

# Internally displaced persons and health effects caused by the floods that affected Romania during 2006-2007

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## ABSTRACT

The heavy rainfall between late 2005 and early 2006 in South Romania caused severe flooding, as to environmental, social and economic consequences. The event was unique in the last 3 decades in Romania, and among the most severe flooding events in the WHO-European region, in the last decade, next to the floods registered in Russia, Turkey and Great Britain. Large household damages, requiring internal displacement of persons, part of which being sheltered in camps, for up to 17 months occurred in 6 counties, 5 of them located along the Danube river and 1 county in the hill-mountain region. Our study **aimed** to quantify people displacement, camp sheltering and morbidity profile among the sheltered people, during the existence of the camps. We present an observational study, using data collected by the surveillance system that ran in the affected territory, under the management of the National Institute of Public Health. The calculated values of the target indicators showed the following **results**: people displacement rate of 316 %000 inhabitants, camp sheltering rate of 100 %000 inhabitants; sheltering in tents represented 84%, for 2-25 weeks, of the total 68 weeks. “Communicable diseases” was the diagnosis category registered in each of the 6 counties, representing less than 30% of all the diagnosis categories. The category “injuries” did not exceed 5%, in 5 of the 6 counties, while “psychological trauma” did not exceed 1.2%, in only 3 of the 6 counties. The acute respiratory infections, of upper tract, followed by those of lower tract contributed more than 85% to all communicable diseases. Acute eye inflammations, acute watery diarrhoea, other rashes than measles and pediculosis contributed each less than 5%. Only 2 cases of clinical measles and 1 case of scab were registered. Most of the communicable diseases occurred in children and adults. Neither death, nor disease outbreak were registered.

**Conclusions.** The flood event generated internally displaced persons, some of which needed shelter in long term camps. Tents were the preponderant category of shelters. The communicable diseases, injuries and psychological trauma were not prevailing categories among the camp sheltered persons. The acute respiratory infections were preponderant among infections. Neither deaths, nor disease outbreaks occurred for the duration of camps.

**Keywords:** floods, Danube river, internally displaced persons, long term camps, communicable diseases, injuries, psychological trauma

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## INTRODUCTION

The human activities based on fossil fuel burning during the last 5 decades have been generated greenhouse gases, responsible for the increasing global warming. Among consequences are the extreme weather events, more intense, more frequent, affecting larger areas, including the temperate climate regions: heat waves, wild fires and droughts, on one side, heavy rainfalls, floods, landslides, violent landstorms and cyclones, on the other side. Climate changes affects major social and environmental determinants of health, such as availability and quality of drinking water, ecosystems, agriculture and food production, economic development and population migration (41). Globally, the natural disasters related to climate changes, registered after 1960 increased 3 times, causing 60,000 deaths. The WHO estimation for 2030-2050 is not at all optimistic: 250,000 deaths per year, of which 38,000 through heat waves, 48,000 through diarrhoea, 60,000 through malaria and 95,000 through infant malnutrition (39,43). As to the WHO European Region, between 1990 and 2012 there have been registered: 40 drought events, 121 earthquake, 222 extreme temperature, 491 floods, 2 insect infestation, 5 mass movement dry, 57 mass movement wet, 333 storms, 4 volcano and 82 wild fires.

The above mentioned **floods** caused 4,568 deaths, affected 12,800,073 people and caused an economic damage (thousands of US\$) of 94,410,590 (40). The estimation for the next decades in Europe shows increasing precipitation, soil erosion and flooding (1), that, without adaptation, might lead to an increasing number of European people potentially affected by flooding, every year by 2085, from 775,000 to 5.5 million (10). The short term health risks when exposed to heavy rainfall and flooding are deaths (by drowning), infections (water, food and vector borne), injuries and psychiatric trauma. The risk of infection is high in important population displacement and/or compromised water sources. It occurs typhoid fever, cholera, hepatitis A (through unsafe water consumption), as well as leptospirosis, wound infections, dermatitis, conjunctivitis, and ear, nose and throat infections (through direct contact with polluted waters). In flooding, the expansion in the number and range of vector habitats also occurs, causing an increase of vector-borne human diseases: malaria, dengue and dengue haemorrhagic fever, yellow fever, and West Nile

