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# *The impact of heat waves on mortality in Cluj-Napoca city, Romania*

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# Introduction

- Climate change impact on human health is a global concern;
- The main aims of this study were:
  - to **analyze the impact of heat waves/warm spells on death rate** in one of the most important cities in Romania, Cluj-Napoca;
  - to compare the results of death rate during heat waves in summer with those during warm spells, in winter;
  - to investigate the most vulnerable age groups and gender;

# Data and methods

## Data

- Daily maximum temperature data and daily number of casualties data over a 10-yr period (2006-2015).

### *Data sources*

- *The number of casualties* extracted from the archive of Cluj-Napoca City Hall;
- *Meteorological data:*
  - ECA&D project database (<http://eca.knmi.nl>);
  - Meteomanz (<http://www.meteomanz.com>);

# Data and methods

## Methods

### **Heat wave identification:**

- Was based on a relative intensity threshold, respectively when the daily maximum air temperature exceeded the intensity threshold of the 98<sup>th</sup> percentile for at least three consecutive days.
- The percentile threshold was calculated over the 1961-1990 base line period.

# Data and methods

## Methods

### **To identify the influence of heat waves on the death rate:**

- we compared the number of dead people recorded during the heat wave days with the same intervals of the other years under no heat wave conditions;
- we compared the average death rate in the heat waves days with the average one recorded in the month of heat wave occurrence;
- we also compared the average deaths rate recorded during the heat wave events, with the average number of monthly casualties, excluding those recorded during the considered heat wave period;
- another type of analysis was focused to indentify the most culnerable groups in terms of gender and age.

# Results

Table 1. The heat wave days and similar intervals of all years considered (under no heat wave conditions) for summer season

No. of events	Date of HWs	HWs	The previous period	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	16-24 iul 2007	115	84	95	-	81	113	-	88	95	102	113	108
2	21-25 aug 2007	58	59	63	-	-	49	53	-	45	51	45	-
3	13-16 aug 2008	46	43	29	42	-	32	44	43	46	43	-	42
4	21-23 aug 2008	44	37	39	-	-	31	31	-	27	28	22	36
5	27-29 aug 2009	34	28	28	32	37	-	32	17	39	28	39	-
6	8-14 iun 2010	103	75	70	68	76	81	-	78	88	74	-	-
7	16-18 iul 2010	38	29	27	-	25	39	-	30	49	39	34	37
8	9-11 iul 2011	38	26	35	30	34	29	25	-	-	34	29	-
9	23-26 aug 2011	38	39	50	-	-	37	39	-	39	44	48	58
10	18-21 iun 2012	67	55	49	47	40	40	60	55	-	-	49	41
11	1-11 iul 2012	143	131	109	105	124	114	101	-	-	123	109	-
12	3-7 aug 2012	58	56	43	37	46	59	65	39	-	-	62	55
13	18-22 iun 2013	73	66	61	56	47	50	70	50	-	-	61	54
14	28-30 iul 2013	49	28	37	35	34	27	27	29	30	-	25	37
15	5-10 aug 2013	74	72	58	59	51	71	71	58	-	-	68	81
16	7-12 iun 2014	83	49	64	57	68	72	-	82	81	56	-	-
17	12-14 aug 2014	36	29	23	26	-	37	35	35	33	29	-	-
18	7-9 iun 2015	31	31	-	30	34	35	-	50	48	26	-	-
19	6-8 iul 2015	37	49	32	23	26	38	26	-	-	35	29	-
20	23-25 iul 2015	37	42	34	43	22	-	34	27	29	29	40	-
21	11-16 aug 2015	80	-	51	-	-	64	65	64	68	60	-	-
22	27 aug-3sept 2015	106	103	85	87	87	-	78	69	88	83	87	-

# Results

Table 2. The heat wave days with the same intervals of the other years under no heat wave conditions for winter season

No. of events	Date of HWs	HWs	The previous period	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	8-12 ian 2007	77	67	56	-	52	49	40	72	55	74	-	65
2	18-20 ian 2007	43	32	40	-	49	41	32	37	36	31	-	36
3	7-9 feb 2007	30	29	44	-	29	-	24	31	40	31	37	42
4	4-6 dec 2008	43	31	37	36	-	37	23	39	45	37	40	34
5	21-23 ian 2009	36	41	31	40	32	-	36	31	-	35	35	44
6	5-8 feb 2009	50	47	51	-	41	-	39	47	36	39	43	54
7	23-26 dec 2009	46	48	43	51	45	-	41	55	48	43	61	58
8	19-21 ian 2014	44	32	32	-	46	39	28	42	38	29	-	40
9	11-13 ian 2014	33	50	37	-	34	24	35	39	-	34	-	47



