhsan Kilci: <https://orcid.org/0000-0003-0029-3942>

Özlem Güler: <https://orcid.org/0000-0002-1444-7730>

Fatih Nazmi Yaman: <https://orcid.org/0000-0003-1555-4658>

Ramazan Azim Okyay: <https://orcid.org/0000-0001-8767-2771>

Abstract

| | |
|-----------------------|---|
| Objective | In this study, it is aimed to evaluate the demographic, etiologic and clinical characteristics of the poisoning cases admitted to emergency room along with their costs to Social Security Institution. (<i>Sakarya Med J</i> 2019, 9(3):470-478). |
| Materials and Methods | This is a descriptive study. The data were obtained by retrieving the files of the patients who were registered for poisoning to a university hospital adult emergency service between October 2015 and October 2017 from the automation system. |
| Results | Of the patients, 60.3% were in the 18-24 age group, 30.6% were in the 25-34 age group and 60.0% were females. Of the admissions, 56.8% were due to suicide attempt. In the 18-24 age group and in women, poisonings were found more likely to be a suicide attempt. Of the patients, 50.6% admitted with drug poisoning. The second common cause of poisoning after drugs was carbon monoxide (CO) with 20.6%. |
| Conclusion | Poisoning is an important public health problem requiring urgent diagnosis and treatment. Most of the drug poisonings, which have a significant share in all poisonings, are suicide attempts. For this reason, the presence of psychiatric symptoms must be investigated in patients with drug poisoning. The second common cause of poisoning after drugs was found to be CO in our study. This situation should be taken into account especially for applications in winter period. Poisoning is also costly in terms of the health economy. It is important to raise public awareness of poisoning in order to prevent both health-related and financially adverse consequences |
| Keywords | Emergency room, costs, poisoning |

Öz

| | |
|--------------------|---|
| Amaç | Bu çalışmada acil servise başvuran zehirlenme olgularının demografik, etiyolojik ve klinik özellikleri ile bunların sosyal güvenlik kurumuna olan maliyetlerinin değerlendirilmesi amaçlanmıştır. (<i>Sakarya Tıp Dergisi</i> 2019, 9(3):470-478) |
| Gereç ve Yöntemler | Çalışmamız tanımlayıcı tiptedir. Veriler, Ekim 2015-Ekim 2017 tarihleri arasında bir üniversite hastanesi yetişkin acil servisine zehirlenme ön tanısıyla kaydı yapılan hastaların dosyalarının otomasyon sisteminden retrospektif olarak incelenmesi ile elde edilmiştir. |
| Bulgular | Hastaların %60,3'ü 18-24, %30,6'sı 25-34 yaş grubunda olup, %60,0'i kadındır. Başvuruların %56,8'inde etkenle maruziyet, intihar amacıyla gerçekleşmiştir. 18-24 yaş grubunda ve kadınlarda zehirlenmelerin daha çok intihar amaçlı olarak gerçekleştiği bulunmuştur. Hastaların %50,6'sı ilaç nedeni zehirlenme ile başvurmuştur. İlaç dışı başvuruların en sık nedeni ise %20,6 ile karbonmonoksit (CO) zehirlenmesi olmuştur. |
| Sonuç | Zehirlenmeler, acil tam ve tedaviyi gerektiren önemli bir halk sağlığı sorunudur. Tüm zehirlenmeler içinde önemli bir paya sahip olan ilaca bağlı zehirlenmelerin büyük bölümü intihar amaçlı alım sonucu gerçekleşmiştir. Bu nedenle ilaç zehirlenmesi ile gelen hastalarda psikiyatrik tabloların varlığı mutlaka araştırılmalıdır. Çalışmamızda ilaç dışı nedenlerle gerçekleşen zehirlenmelerin en büyük nedeni CO olarak bulunmuştur. Özellikle kış döneminde gelen başvurularda bu durum dikkate alınmalıdır. Zehirlenmeler, sağlık ekonomisi açısından da maliyetlidir. Zehirlenmelerin gerek sağlıkla ilgili, gerekse de mali açıdan yarattığı olumsuzlukların önlenmesi açısından toplumsal farkındalığın artırılması önemlidir. |
| Anahtar Kelimeler | Acil servis; maliyet; zehirlenme |