Fever. Workers who routinely handle corpses may have a risk of contracting tuberculosis, bloodborne viruses (such as hepatitis B/C and HIV), and gastrointestinal infections (such as rotavirus diarrhoea, salmonellosis, E. coli, typhoid/paratyphoid fevers, hepatitis A, shigellosis and cholera). Respiratory infections, measles, pediculosis or scab might also occur, in conditions of high density of habitation and insufficient sanitation and personal hygiene. Such health risks are amplified by the possible diminished access to healthcare services in floodings (damaged access routes and/or healthcare units) (6-8,38,45).

People migration is another major effect in natural disasters or conflicts. Globally, between 2008 and 2014, 1 person per second have been displaced (17). Migration is defined in terms of duration and distance of movement from the native place. It is used "short term migration", for less than 1 year, or "long term migration", for duration more than 1 year. It is used "internal displacement", inside a country's borders and "international migration" when people migration crosses the borders. "Internal displacement" occurs most frequently in natural disasters ("environmental migrants"), "international migration" in conflicts and wars ("international migrants") (5,37). Internally Displaced Persons (IDP), are defined as "persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, as a result of ...natural or human-made disasters, and who have not crossed an internationally recognized state border" (19). Floods generate effects of high to medium severity, in comparison to other natural disasters (38).

During the last decades, Romania was the most frequently affected by heat waves, followed by intense precipitation causing flooding and landslides. The most important flooding event occurred after the heavy rainfall between the late 2005 and the early 2006, affecting 11 counties of the southern part of the country: 10 counties located in the plain of the river Danube – Braila (BR), Calarasi (CL), Constanta (CT), Dolj (DJ), Giurgiu (GR), Ialomita (IL), Mehedinti (MH), Olt(OT), Tulcea (TL) and Teleorman (TR) and 1 county, Gorj (GJ), situated in a hill-mountain area, crossed by an important affluent of the Danube. There have been registered a lot of damaged to destroyed households, internally displaced people (IDP), part of them sheltered in camps. For the local government authorities the event was challenging, as to ensuring shel-

tering, water and food supplies, sanitation and hygiene, vector control, under the recommendations of the public health authorities, guided by specific provisions (31,35,42,46,47,50,52). The public health authorities elaborated plans and run the actions of: health state surveillance of the persons sheltered in camps, monitoring the quality of food and drinking water, waste management, vector control, health education, vaccination (4,18,23,25,30,48,49,51). Priority was given to vaccinations against measles, mumps, rubella, diphtheria, tetanus, pertussis, Haemophilus influenzae tip B infections, B virus hepatitis, meningococcal disease, pneumococcal disease, varicella, influenza, tuberculosis (4,11). The decisions with regard to the site selection, the arrangement of emergency settlements and the living conditions in such settlements were guided by global references (3,12,28,34).

**The aim** of our study was to quantify and describe: internal displacement of persons, camp sheltering, addressability to healthcare services in camps, morbidity and mortality in camps.

## METHOD AND MATERIALS

We ran an observational study of the internal displacement of persons, habitation conditions, morbidity and mortality in camps that functioned for up to 17 months (may 2006 – september 2007) on the territory of 6 of the 11 counties affected by flooding (Braila, Calarasi, Constanta, Dolj, Tulcea) or landslides (Gorj). In each camp the local public health authorities surveilled the health state of sheltered persons and monitored the hygiene and sanitation conditions, under the coordination of the National Institute of Public Health (NIPH). We used weekly generated data, related to: urban and rural affected localities, number of displaced persons, of which number of camp sheltered, by type of shelters: tent (T), building (B), pontoon (P), number of camp sheltered persons who addressed primary healthcare services attributed to the camps, total and by 4 diagnosis categories: “communicable disease” (CD), “injury” (INJ), “psychological trauma” (PSY TR) and “other diagnosis” (OTH). In the category “communicable disease”, the clinicians ran diagnosis for 15 syndromes recommended by WHO to be surveilled in human communities affected by natural disasters or conflicts/wars: acute respiratory infections of upper respiratory tract (ARIUT), acute respiratory infections of lower respiratory