# Results

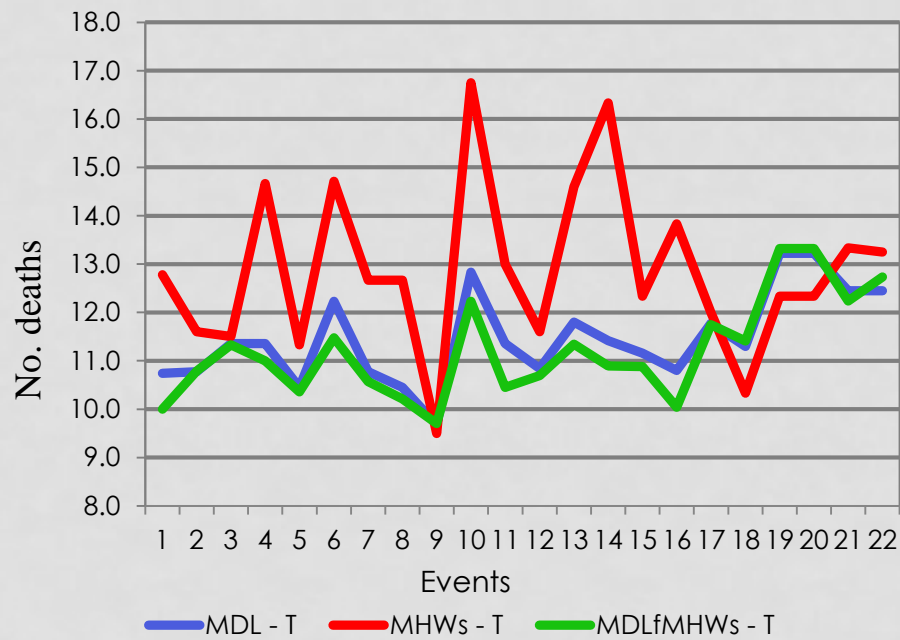


Fig. 1a. Total casualties during summer

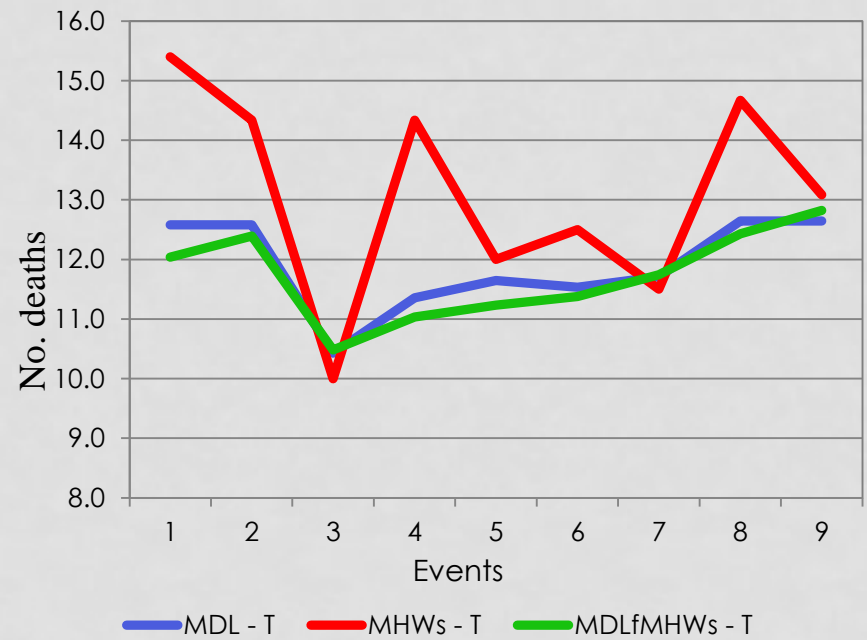


Fig. 1b. Total casualties during winter



# Results

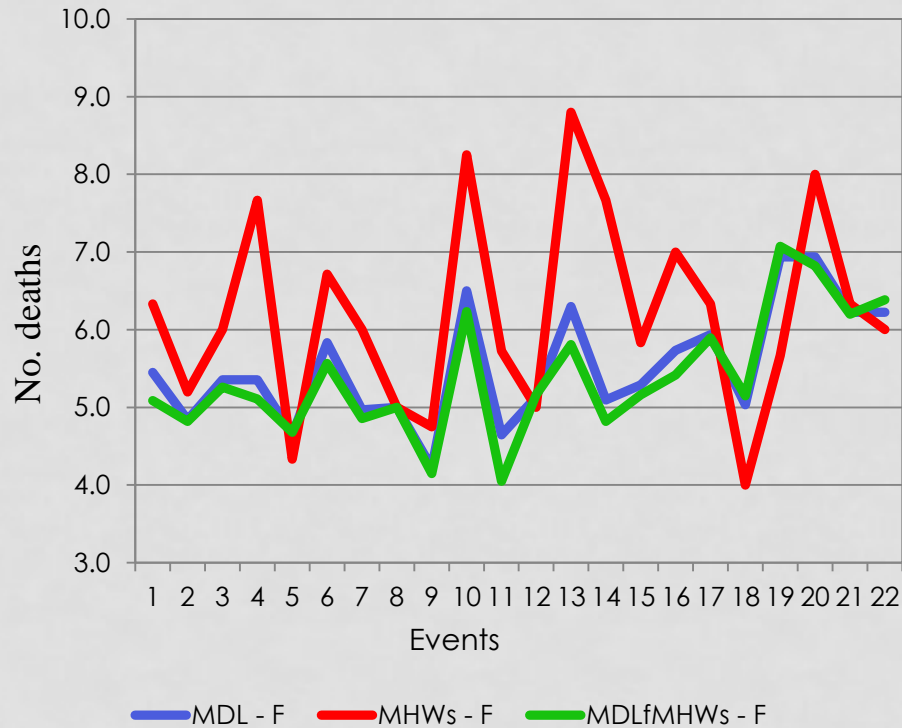


Fig. 2a. Women casualties for the summer season

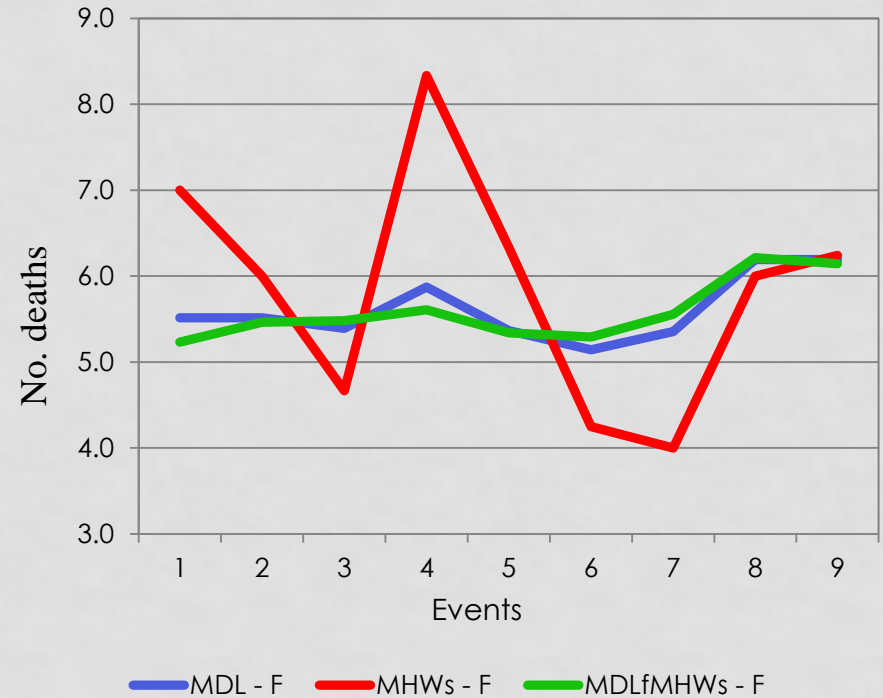


Fig. 2b. Women casualties for the winter season