INTRODUCTION

If any substance can cause damage to structures with its chemical effects, even in small quantities when digested, inhaled, absorbed or injected, that substance is called poison and the case is called the poisoning.¹

Poisoning cases are among the most common medical emergencies. Poisoning cases can be accidental or due to suicide attempts, along with occupational exposure or as a consequence of the extended use of a medically required medicine.² While accidental poisoning cases are more commonly observed for children under 6 years old, intoxications due to suicide attempts are observed more frequently especially during puberty.³ Poisoning is the most common reason of nontraumatic coma for the patients under the age of 35, who were admitted to the emergency service.⁴ The annual incidence of poisoning in developed countries is between 0.02% and 0.93% and this rate continues to increase globally.⁵ It is reported that poisoning cases constitute 0.46-1.57% of all the emergency service admissions in Turkey.⁶ Causes of poisoning vary with the geographical area, socio-cultural and economic situation. Medications, nutrients, industrial and agricultural toxic substances are the most common causes of intoxication.⁴ The most common cause of poisoning cases in our country is suicidal attempts and it is observed that most them are multiple medicine intake induced intoxications.^{5,6} The cases which require hemodynamic close follow-up are being monitored in the intensive care unit and these follow-ups are more costly when compared to other clinical applications and admissions.

Despite admissions due to poisoning constitute an important part of the emergency service admissions and there are a lot of publications concerning the clinical picture due to these poisoning cases, the number of studies which approach to the matter costwise are insufficient.

In the light of this information, we aimed to evaluate the demographic, etiologic and clinical characteristics of the

patients who were admitted to a university hospital due to poisoning and their cost to Social Security Institution (SSI).

MATERIALS and METHODS

Type of the Study

In this descriptive study, reports of the patients who were admitted to the Adult Emergency Service of a university hospital between October 2015 and October 2017 with the initial diagnosis of intoxication were retrieved from automation system and analyzed retrospectively.

The inclusion criteria were as follows: Patients' age, gender, time of admission, application period, the substances causing the poisoning, the form of poisoning, cause of the substance intake, symptoms, prognosis, and the costs were evaluated; and above 18 year old patients with complete demographic data were included to the study. Patients under 18 years old and patients whose file information and demographic data were missing despite having the pre-diagnosis of intoxication were excluded from the study.

Data analysis

The costs included in the cost analyses comprised of patients' all direct costs invoiced to SSI, from their arrival to emergency service upon their discharge from hospital. Total cost of health services were converted to United States Dollar (\$) from Turkish Lira, using the 2015, 2016 and 2017 years' average USD/TRY parity value which is 3.10.

Demographic data were outlined as numbers and percentage. The differences between groups in categorical variables have been analyzed with Chi-square test. Data were evaluated according to Shapiro Wilk Test to check if they fit to the normal distribution. Numerical measurements were presented as mean \pm standard deviation; median and minimum-maximum. Mann Whitney U test and Kruskal Wallis tests were utilized while comparing the measurements of different groups, and Spearman Correlation Test is used for correlation analysis. P values lower than 5 %

was considered to be statistically significant. SPSS 16.0 program was used for data analysis.

Ethics Committee Approval

The study got approval from local ethics board by the decision number 13, dated 06.12.2017.

RESULTS

The total number of admissions to the emergency service between the dates of October 2015 and October 2017 was 177,617 and 385 of them were poisoning (0.21% of total admissions). 310 patients in total were included in this study who comply with the inclusion criteria.

Of the patients, 60.3% belong to 18-24, 30.6% of them belong to 25-34 age group and 60.0% of them were women. In 56.8% of the admissions, exposure to the agent was due to suicide attempt. Of the patients, 50.6% (n = 157) applied with medicine induced intoxication. It was determined that 61.8% of the medicine induced admissions (n = 97) was due to single use; 38.2% (n = 60) of them was due to multiple medicine intake. The most common cause of admission other than medication was carbon monoxide (CO) poisoning with the ratio of 20.6% (Table 1).

