TRAUMATIC HEALTH EFFECTS DUE TO A STORM: AN OBSERVATIONAL CASE-STUDY ON PATIENTS RECEIVED AT THE COUNTY EMERGENCY CLINICAL HOSPITAL FROM TIMISOARA

Cristina Petrescu[1], **Mihai Grecu**[2], **Silvia Barbu**[3], **Marius Craina**[4]

Abstract:

Objective: The aim of the performed study was to investigate the traumatic health effects in patients received at the emergency service due to a storm event that happened on the 17th of September 2017 in Timisoara.

Material of study consisted of a sample of 75 patients (62.67% males, 37.33% females) who came to the emergency service of the County Hospital with traumatic health effects.

The method was an observational case-study with an investigation of traumatic health effects.

Results: Traumatic health effects due to the storm were caused by patients falling (51.78% of diagnostics: fractures, contusions, sprains) and by being hit by flying objects (42.85% of diagnostics: craniocerebral traumatisms and contusive wounds). The patients were either sent home (54.66%), admitted (25.34%) and hospitalized (13.33% more than 10 days) or transferred (12%).

Conclusion: Traumatic health effects due to the storm were severe and involved substantial recovery time and considerable expense of resources.

UDC Classification: 614, 617, **DOI**: 10.12955/cbup.v7.1458

Keywords: traumatic health effect, storm, observational case-study

Introduction

Climate change poses unprecedented threats to human health by impacting upon food and water security, heat waves and droughts, violent storms, infectious diseases, and rising sea levels (Barrett et al., 2015). The risk of extreme precipitations and wind speed was found to be associated with concurrent phenomena (cyclone, front and thunderstorm) in causing extreme weather (Dowdy & Catto, 2017). Wind disasters as natural calamities often cause property damage (collapse of houses or other manmade structures) (Marchigiani et al., 2013). In the same research study by Marchigiani et al. (2013), there is a classification of health effects due to disasters: prior to impact, impact, immediate post impacts and long term post impact. Health effects of impact (trauma, wounds, and lacerations) and immediately post impacts (falls, lacerations, puncture wounds and blunt trauma) determine whether people go or are taken to emergency services. The emergency services of a County hospital needs to be prepared for future extreme weather events. On the other hand, a study by Brown et al. (2018) showed that distorted beliefs that cause exaggerated anxiety in people created by the individuals` risk perception change in response to the frequency and magnitude of future shocks and can encourage over-investment in preventative measures. The aim of the performed study was to investigate traumatic health effects in patients who were received at the emergency services of the County Emergency Clinical Hospital in Timisoara due to a storm that happened on the 17th of September 2017.

Material and method

The material of study consisted of a sample of 75 patients (62.66% males and 37.33% females, 25.34% aged 50-60 years) who came to the emergency services of the "Pius Branzeu" County Emergency Clinical Hospital Timisoara to receive medical assistance for traumatic health effects, after a storm that happened on the 17th of September 2017.

The method consisted of an observational case-study with data collection from the primary evidence provided by the "Pius Branzeu" County Emergency Clinical Hospital Timisoara of the patients recorded with traumatic health effects due to a storm during 17th-18th September 2017. Traumatic health effects were direct due to the storm or indirect after the storm, when people tried to repair damage to buildings

[1] "Victor Babes" University of Medicine and Pharmacy Timisoara, Faculty of Medicine, Department of Hygiene, Timisoara, Romania, cpetrescu64a@yahoo.com
[2] County Emergency Clinical Hospital "Pius Brinzeu" Timisoara, UPU SMURD (Emergency Receiving Unit SMURD), Timisoara, Romania, mihai.grecu@urgentatm.ro
[3] Regional Meteorological Center Banat-Crisana, Romania, siba1900@yahoo.com
[4] County Emergency Clinical Hospital "Pius Brinzeu" Timisoara, Timisoara, Romania, mariuscraina@hotmail.com

or to clear the streets of the broken branches and fallen trees. The initial outcome of recording of the traumatic health effects due to the storm was to report them to local and national authorities.