tract (ARILT), acute eye inflammation (AEI), acute watery diarrhoea (WD), acute bloody diarrhoea (BD), measles (MEA), other rushes (RSH), pediculosis (PED), scab (SCB), meningitis/encephalitis (MGE), acute jaundice syndrome (AJS), unknown origin fever (UF), cluster of unknown disease (CUD), influenza (FLU), cholera (CHL). There have been registered the possible cases, according to the case definitions (4,9,15,18,23, 25). Data served to compute the following indicators: displacement rate, camp sheltering rate, density of habitation in tents, buildings or pontoons, people addressability to primary healthcare services in camps, diagnosis categories profile, communicable diseases profile, attack rates by communicable diseases, specific mortality in camps.

## RESULTS

In may 2006 we registered the highest number (9,000) of internally displaced persons, from 6 of the 11 affected counties, with a weekly dynamic showed in Fig. 1. The displacement rate in the territory was 300 persons %000 inhabitants, from 42 localities, 37 rural (88%) and only 5 urban (12%). The values by county are shown in Table 1. Camp sheltering in the territory was 37% of the displaced, at a rate of sheltering of 121 persons %000 inhabitants. The weekly dynamic of the number of persons sheltered in camps is shown in Fig. 1, too. The county levels of sheltering indicators are shown in Table 2. The duration of camps ranged 4-68 weeks (1-17 months), depending on county (Table 2). Camp shelters profile showed 84% tents, 15% buildings, 1% pontoons (in TL county only). The density of habitation resulted of 17 people/pontoon, 12 people/tent and 7 people/building. Details by county are shown in Table 3.

**TABLE 1.** Displacement: frequency and spread

county	no. of displaced	displaced rate (%000 inhabitants)	no. of localities with displacement	
			rural	urban
CL	2,693	863	8	1
DJ	4,494	640	6	0
TL	777	316	7	1
GJ	510	136	1	0
CT	360	50	15	2
BR	98	27	0	1
<b>TOTAL</b>	<b>8,932</b>	<b>329</b>	<b>37</b>	<b>5</b>