When the form of exposure of the poison is evaluated, it is determined that 79.4% of them were oral intakes. It is determined that patients apply to the hospital averagely 129.63 ± 156.23 minutes after the exposure and the duration of hospital stay is 0.88 ± 2.02 days on average.

When the form of exposure is evaluated by the age groups, difference between them found to be meaningful ($\chi^2 = 14,756$, $p = 0.001$). It is determined that especially for the age group of 18-24, reason behind the poisoning is more likely to be a suicide attempt. When the form of exposure is evaluated by gender, it is determined that women who were admitted to the hospital due to intoxication has a high incidence of attempted suicide ($\chi^2 = 8,421$, $p = 0.004$).

Table 1. Demographic characteristics of patients admitted to the emergency room due to poisoning

| Demographic Features | Number | Percentage |
|----------------------|--------|------------|
| Age (year) | | |
| 18 – 24 | 187 | 60.3 |
| 25 – 34 | 95 | 30.6 |
| 35 and above | 28 | 9.0 |
| Gender | | |
| Male | 124 | 40.0 |
| Female | 186 | 60.0 |
| Form of exposure | | |
| By accident | 134 | 43.2 |
| Suicidal purposes | 176 | 56.8 |
| Factor | | |
| Medication | 157 | 50.6 |
| Carbon monoxide | 64 | 20.6 |
| Food | 22 | 7.1 |
| Corrosive material | 21 | 6.8 |
| Pesticides | 20 | 6.5 |
| Fungus | 13 | 4.2 |
| Alcohol | 13 | 4.2 |

Even though suicide attempts are the most common reason behind medicine-induced intoxications, no statistically significant difference has been found between exposure forms of singular or multiple intake ($\chi^2 = 188,458$, $p < 0.0001$)(Table 2).

Antidepressants are the most common cause of drug-induced poisoning 16.5% (n = 51). Analgesics follow them with 15.5% (n = 18). Distribution of drug-induced poisonings according to the medicine subgroups are presented in Table 3.

The cost of 310 patients who were admitted with poisoning to SSI was 56536,64 \$. No statistically significant difference in costs has been found according to age groups, gender and type of medicine in intoxications with single medicine intake. On the other hand, it is determined that the costs are higher for suicidal poisonings ($p < 0.0001$), medicine-induced intoxications ($p < 0.0001$) and in cas-

| Demographic Features | Form of exposure | | P |
|---|---------------------------------|------------------------------|--------|
| | By accident (Number-Percent) | Suicidal (Number-Percent) | |
| Age (year) | | | |
| 18 – 24 | 65 (48.5%) | 122 (69.3%) | 0.001 |
| 25 – 34 | 51 (38.1%) | 44 (25.0%) | |
| 35 and above | 18 (13.4%) | 10 (5.7%) | |
| Gender | | | |
| Male | 66 (49.3%) | 58 (33.0%) | 0.004 |
| Female | 68 (50.7%) | 118 (67.0%) | |
| Factor | | | |
| Medication | 8 (6.0%) | 149 (84.7%) | 0.0001 |
| Non-medication | 126 (94.0%) | 27 (15.3%) | |
| Single or multiple medication intake | | | |
| Single | 5 (62.5%) | 92 (61.7%) | 0.966 |
| Multiple | 3 (37.5%) | 57 (38.3%) | |

| Medication sub-groups | Number | Percent ^a |
|-----------------------|--------|----------------------|
| Antidepressant | 51 | 16.5 |
| Analgesics | 48 | 15.5 |
| Antibiotics | 22 | 7.1 |
| Antihypertensives | 18 | 5.8 |
| Antiepileptic | 17 | 5.5 |
| Antipsychotics | 16 | 5.2 |
| Anaesthetics | 15 | 1.8 |
| Anti-influenza | 14 | 4.5 |
| Other ^b | 41 | 13.2 |

a: Since there is multiple medication use, the sum of the rates exceeds 100%
 b: Oral antidiabetics, antihyperlipidemics, anticoagulant agents, thyroid preparations, lithium etc.