We considered the following stages in the epidemiological analysis: (1) general information regarding the patients such as gender, age, residence and time of arrival at the emergency service: (2) the established traumatic diagnosis due to the storm and the causes related to them; (3) the interventions and referral from the emergency service; (4) the established diagnosis of the admitted patients and the number of hospitalization days. Statistical approach (frequencies) was performed with the aid of the SPSS 20 program.

Confidentiality and protection of the patients' data was assured by the hospital with strict reference to statistical processing by concluding a collaboration contract with the hospital leadership. For the project in which this study is included we asked for and obtained ethical approval from the Ethical Commission of the University of Medicine and Pharmacy "Victor Babes" from Timisoara.

Results

General information regarding the patients

The 75 patients, who came to the "Pius Branzeu" County Emergency Clinical Hospital Timisoara with traumatic health effects due to the storm, presented the following distribution depending on their gender, age, residence and time of arrival at the emergency services.

62.67% of patients (47) were male and 37.33% of patients (28) were female. Considering age groups in decades, the patients most affected by the storm event were in the age group 50-60 (19, 25.34%), followed by 30-40 (14, 18.67%) and then 20-30 years (13, 17.33%). Distribution of patients depending on residence indicated that 38.67% of patients (29) were from Timisoara, 6.67% of patients (5) came from other towns, 2.66% of patients (2) came from other countries and 33.34% of patients (25) came from rural areas of Timis county. When we considered the county of residence, we noticed that 78.66% of the patients (59) came to the hospital from Timis county, and 21.33% of patients (16) came from other counties. Distribution depending on time of arrival at the emergency service showed that the majority of patients (57, 76%) with traumatic health effects due to the storm came on the 17th of September. 24% of patients (18) with traumatic health effects due to the storm came to the emergency services on the 18th of September. One patient was declared deceased and three patients left the emergency services before receiving medical assistance.

The established traumatic diagnosis due to the storm and the causes related to them

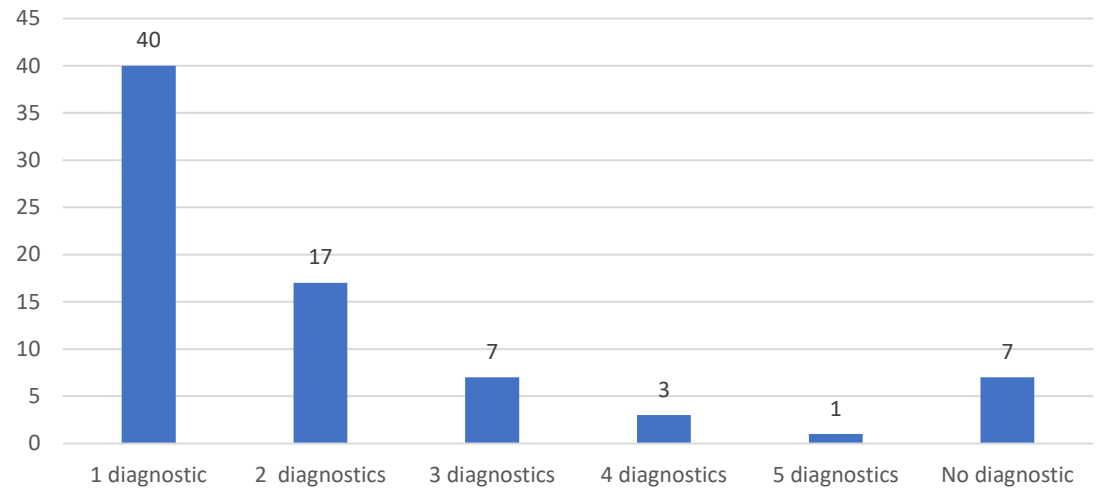
At the emergency services, 112 diagnosis were established, the most frequent being: contusive wounds (24, 21.42%) and fractures (24, 21.42%), followed by craniocerebral traumatisms (CCT) (21, 18.75%), contusions (15, 13.39%) and sprains (10, 8.92%) (Table 1). 53.33% of patients (40) presented 1 diagnosis, 22.66% of patients (17) presented 2 diagnosis and 1.33% of patients (1) presented 5 diagnosis of traumatisms established at the emergency service (Figure 1).