# Results

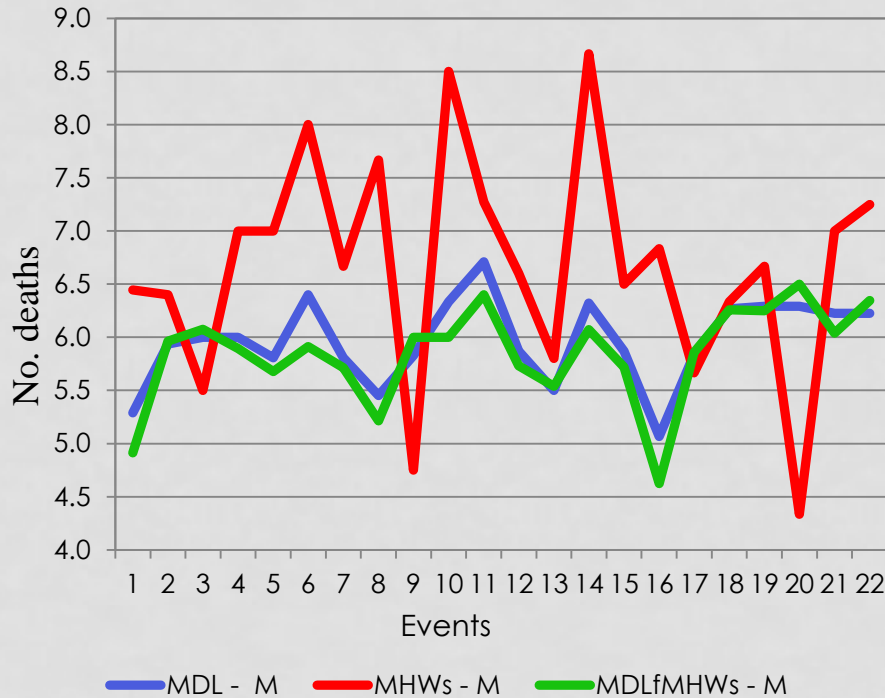


Fig. 3a. Men casualties for the summer season

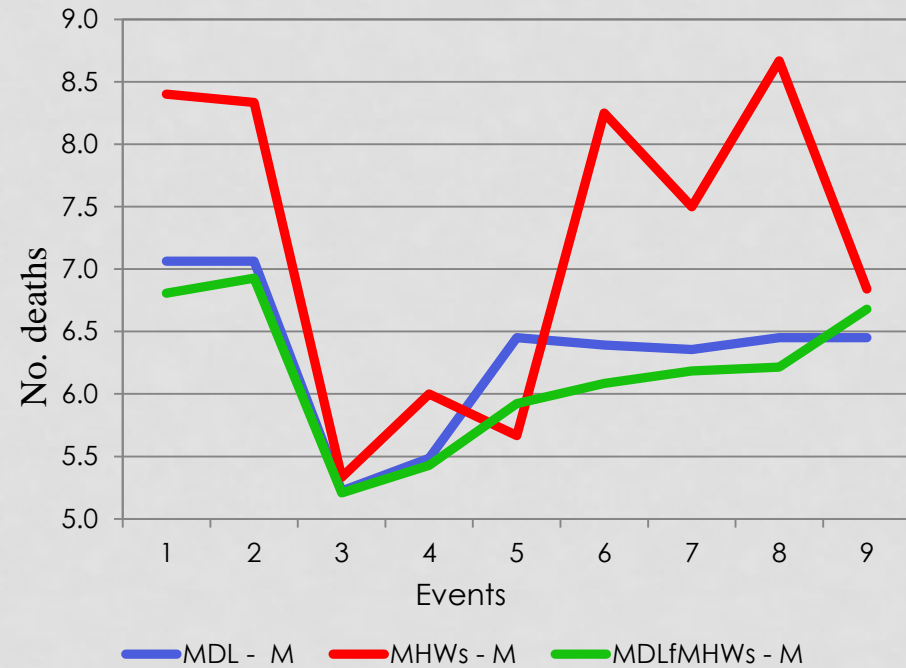


Fig. 3b. Men casualties for the winter season

# Results

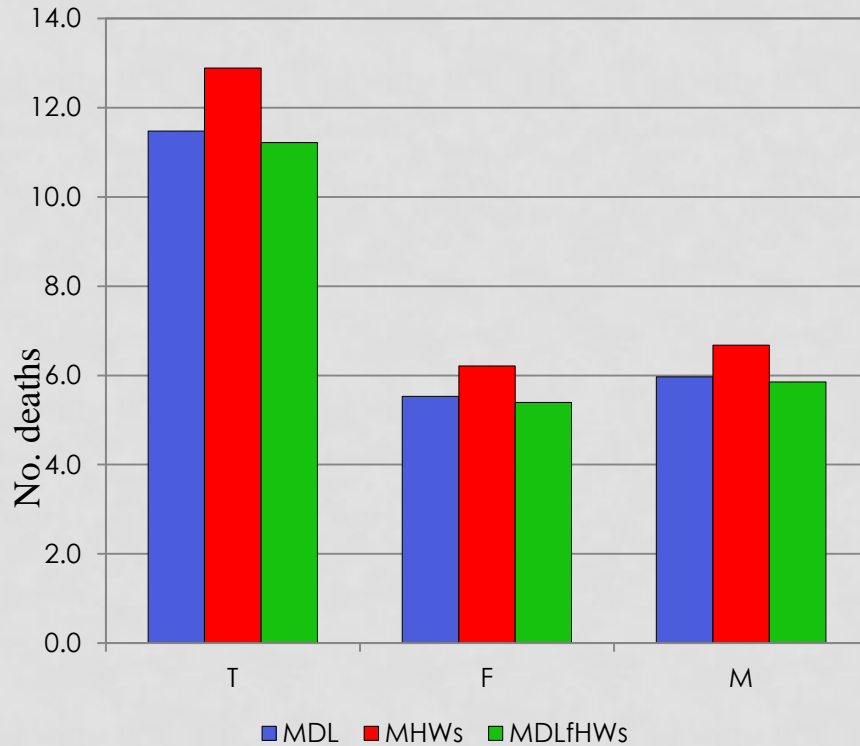


Fig. 4a. The average death rate in summer season

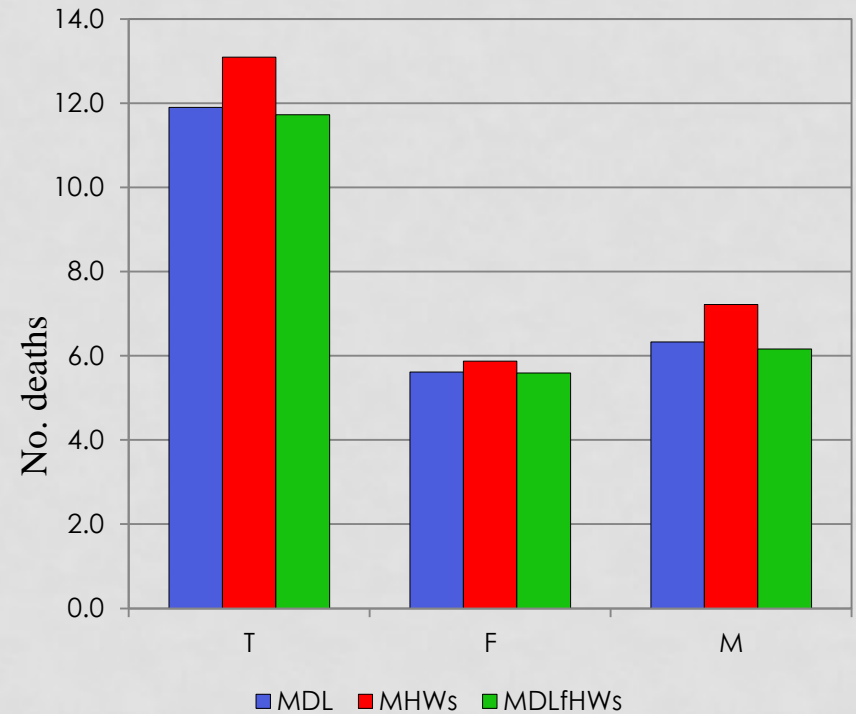


Fig. 4b. The average death rate in winter season