es who required intensive care is needed ($p < 0.0001$). In addition, it was found that multiple medicine intake poisonings were more costly when compared to single medicine intake poisonings ($p = 0.039$) (Table 4). Positive and significant correlations are found between the cost factor and hospital admission time upon exposure and hospitalization duration, in the linkage analysis (respectively $r = 0.369$; $p < 0.0001$ and $r = 0.844$; $p < 0.0001$). In addition, a positive and significant correlation was found between

hospital admission time upon exposure and hospitalization duration ($r = 0.461$; $p < 0.0001$).

Distribution of cost according to non-medication induced poisoning cause is presented in Figure 1. Accordingly, highest median cost of 323,2 \$ (minimum = 22,04; maximum = 2898,22) for non-medicinal poisoning is of pesticide poisoning; the least median cost 13,92 \$ (minimum = 6,29; maximum = 269,05) is of alcohol poisoning.

Table 4. Distribution of costs to SSI by groups

| Groups | Cost (\$ (median (min-max)) | p |
|--|------------------------------|---------------------|
| Age (year) | | |
| 18 – 24 | 50,14 (5-972,58) | 0.717 ^a |
| 25 – 34 | 41,59 (9,93-53339,67) | |
| 35 and above | 81,9 (6,31-745,161) | |
| Gender | | |
| Male | 57,45 (5-5339,67) | 0.888 ^b |
| Female | 46,09 (7,95-1260,37) | |
| Form of exposure | | |
| By accident | 28,14 (6,29-1636,35) | 0.0001 ^b |
| Suicidal purposes | 163,68 (5-5339,88) | |
| Factor | | |
| Medication | 68,88 (5-1260,37) | 0.0001 ^b |
| Non-medication | 30,3 (6,29-5339,88) | |
| Single or multiple intake of medication | | |
| Single | 63,23 (5-1260,37) | 0.039 ^b |
| Multiple | 203,39 (11,96-972,63) | |
| Drug subgroup^c | | |
| Antiepileptic | 212,05 (37,57-375,98) | 0.098 ^a |
| Anaesthetics | 123,2 (10,83-663,64) | |
| Antihypertensives | 73,75 (7,95-331,71) | |
| Antipsychotics | 68,88 (19,12-318,73) | |
| Antidepressant | 67,90 (33,01-589,88) | |
| Antibiotics | 39,93 (23,51-64,60) | |
| Analgesics | 37,77 (5-612,64) | |
| Other ^d | 78,85 (15,58-1260,37) | |
| Intensive care requirement | | |
| Yes | 331,71 (60,89-5339,88) | 0.0001 ^b |
| No | 33,69 (5-2898,22) | |

\$: Dollar
 a: Determined with Kruskal Wallis test
 b: Determined with Mann Whitney U test
 c: the analysis included only patients with single medication intake
 d: Oral antidiabetics, antihyperlipidemics, anticoagulant agents, thyroid preparations, lithium, etc.

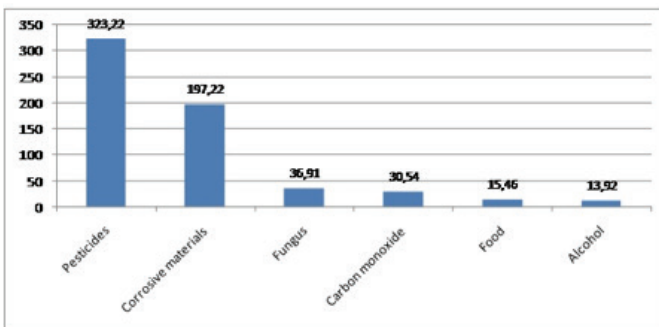


Figure 1. Distribution of median costs of non-medication poisoning agents (\$)