Table 1: Distribution of trauma diagnosis depending on cause

Trauma diagnostic	Falling	Being Hit	Being crushed	Not registered	Total
Contusion	10	2	2	1	15
Crushing	0	2	0	0	2
Amputation	0	1	0	0	1
Contusive wound	7	15	0	2	24
Cut Wound	1	4	0	1	6
CCT	7	14	0	0	21
Fracture	16	6	2	0	24
Sprain	9	0	1	0	10
Coma	0	2	0	0	2
Paralysis	0	0	1	0	1
Tensional leap	1	0	0	0	1
Urethral rupture	0	0	1	0	1
TILTC1basin	0	0	1	0	1
Bleeding	1	2	0	0	3
Total	52	48	8	4	112

Source: Author

Figure 1: Number of traumatic diagnosis per patient



Source: Author

When we considered the causes of traumatisms, it was found that 51.78% of trauma diagnosis (52) were resultant of people falling from a height (usually more than 2 meters) or by simple falling to the ground. 42.85% of diagnosis (48) in patients received at the emergency services were caused by being hit with different materials (glass, tree branches, trees, metal, roofs or other building materials). 7.14% of diagnosis (8) were caused by people being crushed (Table 1).

A direct relation between the diagnosis established at the emergency services and causes due to the storm resulted in the performed study. The following results proved to be useful in this purpose. We noticed that fractures (14.28%, 16 diagnosis), contusions (8.92%, 10 diagnosis) and sprains (8.03%, 9 diagnosis) were caused by falling. Meanwhile, craniocerebral traumatisms - CCT (12.5%, 14 diagnosis) and contusive wounds (13.39%, 15 diagnosis) were determined by being hit by objects. One patient presented 5 separate diagnosis (fractures, sprains, paralysis, urethral ruptures, and a TILTC1 basin) caused by being crushed (Table 1).

Interventions and referral from the emergency service

The following interventions were performed in the emergency services: 33.33% of patients (25) were consulted and sent home with recommendations; 25.34% patients (19) were admitted into the hospital, and 12% of patients (9) were transferred to other hospital units; 12% of patients (9) had dressings applied on their wounds; 6.66% (5) had their wounds sutured and 5.33% of patients (4) had their fractures or sprains reduced and immobilized.

In term of places where the patients were referred from the emergency services, 54.66% of patients (41) were sent home, 9.33% of patients were admitted to neurosurgery (7), 6.66% to orthopedic traumatology (5), 4% to maxilofacial-surgery (3), 2.66% to politraumatology (2) and 1.33% of patients (1 each) to surgery and plastic surgery. 1.33% of patients (1) were transferred to pneumology for O2 administration. 5.33% of patients (4) were transferred to the Municipal Hospital from Timisoara, 4% of patients (3) were transferred to Deta and 1.33% (1) of patients to Arad hospitals. 2.66% of patients (2) left the emergency services on their own accord.

The established diagnosis of the admitted patients and the number of hospitalization days

25.33% of patients (19) were admitted into the hospital. They presented the following diagnosis: contusions (3, 4%), crushing (1, 1.33%), contusive wounds (5, 6.66%), cut wounds (1, 1.33%), CCT (8, 10.66%), fractures (12, 16%), sprains (2, 2.66%), coma (2, 2.66%), paralysis (1, 1.33%), urethral rupture (1, 1.33%), bleeding (2, 2.66%). The number of hospitalization days varied a lot depending on the severity of trauma. The patient distribution depending on hospitalization time indicated the following results: 194 days (1 patient, 1.33%), 52 days (1, 1.33%), 40 days (1, 1.33%), 30 days (1, 1.33%), 12 days (1, 1.33%), 10 days (1, 1.33%), 8 days (4, 5.33%), 7 days or less (5 patients, 6, 8%). The number of hospitalization days for the patients who were transferred (4 patients, 5.33%) was not provided.

