P1.18 DEATHS AND CAR ACCIDENTS UNDER DIFFERENT SYNOPTIC SITUATIONS

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1. INTRODUCTION

The poster presented the results of the analysis of weather-related mortality and car accidents in two big polish cities: Warsaw and Radom. The paper try to answer the question if we can name some special type of weather as especially oppressive, apart from the type of human response that we consider. If the same weather causes both the excess of death rate and road accidents or maybe some types of atmospheric conditions influence only selected human reactions?

2. METHODS

The synoptic situation was analysed using bioclimatic classification of air pressure systems and atmospheric fronts by M. Baranowska (1986), types of air masses, values as well as day-to-day changes in meteorological parameters and seven types of thermal human sense according to effective temperature (defined for Warsaw climate conditions). In synoptic classification of air pressure systems the most important were distance from the low centre and the shape of isobars, in atmospheric fronts definition of – they velocity and the size of air temperature, air pressure, water vapour pressure changes they cause. Air masses were the same as on the synoptic maps.

In comparative statistic analysis the variable *Z* with standardise normal distribution using for the mean value testing was used (Crawshaw, Chambers 1994):

$$Z = \frac{(X-\mu)\sqrt{n}}{\sigma}$$

X – mean daily number of deaths or road accidents on days with specific weather situation, *n* – number of days with this situation, μ - general mean daily number of deaths or road accidents, δ - standard deviation of number of deaths or road accidents on days with specific weather situation.
If $Z < -1{,}96$ or $Z > 1{,}96$ – variable significantly differs from the mean on the significant level of 5%, if $Z < -1{,}645$ or $Z > 1{,}645$ - on the significant level of 10%.

In calculations one day lag (+1), one day acceleration (-1) of death or road accidents in relation to weather stimuli was considered (see Figure).

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3. RESULTS

Among the air pressure systems only disturbances in high pressure, named as low embayment in high caused both, rise in car accidents and mortality. On the first days of low which appear over Poland the sudden increase of car accidents is always noted but mortality at the same time sometimes goes down. In a high, the weather in general is favourable for human, though the decrease of car accidents is more obvious than drop in mortality (see Table 1).

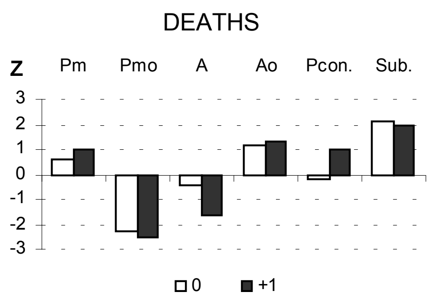
Strong atmospheric fronts, apart from their type, always lead to the excess of car collisions, however deaths are more frequent only behind warm front, in warm sector of low, where oxygen pressure is going down. Only on days when several (2 or 3) atmospheric fronts crossing over central Poland (multifront day) the rise in both characteristics is observed (see Table 1).

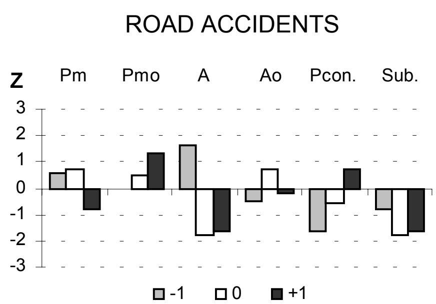
TABLE 1

Weather features	**DEATHS**		**CAR ACCIDENTS**	
	0	+1	0	+1
Particular air pressure system				
Near low	1.6	-0.2	1.8	1.6
Low with centre over Poland	-0.9	-0.8	0.9	-0.6
Far low	-0.6	-0.7	0.3	1.3
Weak-gradient cyclonic area	-0.1	2.2	-0.2	0.7
High with cyclonic disturbances	1.2	1.4	0.7	0.7
Types of air pressure systems				
Cyclonic systems	1.3	2.2	1.9	0.8
Anticyclonic systems	-1.7	-1.0	-3.2	-1.9
Transitory systems	0.3	-2.1	0.7	1.4
Atmospheric fronts				
strong cold front	1.9	-2.0	1.8	-0.8
strong warm	-0.1	1.7	2.2	1.0
multifront day	0.9	1.0	0.9	1.6

When considering the changes in meteorological parameters the highest number of car accidents occurred after the biggest day to day changes of air pressure, decreases up to 28 hPa and rises of 11 hPa, without any dependence to air temperature changes. On the contrary mortality was not related to changes in air pressure but it was strongly correlated to the air temperature. An increase of mortality rate was noted according to big rise of air temperature (of 14°C) and the highest number of deaths in Warsaw in 1994 was noted during the heat wave, formed in subtropical, extremely hot and hardly polluted, air mass. It indicates a critical load of heat stress above which the physiological adaptation mechanisms become inadequate (Błażejczyk, Krawczyk 1991).

Different features of atmospheric environment are the best seen in types of air masses which influence number of deaths considerably stronger than number of road accidents. The greatest mortality is noted in the warmest and the most seldom (6,6% of days) over Poland subtropical air, the smallest mortality in much more frequent (26%) polar maritime, old air mass (see Figure below).





Types of air masses: Pm – polar maritime fresh, Pmo - polar maritime old, A – arctic, Ao – arctic old, Pcon. – polar continental, Sub. - sutropical

Driving a car needs both the high concentration of mind and proper body position that may cause both, fatigue of nervous system and muscle tension. That is why number of car accidents grows during the weather that dampen physical reactions, when sleepiness, tiredness, the weakening of straight reaction or its big variations appeared. What is interesting, if the meteorological phenomena like: rain or fog, commonly known as those which disturb in driving do not appear with active weather they do not cause any access in car accidents.

The sizeable rise in mortality rates noted in Warsaw in high temperatures (heat waves), caused not only by sunstroke cases but also as an effect of exacerbation of many pre-existing health problems, confirmed studies conducted in different climatic zones; e.g., weather Auliciems, Frost (1989), Kalkstein (1991), Smoyer et al. (2000).

4. CONCLUSIONS

These searches confirm that different meteorological conditions are responsible for an increase of car accidents, different for the mortality excess. This is why there is no simple definition of oppressive weather because the result of research depends mainly on the kind of human reaction that was taken for correlation to weather.

Due to the studies:

Bigger amount of road accidents occurs on days with big weather disturbances (especially in air pressure) and lesser inflow of solar radiation, when the time of reaction for the light signal is lengthen.

The highest excess of mortality appears in extreme hot or cold air as a result of impaired thermoregulation, or after long period of high weather instability when the body cannot cope with oppressive weather.

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