DISCUSSION

Poisoning is an important public health problem for our country. In poisoning cases; preventive measures, rapid diagnosis and early use of antidotes during treatment reduce the mortality and morbidity rates.⁷ According to the data from National Poisons Information Centre, which was founded in Ankara in 1988, poisoning case admission counts were 1,100 in 1988, 18,841 in 2000, 47,452 in 2006 and, 77,988 in 2008. This increase in the number of poison case reports after 2006 is thought to be related to the increase in the awareness among patients and physicians. Accidental and suicidal poisonings are sources of serious morbidity and mortality worldwide and they lead to high health expenditures.^{8,9,10} The aim of this study is to analyze the demographic, etiologic, clinical characteristics and costs of poisoning cases admitted to the emergency department of our university.

Annual emergency department admission rates worldwide due to poisoning vary between 0.07% and 0.70%.^{11,12,13} A study conducted in Oman in 2001 and has found this rate to be 0.18%.¹⁴ In epidemiological studies conducted in our country, this rate is reported to be between 0.70% and 5%.^{3,15} In this study, the rate of annual admissions to the emergency room due to poisoning was determined as 0.21%; this figure was lower than the national data but close to the average of the data worldwide. It is thought that this ratio is below the national data, because our hospital is a tertiary university hospital.

According to the American Association 2014 reports, poisoning has been observed to have more prevalence in the 20-35 age gap and female population (56%).¹⁶ Studies conducted in our country, average poisoning age is generally between 25 and 35 years, and the incidence of poisoning is more common in women below the age of 35.^{3,17,18,19} In our study, 90.9% of survey respondents were between the 18-34 age gap, women population ratio was also found to be higher, consistent to previous studies.

In studies conducted in our country and in different countries, it was determined that poisoning due to suicidal purposes outweigh accidental occurrences.^{1,17,20,21,22} In our study, 176 (56.8%) of poisoning cases were due to suicide attempt, 134 (43.2%) were accidental and poisoning due to suicide purposes were found to be high in accordance with the literature. In the study Dal et al. conducted in Turkey, accidental poisoning was found to be 13.5%.¹⁷ Accidental poisoning rate was found to be relatively higher in our study. In this study, the second most common cause of poisoning is found to be CO poisoning, following medicine intoxication. CO poisoning is a common health problem in the winter and fall months of our region, thus accidental poisoning in our study was considered high compared to other studies.

According to United States of America (USA) data, 79.63% of poisoning cases were reported to be oral, 6.67% were dermal and 5.83% were inhalation/nasal exposures.²³ In a study conducted in Turkey, cases admitted to emergency room were 83.9% oral, 8.2% inhalation/nasal, 7.9% dermal exposures. Our study supports the literature and 79.4% of the cases have been orally exposed to poisoning.

In a study conducted in the USA, medicine induced poisonings were determined to be quite often.²⁴ Analgesic and psychotropic agents were observed to be the most common causes of hospital admission in medicine induced intoxications in Western Europe and North America.²⁵ In studies conducted in Turkey, the most common cause of poisoning was found to be medicine; and analgesics, antidepressants and antibiotics respectively are the most common medicine groups that cause poisoning.^{1,3,17,22,26} In this study, there were 157 medicine induced poisoning cases (50.6%), of which 149 (84.7%) were for suicidal purposes. Most common medication poisoning is found to be due to antidepressants (16.5%) and analgesics (15.5%). We believe such high rates of observation with these medicine groups is because they are easy to access, commonly prescribed and widely used. In the study conducted by Yeşil

et al. nutrition is the leading cause of non-medicinal intoxication with the rate of 42.8%, while Özköse et al. has found the leading cause of non-medicinal intoxication to be CO poisoning with the rate of 17.6%.^{1,27} Another study has found the leading non-medicinal intoxication cause to be corrosive substance intake and CO poisoning as the second most leading cause.¹⁹ In this study the most common cause of non-medicinal admissions, were found to be CO poisoning with 20.6%. We believe that frequent use of coal burning stoves in the rural areas and strong winds especially during the fall and winter months are related to the increase in CO poisoning frequency.