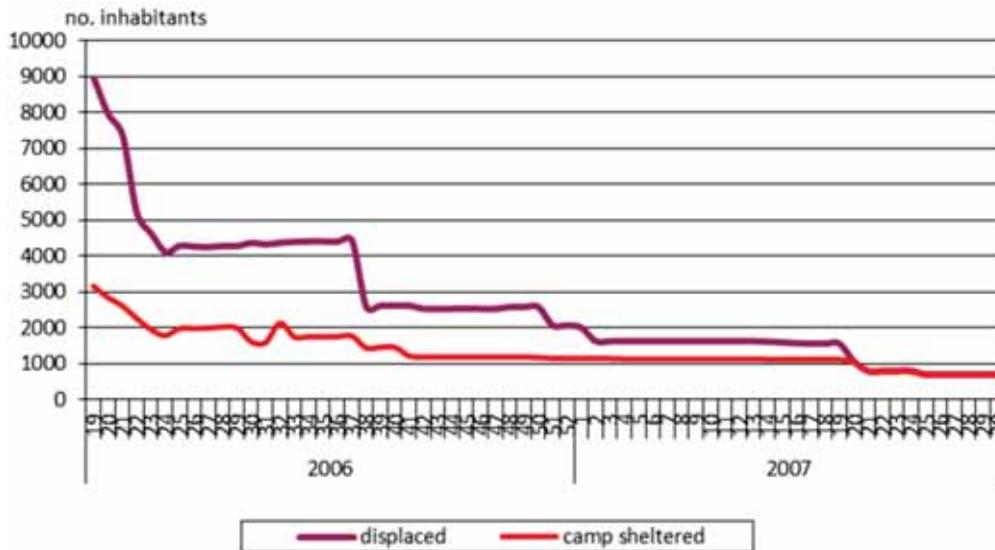


FIGURE 1. Weekly dynamics of the displaced and camp sheltered people. Romania, flooding, 2006-2007

TABLE 2. Displacement, sheltering in camps and duration of camps

county	no. of displaced	% sheltered	rates (%000 inhabitants)		camps duration (weeks)
			displaced	sheltered	
CL	2,693	46	863	395	63
DJ	4,494	35	640	226	63
TL	777	8	316	26	35
GJ	510	54	136	73	32
CT	360	22	50	11	68
BR	98	54	27	15	4
<b>TOTAL</b>	<b>8,932</b>	<b>37</b>	<b>329</b>	<b>121</b>	

TABLE 3. Sheltering conditions in camps

county	shelter type (%)			habitation density (no. people/shelter)			habitation in tents (no. weeks)
	B	T	P	B	T	P	
BR	100	0	0	53	0	0	0
CL	0.6	99.4	0	43	7	0	20
CT	96.4	0.6	0	1	2	0	25
DJ	61.5	38.5	0	22	283	0	12
GJ	42.6	57.4	0	6	1	0	2
TL	18.2	63.6	18.2	4	3	17	25
<b>TOTAL</b>	<b>15</b>	<b>84</b>	<b>1</b>	<b>7</b>	<b>12</b>	<b>17</b>	

Weekly addressability to primary healthcare services organized in camps ranged largely 5-80%, peaking during the first 2 months (Table 4). The morbidity profile in camps, territory level: 90.9% "other diagnoses", 7% "communicable diseases", 2% "injuries" and 0.1% "psychological trauma", details by county in Fig. 2. ARIUT, followed by ARILT, contributed 85% of the communicable diseases. Other infectious syndromes, each less than 5% contribution, were: AEI, WD, RSH, PED, MEA and SCB (Fig. 3). The communicable diseases by age groups is shown in Fig. 4 and by county in Table 5. The attack rates by

communicable diseases peaked the first 6 weeks and ranged as follows: ARIUT 6% (CL) – 60% (GJ); ARILT 0.7% (CL) – 10% (CT); AEI 0.4% (DJ) – 7.5% (CT); WD 0.7% (CL) – 0.9% (GJ); MEA 35% (CL); RSH 0.7% (CL) – 9% (CT); PED 0.4% (CL) – 4% (BR); SCB 0.4% (GJ). Along the maximum duration of camps no case of influenza, acute bloody diarrhoea, meningitis/encephalitis, acute jaundice syndrome, unknown origin fever, cluster of unknown disease or cholera was registered. Neither disease outbreak, nor deaths were registered in camps.