Discussion

In the performed study we investigated the traumatic health effects due to a storm on a population of patients received at the emergency services of a County hospital in Timisoara. This storm was explained meteorologically by the rapid formation of cumulonimbus clouds associated on an atmospheric front (Meteo Romania, 2017). Our study was an epidemiological one with the purpose to offer immediate observable information regarding the traumatic health effects in the population due to a storm as they are determined by the medical personnel at the hospital emergency service. The role of the epidemiologic studies of health effects beyond the direct impact of disaster proved to be important (Greenough et al., 2001).

Research literature in the field of Emergency Medicine is rich and with different approaches related to: time evolution and admissions (Roberts et al., 2017), urban/rural environment (Lipsky et al., 2014), gender (McGregor et al., 2017) and age (Baum & Rubenstein, 1987).

Although the storm happened on Sunday, the majority of patients with traumatic health effects due to the storm went to and were received by emergency service immediately after the storm and only 1/3 of patients went to and were received the following day. A risk for a higher mortality in 30 days after admissions on Sunday than on Wednesday resulted in another study research (Walker et al., 2017).

67% patients who came to the emergency service were from Timisoara and rural areas of Timis county. This result suggests that the most affected population by the storm was from the local areas. This result that the population affected by the storm who was from Timisoara and from areas close to Timisoara offers us a possible explanation of the high addressability to the emergency services immediately after the storm. Another research study proposed alternative ways for rural areas to offer medical support and ways to encourage medical students to choose to practice in rural areas (Farmer et al., 2015).

The majority of patients with traumatic health effects due to the storm who came to the emergency service were males. Gender analysis is rich in research literature with reference to the role of emergency physicians to lead gender-specific clinical studies (Safdar & Greenberg, 2014) or to the role of gender within policy and practice (Morgan et al., 2018).

The most affected age group of the patients received at the emergency service with traumatisms due to the storm was 50-60 years. Research in the field describes differences between young and old patients regarding risk and costs of emergency surgery (Keller et al., 1987).

Fractures, contusive wounds, craniocerebral traumatisms and contusions were the most frequently established diagnosis of the patients received at the emergency services. Fractures and contusions were resultant of falling from a height or at one's level to the ground, while craniocerebral traumatisms and contusive wounds were determined by being struck with different falling of flying material. Fractures related to other diseases such as Parkinson diseases (high prevalence in fall-related injury (Beydoun et al., 2017) or related to patients in the geriatric age group (lower trunk -hip, pelvic, and lower spine fractures, followed by upper trunk fractures -upper spine, clavicle and rib fractures) (Baidwan & Naranie, 2017) were mentioned in other research studies. In addition, in case of traumatic brain injuries it was considered necessary to use telemedicine as one strategy for improving triage (Walcott et al., 2011).

Main interventions at the emergency services on patients with traumatism who were sent home were: consultations and recommendations, wound dressing, wound sutures, fractures and sprains reductions and immobilizations. The patients with severe traumatisms were admitted into the hospital or they were transferred to other hospitals. A vigorous approach of public health response in severe situations in research literature offer the possibility to create response profiles or to identify functional and structural response patterns useful at the emergency services (Hunter et al., 2013).

Cooperation between the emergency department of the County Hospital, the hospital departments and the other hospital units from Timisoara or other towns was effective regarding the admission and transfer of the patients with severe traumatisms due to the storm. Fractures and craniocerebral traumatisms were the most frequent diagnosis with which the patients were admitted into the hospital departments. The number of the days of hospitalization varied from 1 to 194. A limitation of this study was that we could not obtain information about the patients who were transferred. Alternatives to emergency departments were considered and analysed in many research studies as an emergency department short-stay unit

(Juan et al., 2006), emergency department observation units for elderly patients (Moseley et al., 2013) or direct admission into a hospital unit (Leyenaar et al., 2016).