In the literature, there are not enough studies on the costs of cases admitted to the emergency department due to poisoning. In a study conducted in 2014, the average cost of patients admitted with paracetamol poisoning to the Emergency Rooms in New Zealand was found to be 686,89 \$.²⁸ In another study, the average total cost of cases hospitalized in the intensive care unit due to intoxication was found to be 18958 \$.²⁹ In the study of poisoning referrals to the emergency room for suicidal purposes in our country, average cost was found to be 144,06 \$.³⁰ Another study conducted in 2008, the average cost of staying in the intensive care for the patients referred as a result of poisoning, was found to be 821 \$.³¹ In a study conducted in 2015, the average hospital cost of poisonings was found to be 24,23 \$ In the same study, there was a linear relationship between age and cost and that women population have a higher hospital cost.³² In our study, total cost of cases admitted to our hospital with intoxication for two years has been found to be 56536,64 \$ and the average cost is calculated as 182,32 \$. Causes of high cost burden can be interpreted as; more defensive approach of physicians to forensic cases, malpractice cases and unnecessarily long hospitalization period due to the distrust of the information given by patients. In our study, no statistically significant difference was found in the cost distribution according to age groups and gender. We believe that due to the fact that 90% of the poisoning related applicants are in the 18-35

age group, there is no linear relationship between age and cost. In addition, the low incidence of additional diseases in the young age group compared to the adult and the elderly population; decreases the length of hospitalization period, the need for examination and consultation, and reduces the cost.

In a study conducted in our country, the average cost of suicidal attempts were calculated to be 130,67 \$, and the hospital cost of accidental poisonings were calculated as 79,25 \$.³³ In another study conducted on the intensive care patients, average costs of poisoning due to suicide was found to be 711 \$, and of accidental poisoning as 1036 \$. In our study, the median cost was higher in suicidal poisonings and this result was statistically significant ($p < 0.0001$). Medication intoxication is generally on the forefront in suicidal poisonings and majority of those are multiple medication intakes. We believe the cause of such high costs to be; the requirement of further examination due to unidentified levels of medication depending on multiple intakes, keeping the average length of follow-up duration long, diversity in treatment options and the necessity to intensive care units. In addition, costs were found to be higher in medication-induced intoxication and poisonings that are in need of intensive care and this result was statistically significant ($p < 0.0001$). We believe that the cause of the high cost of medicinal intoxication is similar to that of suicidal poisonings.

Suicidal poisoning is investigated in two groups, medicine related and non-medicine related intoxication. In a study that compared non-medicinal poisoning with medicinal poisoning in terms of their costs, a statistically significant difference was found between those two groups.³⁰ Poisonings due to pesticides have been reported to have a higher hospitalization rate and longer hospitalization period time compared to medicinal intoxications.³⁴ Other factors that contribute to the increased cost can be stated as, the requirement for more aggressive, intense and expensive treatment methods for non-medicinal (pesticides etc.) in-

toxication, such as mechanical ventilation, dialysis etc. In our study, even though the costs of medicine related poisoning is statistically and significantly higher compared to non-medicinal intoxication, when non-medicinal intoxications were evaluated within themselves, cost of pesticide related intoxication has been found to be higher compared to other reasons.

Hospitalization duration of patients who were admitted due to poisoning, range between 1.6 - 6.4 in the literature, however, average hospitalization time has been found to be 0.88 ± 2.02 days in our study.^{30,35,36} Reason for such short hospitalization durations are thought to be due to the small number of cases in our study that require longer hospitalization time, such as pesticide and corrosive substance poisoning.

As a result, poisoning is a major public health problem that requires immediate diagnosis and treatment. Medication related poisoning has an important share in all poisonings and a large proportion of those poisonings are a result of suicidal intake. A significant portion of the medication used for this purpose is psychiatric drugs. For this reason, presence of psychiatric disorders should be investigated in patients that were admitted with drug poisoning and psychological support should be provided to the patient, if deemed necessary. In our study, CO poisoning was the major cause of non-medicinal poisoning. This should be taken into account in referrals where coal is widely used, especially during winter. Poisonings which cause significant rates of mortality and morbidity, are also costly in terms of health economics. It is important to increase public awareness in terms of preventing the negative effects of poisoning on health and financial issues.

