LIGHTNING KNOWLEDGE AND SAFETY BEHAVIOR IN AUSTRIA AND BAVARIA, GERMANY

Keul, A.[1], Duernfeld, C. [1], Holzleitner, J. [1], Schoerghofer, A. [1], Weichenmeier, L.A. [1]

[1] *Psychology Dept., Salzburg Univ., 5020 Salzburg, Austria, alexander.keul@sbg.ac.at*

(Dated: 18 August 2011)

I. INTRODUCTION

In the social sciences, lightning is a traditional subject of risk assessment research (Slovic, 2000). Here, "hazard" means potential risk as a statistical value, and "risk" the probability of getting personally harmed.

Seen from the angle of cognitive psychology, thunderstorms and lightning are no simple, comprehensible threats. Different from other natural hazards as floods or fire, lightning is a very short, random, rare event, never anticipated, with stochastic secondary events. To the general public it constitutes a complex, sometimes counter-intuitive and confusing danger: Buildings are safe, but not always. A car is safe, but a cabriolet is not. A lightning conductor gives safety, if you keep a safe distance from it (Keul et al, 2009).

Consequently, people without personal experience underestimate the lightning fatality risk relative to a tornado risk. Personal exposure to both risks results in more realistic estimations (Greening et al, 1992). Also, there exists a false security ("overconfidence") that ones personal judgments are correct. This even goes for scientists and expert witnesses. Simplistic „lay theories" develop that reduce cognitive dissonance and increase the subjective security (Furnham, 1988).

Medical lightning research is a large compendium. Cooper et al. review folk beliefs in this area (2007). To prevent medical lightning risks, personal responsibility has to be taken by the individual (Roeder, 2008). For the optimum "diffusion of information" (Rogers, 1995) in public education campaigns, it is important to know the proportion of right or wrong answers to information/behavioral items as a benchmark (see Fig.1 for an example).

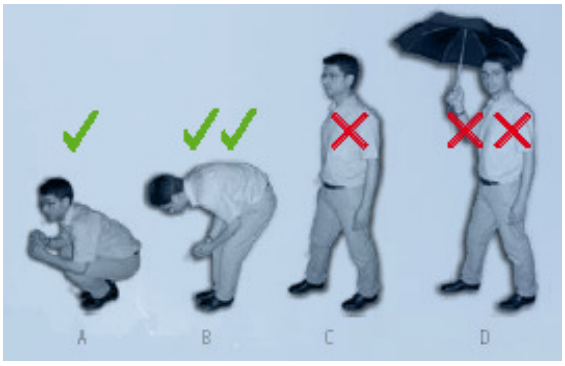

FIG. 1: Right (A, B) and wrong (C, D) behavior upon immediate lightning risk in the open, when no shelter is available (Photographs by first author for COST P-18).

II. PRESENTATION OF RESEARCH

In the EC-funded project COST P-18, first steps were taken to test lightning folk beliefs and to operationalize the results for European lightning protection information (Keul, 2008; Berger & Keul, 2009).

An Austrian survey on lightning knowledge and safety behavior with 133 respondents (age 20-84, mean 43) was organized in 2008 (Keul et al, 2009). Within the Interreg IVA project REBLAUS, a sample of 108 persons (age 19-81, mean 44) from Bavaria filled in the same questionnaire in 2010 (Diendorfer et al., 2011). In the following, the two surveys are reviewed for possible risk assessment differences.

On a list of natural risks (storm, flood, avalanche, ice etc.), lightning was both rated as a medium risk in Austria and Bavaria. 66% of the Austrian sample felt well-informed about thunderstorms, in Bavaria 74%. The self-reported lightning fear was mostly low. However, subjective security and „overconfidence" has to be compared with reported knowledge and behavior.

In a distance calculation task („thunder follows 3 seconds after lightning – what is the lightning distance?"), the most frequent (and wrong) answer was 3 km (54-55%; see Fig.2). Only 20% of the Austrians and 29% of the Bavarians answered correctly (1 km). As 1 kilometer distance means immediate danger, the calculation error may lead to a false feeling of security.