A small number of the patients (5) left the hospital without being consulted (3) or without a doctor`s recommendation (2) and one patient was declared deceased. Studies regarding financial costs (Schreyer & Martin, 2017) of emergency department activities and the improvement of emergency services through telemedicine (Abo-Zahhad et al., 2014) indicate that researchers are very concerned with improving the efficacy of emergency responders. A limit of the performed study is that it is an observational one.

Conclusions

The majority of patients with traumatic health effects were received at the emergency services immediately after the storm. The most affected population due to the storm was represented by males, people aged 50-60 years, and people who came from the local area (Timisoara and rural areas close to Timisoara). Traumatic health effects as fractures, contusions and sprains were determined by falling from height or from one's own level to the ground, and craniocerebral traumatisms and contusive wounds were determined by being hit with different falling or flying material. Many medical interventions at the emergency services were performed on patients who were sent home. Patients with severe traumatic pathology were admitted into the hospital departments or they were transferred to other hospital units from Timisoara or other towns. The time spent in the hospital of admitted patients with traumatic health effects varied from 1 to 194 days. A final conclusion is that traumatic health effects due to the storm were severe and involved a considerable expenditure of both time and financial resources by both the patients and the emergency staff.

References

Abo-Zahhad, M., Ahmed, S. M., Elnahas, O. (2014). A wireless emergency telemedicine system for patients monitoring and diagnosis. *International Journal of Telemedicine System for Patients Monitoring and Diagnosis* 380787:1-11. http://dx.doi.org/10.1155/2014/380787.

Agentia Nationala de Meteorologie. (2017). Comunicat 17 Septembrie 2017. Retrieved March, 15, 2019, from http://www.meteoromania.ro/anm2/.../Comunicat-17septembrie2017.pdf.

Baidwan, N. K., & Naranie, S. M. (2017). Epidemiology and recent trends of geriatric fractures presenting to the emergency department for United States population from year 2004-2014. *Public Health 142*:64-69. Doi: 10.1016/j.puhe.2016.10.018.

Barrett, B., Charles, J. W., & Tempte, J. L. (2015). Climate change, human health, and epidemiological transition. *Preventive Medicine, 70*:69-75.

Baum, S. A., & Rubenstein, L. Z. (1987). Old people in the emergency room: age related differences in emergency department use and care. *Jurnal of the American Older Agency.* https://doi.org/101111/j.1532-5415.1987.tb04660.x.

Beydoun, H. A., Beydoun, M. A., Mishra, N. K., Rostant, O. S., Zonderman, A. B., & Eid, S. M. (2017). Comorbid Parkinson`s disease, falls and fractures in the 2010 National Emergency Department Sample. *Parkinsonism Relat Disord 35*:30-35. Doi: 10.1016/j.parkreldis.2016.11.005.

Brown, P., Daigneault, A., Tjernström, E., & Zou, W. (2018). Natural disasters, social protection and risk perception. *World Development, 104*:310-325.

Dowdy, A. J., & Catto, J. L. (2017). Extreme weather caused by concurent cyclone, front and thunderstorm occurences. *Scientific Reports 7,* Article number 40359. Doi: https://www.nature.com/articles/srep40359#supplementary-information.

Farmer, J., Kenny, A., McKinstry, C., & Huysmans, R. D. (2015). A scoping review of the association between rural medical education and rural practice location. *Hum Resour Health 13*:27. Doi: 10.1186/s12960-01509917-3.

Greenough, G., McGeehin, M., Bernard S. M., Trtani, J., Riad, J., & Engelberg, D. (2001). The potential impact of climate variability and change on health impacts of extreme weather events in the United States. *Environmental Health Perspective 109* (Suppl 2):191-198.

Hunter, J. C., Yang, J. E., Crawley, A. W., Biesiadecki, L., & Aragón, T. J. (2013). Public health response systems in-action: learning from local health departments` experiences with acute and emergency incidents. *Plos One 8*(11):e79457. Doi: 10.1371/journal.pone.0079457.

Juan, A., Salazar, A., Alvarez, A., Perez, J. R., Garcia, L., & Corbella, X. (2006). Effectiveness and safety of an emergency department short-stay unit as an alternative to standard inpatient hospitalization. *Emerg Med J. 23*(11):833-837.