References

- Yeşil O, Akoğlu H, Onur Ö, Güneysel Ö. Retrospective evaluation of poisoning patients in the Emergency Department. *Marmara Medical Journal* 2008; 21(1): 26-32.
- Ayan M, Başol N, Karaman T, Taş U, Esen M. Retrospective Evaluation of Emergency Service Patients with Poisoning: a 20 Month Study. *JAEM* 2012; 11: 146-50.
- Deniz T, Kandış H, Saygun M, Büyükköçak Ü, Ülger H, Karakuş A. Evaluation of Intoxication Cases Applied to Emergency Department of Kirikkale University Hospital. *Düzce Tıp Fakültesi Dergisi* 2009; 11(2): 15-20.
- Demirel İ. A Retrospective Analysis of Intoxication Cases in Intensive Care Unit of Elazığ Education and Research Hospital. *Fırat Tıp Dergisi* 2010; 15(4): 184-187.
- Ozayar E, Değerli S, Gülec H, Şahin Ş, Dereli N. Retrospective Analysis of Intoxication Cases in the ICU. *Yoğun Bakım Derg* 2011; 3: 59-62.
- Çanakçı E, Kaya Y, Karataş A. Retrospective analysis of intoxication cases admitted to our intensive care unit. *Kocatepe Medical Journal* 2017; 18: 100-5.
- Kondolat M, Akyıldız B, Görözen F, Kurtuluş S, Patroğlu T. Evaluation of the poisoning cases who applied to the Pediatrics Emergency Unit. *Çocuk Sağlığı ve Hastalıkları Dergisi* 2009; 52: 68-74.
- Mowry JB, Spyker DA, Brooks DE, McMillan N, Schauben JL. 2014 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 32nd Annual Report. *Clin Toxicol (Phila)* 2015; 53(10): 962-1147.
- Gjersting L, Jonassen KV, Biong S, Ravndal E, Waal H, Bramness JG, et al. Diversity in causes and characteristics of drug-induced deaths in an urban setting. *Scand J Public Health* 2013; 41(2): 119-25.
- Gallagher LM, Kappatos D, Tisch C, Ellis PM. Suicide by poisoning in New Zealand—a toxicological analysis. *N Z Med J* 2012; 125(1362): 15-25.
- McCaig LF, Burt CW. Poisoning-related visits to emergency departments in the United States, 1993-1996. *J Toxicol Clin Toxicol* 1999; 37(7): 817-26.
- Pinar A, Fowler J, Bond GR. Acute poisoning in Izmir, Turkey—a pilot epidemiologic study. *J Toxicol Clin Toxicol* 1993; 31(4): 593-601.
- Thomas SH, Bevan L, Bhattacharyya S, Bramble MG, Chew K, Connolly J, et al. Presentation of poisoned patients to accident and emergency departments in the north of England. *Hum Exp Toxicol* 1996; 15(6): 466-70.
- Hanssens Y, Deleu D, Taqi A. Etiologic and demographic characteristics of poisoning: a prospective hospital-based study in Oman. *J Toxicol Clin Toxicol* 2001; 39(4): 371-80.
- Karakaya A, Vural N. Acute poisoning admissions in one of the hospitals in Ankara. *Hum Toxicol* 1985; 4(3): 323-6.
- Albert M, McCaig LF, Uddin S. Emergency department visits for drug poisoning: United States, 2008-2011. *NCHS Data Brief* 2015; 196: 1-8.
- Dal O, Kavak H, Akay S, Ünlüer E, Aksay E. Retrospective evaluation of poisoning patients in the emergency department. *Journal of Contemporary Medicine* 2013; 3(1): 22-27.
- Akbaba M, Nazlıcan E, Demirhindi H, Sütölk Z, Gökel Y. Etiological and demographic characteristics of acute adult poisoning in Adana, Turkey. *Hum Exp Toxicol* 2007; 26(5): 401-6.