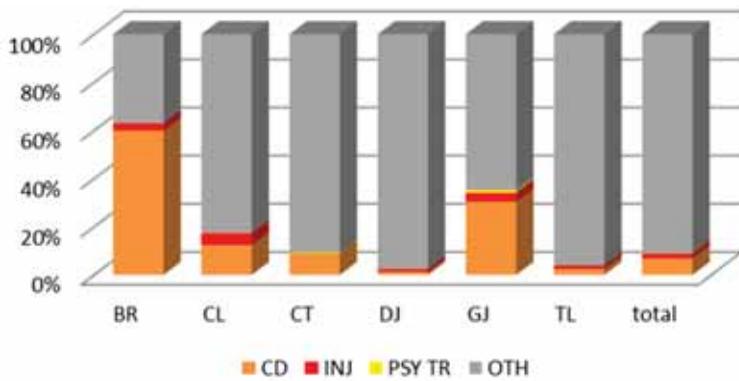


FIGURE 2. The morbidity profile in camps. Romania, flooding, 2006-2007

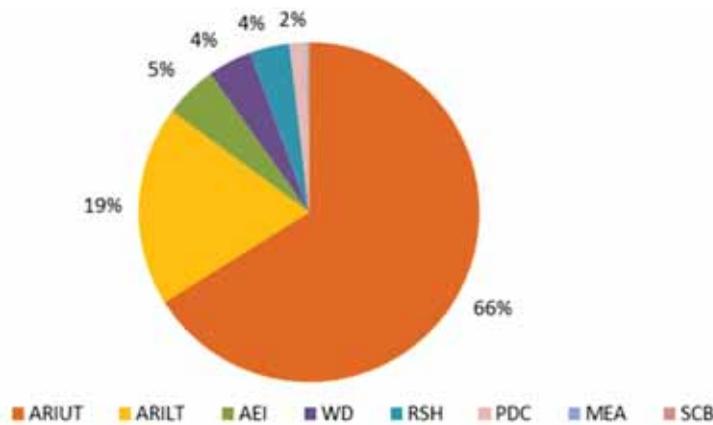


FIGURE 3. Communicable diseases profile in camps. Romania, flooding, 2006-2007

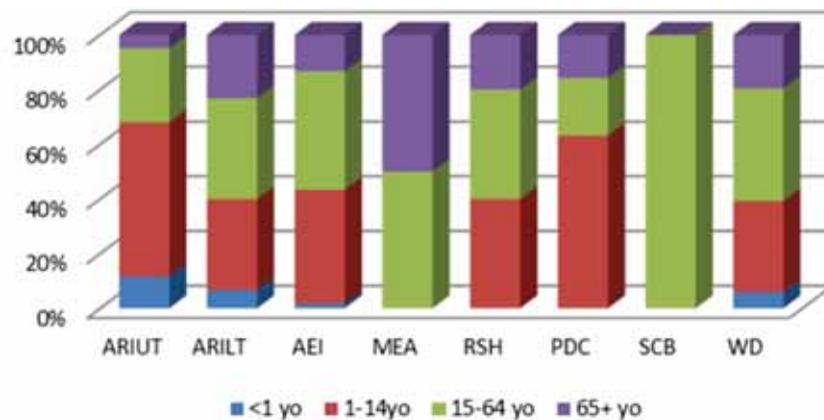


FIGURE 4. Communicable diseases by age group in camps. Romania, flooding, 2006-2007

TABLE 4. Weekly addressability to primary healthcare services in camps

county	addressability (%), range	peaking week
BR	7-25	S2
CL	10-35	S1, S4
CT	5-50	S4
DJ	5-50	S5
GJ	10-80	S2
TL	14-31	S2, S5, S10

## DISCUSSIONS

Among the countries of the WHO European Region, Romania was the most affected by heavy rainfall and flooding, after Russia, during the first decade of the 21<sup>st</sup> century, at a rate of “affected” persons ranging 5,000-10,000 per million inhabitants (20). Our “displacement” rate (3,000 per million inhabitants) converges to the above data, considering “affected” is always

more than “displaced” persons, in any flooding event. More than this, in 2 of the 6 counties where camps had to be organized, the displacement rate overcame the territory level: 3 times more in CL (8,630 per million inhabitants) and 2 times more in DJ (6,400 per million inhabitants) (Table 1).

Yet, have to say that the severity of this flooding event in Romania was relative, comparing to other recent flooding events all over the world: the april 2017 floods in Peru led to 1.3 million people affected and over 42,000 collapsed houses, 136 deaths and 18 missing people (24,32).