# Results

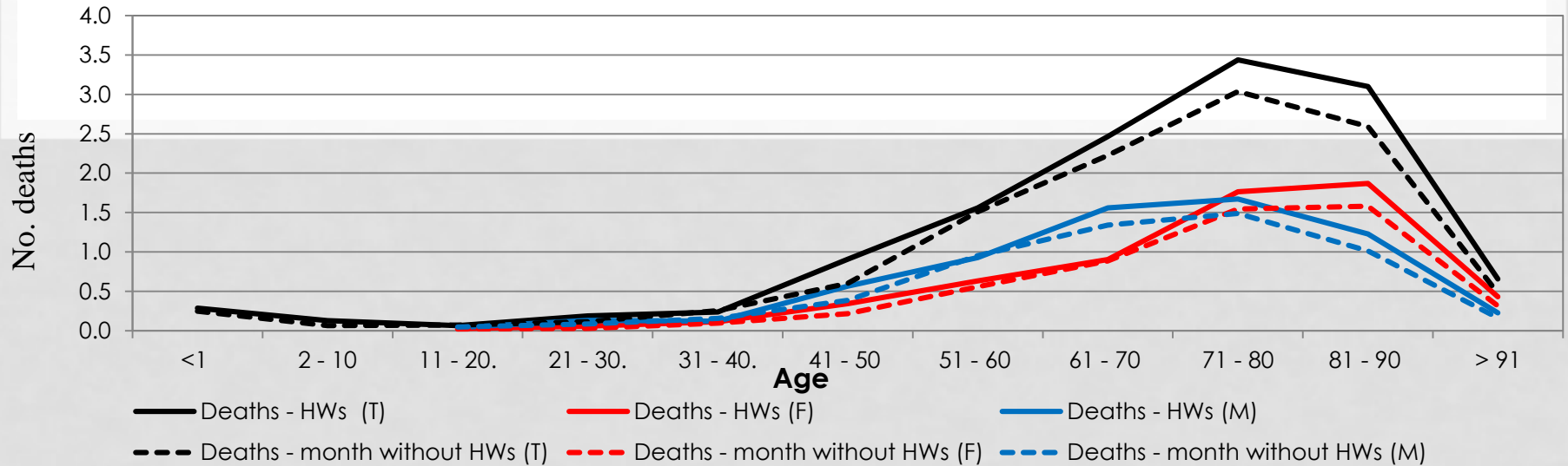


Fig. 5a. The average death rate by age group in summer season

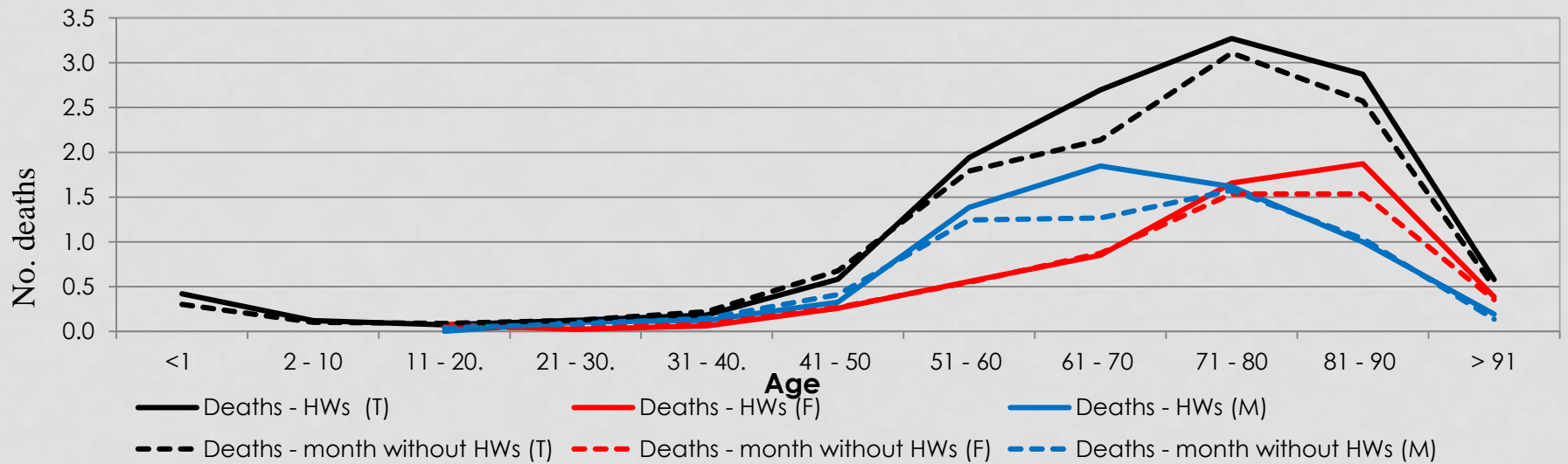


Fig. 5a. The average death rate by age group in winter season

# Conclusions

- There is an important increase (in 84.8% of cases) in the death rate under heat wave conditions in summer, while in winter a moderate increase of the death rate is specific (64.4% of the analyzed cases);
- The average increase in deaths rate during heat waves days was of 14.5 % compared to the monthly average death rate for summer, and of 11.5 % in case of winter warm spells occurrence;
- Both in summer and winter, the men were more affected by the heat wave/warm spells than women;
- The most vulnerable age groups are those of 61-70 years, 71-80 years, and 81-90 years (with a maximum for the men population of 61-70, and for women of 81-90).

# To do list

- Expand the analyzed period → **1981-2015**;
- To conduct an analysis taking into account the **cause of death**.

# Acknowledgment

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*Thank you for your  
attention!*