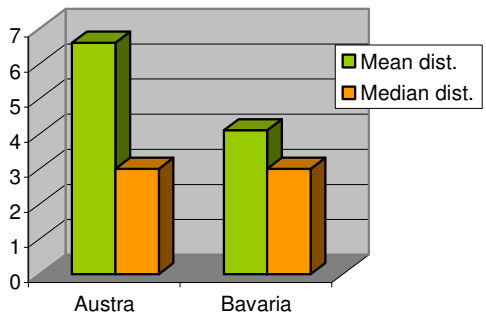

FIG. 2: Lightning lay distance estimations (km), means and medians. The correct value would be 1 km.

Two of four medical knowledge items (lightning kills instantly, victims „charged", death by cardiac arrest, resuscitation needed) were answered correctly by 70 to 90% (see Fig.3). Only 26% in Austria knew about cardiac arrest, in Bavaria 67%. The low precentage of cardiac arrest knowledge in Austria together with a high belief rate in „electrically charged and dangerous lightning victims" may be an obstacle to actual resuscitation attempts. Here, more media information should be given.

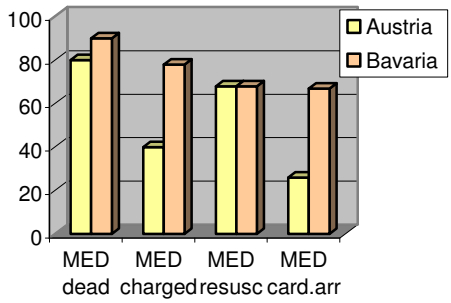

FIG. 3: Correct lay answers (percentages) – medical questions (instant death, victims "charged", resuscitation, cardiac arrest) .

General physics questions (e.g. on a mountain CG maximum) were answered correctly by 50 to 95% (by the Bavarians better than by Austrians). With some exceptions, the knowledge items will have low safety consequences.

Relevant safety items in the open - „crouched position" (correct: A 32%, B 62%) and „3 meters distance to objects" (correct: A 40%, B 69%) - indicate some lack of information. The authors know the US position („there is *no* lightning-safe place in the open"), but appropiate behavior should be known when no shelter is available.

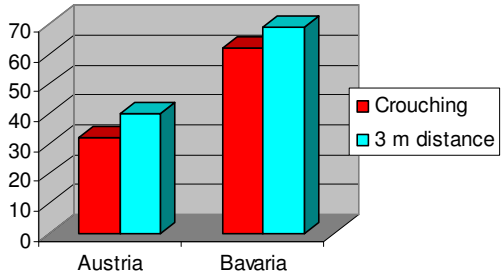

FIG. 4: Correct lay answers (percentages) – Behavior in the open, lightning danger, when no shelter is available.

Historic folk beliefs („churchbells against lightning") are largely rejected, but some have survived („lightning always hits the highest point" - 50% correct, „different trees - different danger to be hit by lightning" - only 24% A/40% B). Also, a high percentage believes that an active cellphone will attract lightning.

Places to stay?	**Austria correct %**	**Bavaria correct %**
inside a building	98	88
under power pylone	98	97
swimming in water	94	99
in a car	96	92
in an airplane	92	70
at a forest edge	94	96
under a single tree	89	98
on a hilltop	78	99
in a forest	68	81
beneath a metal fence	70	89
on a field	66	95
in a hollow	58	33

TABLE I: Correct lay answers (percentages) – safe/unsafe places in a thunderstorm.

Behavioral choice tasks (where to stay/hide in a thunderstorm and where not; see Tab.I) showed a high level of basic knowledge (buildings, car safe >95% A, >85% B correct) with a few exceptions (metal fence, field Austria around 70% correct, Bavaria 95-99%). As with medical issues and behavior in the open, more public information should be handed out via the media.

III. RESULTS AND CONCLUSIONS)

Overall, a number of life-saving questions is answered correctly by most respondents. The level of knowledge in Austria and Bavaria seems to be fairly high. However, there are still weak points in knowledge and behavioral choice in need of competent information. One also has to keep in mind that general lightning knowledge is not valid as a situational predictor in critical incidents, where other parameters (stress, anxiety, group think, risky shift, authority structure) interact with knowledge. Behavioral training (e.g. on resuscitation) is needed to put the theoretical knowledge into action.

IV. ACKNOWLEDGMENTS

Research for this contribution was realized within the EC-funded project COST P-18 as well as in the Interreg IVA project REBLAUS (Regional Lightning Evaluation).

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