- Ayoğlu FN, Ayoğlu H, Kaptan YM, Turan İÖ. A Retrospective Analysis of Cases with Acute Poisoning in Zonguldak, Turkey. *Journal of the Turkish Anaesthesiology & Intensive Care Society* 2009; 37(4): 240-8.
- Abdollahi M, Jalali N, Sabzevari O, Hoseini R, Ghanea T. A retrospective study of poisoning in Tehran. *J Toxicol Clin Toxicol* 1997; 35(4): 387-93.
- Milev V, Mikhov D. Attempted suicide by poisoning in the Sofia region. *Br J Psychiatry*. 1992; 160: 560-2.
- Akköse Aydın Ş, Köksal Ö, Fedakar R, Emircan Ş, Durmuş O. Poisoning Cases in Adults in the Years 1996-2004. *Uludağ Üniversitesi Tıp Fakültesi Dergisi* 2006; 32(1): 25-27.
- Mowry JB, Spyker DA, Brooks DE, McMillan N, Schauben JL. 2014 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 32nd Annual Report. *Clin Toxicol (Phila)* 2015; 53(10): 962-1147.
- Rudd RA, Seth P, David F, Scholl L. Increases in Drug and Opioid-Involved Overdose Deaths - United States, 2010-2015. *MMWR Morb Mortal Wkly Rep* 2016; 65(50-51): 1445-1452.
- Meredith TJ. Epidemiology of poisoning. *Pharmacol Ther* 1993; 59(3): 251-6.
- Karacıoğlu Ö, Ayrik C, Tomruk Ö, Topaçoğlu H, Keleş A. Retrospective Analysis of Adult Poisoning Cases in the Emergency Department. *Journal of Experimental and Clinical Medicine* 2000; 17(3): 156-62.
- Ozköse Z, Ayoğlu F. Etiological and demographical characteristics of acute adult poisoning in Ankara, Turkey. *Hum Exp Toxicol* 1999; 18(10): 614-8.
- Fountain JS, Hawwari H, Kerr K, Holt A, Reith D. Awareness, acceptability and application of paracetamol overdose management guidelines in a New Zealand emergency department. *N Z Med J* 2014; 127(1402): 20-9.
- Fernando SM, Reardon PM, Ball IM, van Katwyk S, Thavorn K, Tanuseputro P, et al. Outcomes and Costs of Patients Admitted to the Intensive Care Unit Due to Accidental or Intentional Poisoning. *J Intensive Care Med* 2018 (doi: 10.1177/0885066617754046).
- Serinken M, Karacıoğlu O, Sengül C, Turkcuer I, Keysan MK. Hospital costs of managing deliberate self-poisoning in Turkey. *Med Sci Monit* 2008; 14(3): 152-8.
- Sut N, Memis D. Intensive care costs of acute poisoning cases. *Clin Toxicol (Phila)* 2008; 46(5): 457-60.
- Kılıçlı E. Characteristics and cost analysis of poisoning cases who admitted to Başkent University Ankara Hospital Adult Emergency Service between 2011 and 2014. *Tıpta uzmanlık tezi, Başkent Üniversitesi Tıp Fakültesi, Acil Tıp Kliniği, Ankara*; 2015.
- Akar T, Derinöz O, Demirel B. Drug intoxications and hospital costs. *Türk Arch Ped* 2007; 42: 103-6.
- Seydaoğlu G, Satar S, Alparslan N. Frequency and mortality risk factors of acute adult poisoning in Adana, Turkey, 1997-2002. *Mt Sinai J Med* 2005; 72(6): 393-401.
- Cengiz M, Baysal Z, Ganıdaglı S, Altındag A. Characteristics of poisoning cases in adult intensive care unit in Sanliurfa, Turkey. *Saudi Med J* 2006; 27(4): 497-502.
- Yeo HM. The cost of treatment of deliberate self-harm. *Arch Emerg Med* 1993; 10(1): 8-14.