Keller, S. M., Markovitz, L. J., Wilder, J. R., & Aufses, A. H. (1987). Emergency and elective surgery in patients over age 70. *The American Surgeon 53*(11):636-640.

Leyenaar, J. K., Lagu, T., & Lindenauer, P. K. (2016). Direct admission to hospital: an alternative approach to hospitalization. *J Hosp Med. 11*(4):303-305. Doi: 10.1002/jhm.2512.

Lipsky, A. M., Karsteadt, L. L., Gausche-Hill, M., Hartmans, S., Bongard, F. S., Cryer, H. G., Ekhardt, P. B., Loffredo, A.J., Farmer, P. D., Whitney, S. C., & Lewis, R. J. (2014). A comparison of rural versus urban trauma care. *J Emerg Trauma Shock 7*(1):41-46. Doi: 10.4103/0974-2700.125639.

Marchigiani, R., Gordy, S., Cipola J., Adams, R. C., Evans, D. C., Stehly, C., Galwankar, S., Russell, S., Marco, A. P., Kman, N., Bhoi, S., Stawicki, S. P., & Papadimos, T. J. (2013). Wind disasters: a comprehesive review of current management strategies. *International of Critical Illnesses Injuries Science 3*(2):130-142.

McGregor, A. J., Beauchamp, G. A., Wira, C. R., Perman, S. M., & Safdar, B. (2017). Sex as a biological variable in emergency medicine and clinical practice: a brief narrative review. *West J Emerg Med 18*(6):1079-1090. Doi: 10.5811/westjem.2017.8.34997.

Morgan, R., Aviasi, R. M., Barman, D., Buzuzi, S., Ssemugabo, C., Ezumah, N., George, A. S., Hawkins, K., Hao, X., King, R., Liu, T., Molyneux, S., Muraya, K. W., Musoke, D., Nyamhanga, T., Ros, B., Tani, K., Theobald, S., Vong, S., & Waldman, L. (2018). Gendered health systems: evidence from low- and middle-income countries. *Health Res Policy Syst. 16*:58. Doi: 10.1186/s12961-018-0338-5.

Moseley, M. G., Hawley, M. P., & Caterino, J. M. (2013). Emergency department observation units and the older patient. *Clin Geriatr Med. 29*(1). Doi: 10.1016/jcger.2012.09.002.

Roberts, C. M., Lowe, D., Skipper, E., Steiner, M. C., Jones, R., Gelder, C., Hurst, J. R., Lowrei, G. E., Thompson, C., & Stone, R. A. (2017). Effect of time and day of admission on hospital care quality for patients with chronic obstructive pulmonary disease exacerbation in England and Wales: single cohort study. *BMJ Open 7*(9):e015532. Doi: 10.1136/bmjopen-2016-015532.

Safdar, B., & Greenberg, M. R. (2014). Applying the gender lens to emergency care – from bench to beside. *Acad emerg Med 21*(12):1325-1328. Doi: 10.1111/acem.12521.

Schreyer, K. E., & Martin, R. (2017). The economics of an admission holding unit. *West J Emerg Med. 18*(4):553-558. Doi: 10.5811/westjem.2017.4.32740.

Walcott, B. P., Coumans, J. V., Mian, M. K., Nahed, B. V., & Kahle, C. T. (2011). Interfacility helicopter ambulance transport of neurosurgical patients: observations, utilizations, and outcomes from a quaternary level care hospital. *Plos One 6*(10):e26216. Doi: 101371/journal.pone.0026216.

Walker, A. S., Mason, A., Quan, T. P., Fawcett, N., Watkinson, P., Llewelyn, M., Stoesser, N., Finney, J., Davies, J., Wyllie, D. H., Crook, D. W., & Peto, T. E. A. (2017). Mortality risks associated with emergency admissions during wekends and public holydays: an analysis of electronic health records. *Lancet 390*(10089):62-72. Doi: 10.1016/S0140-6736(17)30782-1.