Rural habitation areas were far more affected by displacement than the urban ones. The ratio urban: rural localities with IDP was 7:1 (Table 1). CT county registered the highest number (15) of rural localities with IDP. In most of the other counties, 6-8 rural localities were affected by IDP. As to the urban localities with IDP, it was almost expectable a much lower level: no locality to 2 localities per county. It is obvious that the WHO vulnerability criteria were met in rural much more than in urban areas (2,5,38,44). In rural areas prevailed the river floods, while in the urban areas the flash floods, but nowhere was the case of coastal floods, as in at risk coastal cities of the world (Cairo, Calcutta, Delhi, Dhaka, Lagos, Manila, New York, Rio de Janeiro, Sao Paulo, Shanghai) (38). Three thousand of the IDP (37%) needed to be sheltered in camps by the local government authorities, as a consequence of 2 aspects: their households were severely damaged, while they found no shelter at their relatives or friends. In 3 of the 6 affected counties the percentage of IDP sheltered in camps overcame the territory level: GJ (54%), BR (54%) and CL (46%). Half of the affected territory registered “long term” camps, that is more than 52 weeks (19,37): CT 68 weeks, CL and DJ, 63 weeks each (Table 2). The duration of the camps’ operation depended on the economic and organizational capacities of the authorities to ensure permanent and safe new habitation conditions. Tent as shelter represented 99% of the habitation forms in CL camps, 64% in TL camps and 57% in GJ camps. The duration of sheltering in tents lasted up to 25 weeks in CT and TL (Table 3). Under the registered addressability to primary healthcare services in camps (Table 4), the morbidity was dominated by the category “other diagnoses” in 5 of 6 counties. The category “communicable diseases” prevailed in BR county only (60%). In

rest, it did not exceed 31% contribution along the categories. “Injuries” contributed with less than 5%, in 5 of the 6 counties (less CT). “Psychological trauma” was a diagnosis category registered in 3 of 6 counties (CL 0.1%, CT 0.3%, GJ 1.2%), contributing along the categories with less than 1.2% (Fig. 2). Recent studies show psychological trauma to have an important contribution to the pathologies related to flooding, in the chronic phase, especially in high income population (14,29). When appears in the acute phase of the flooding, it is associated with displacement, may persist 6 months to 1 year and may have chronic evolution. The lack of the awareness or of the efficacy of the awareness was found negative influence factor associated with psychological trauma (22,26).

Tackling the awareness in flooding related to health, a prestigious author shows there are enough theoretically measures to prevent and limit the effects of floods. What is deficient in varying degrees from one state to another is their implementation (13). More results are expected from the provisions of the Sendai Framework for Disaster Risk Reduction 2015-2030, that outcome from The Third UN World Conference on Disaster Risk Reduction, March 2015, Sendai City, Japan (36). The Environmental Emergencies Guidelines, 2<sup>nd</sup> edition is also an instrument for action, full of value (33).

As to the communicable diseases profile in camps:

- *ARIUT*: contributed 66% at the territory level, were registered in every county, ranging 45-80%; contribution that overcame the territory level were registered in 3 of the 6 counties (BR, TL, GJ);
- *ARILT*: contributed 19% at the territory level, were registered in every county, ranging 9-39%; contribution that overcame the territory level were registered in 3 of the 6 counties (DJ, GJ, TL);
- *AEI*: contributed 5% at the territory level, were registered in 4 of the 6 counties, ranging 1-10%; contribution that overcame the territory level were registered in 3 of the 4 counties (CL, CT, DJ);
- *WD*: contributed 4% at the territory level, were registered in 4 of the 6 counties, ranging 2-8%; contribution that overcame the territory level were registered in 2 of the 4 counties (CL, TL);
- *RSH*: contributed 4% at the territory level, were registered in 4 of the 6 counties, ranging 1-18%; contribution that over-



ble diseases, nor injuries or psychological trauma had major contributions to the diagnoses profile in camps; however infections ranked the second place, injuries the third place, while psychological trauma the last place. Acute respiratory infections dominated the profile of infections, in children and adult ages.

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