SESSION I

STATISTICAL INFERENCE OF RISKS

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INTRODUCTION TO SESSION I

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Statistical inference is essentially a measure of ignorance and helplessness. This is often forgotten. If this were a meeting on automobile safety, we would never have had the session. People understand the difference between a car crashing at 2 miles per hour and a car crashing at 60 miles per hour, that such crashes obey well-known laws of physics and that causal mechanisms allow a great deal to be said about hazards.

Nonetheless, statistics are the most common language of science. More people have a smattering of statistical knowledge than of mathematical knowledge - especially as you go across the spectrum of sciences, including the biological, social and behavioral sciences.

Statistics serve as our defense against hubris. Statistical inference is our defense against fooling ourselves. Yet it is surprising, for something that is a measure of ignorance and helplessness, how ignorance becomes knowledge and conventional assumptions become facts. We raise eyebrows at 5%, we agree at 1% and we think we know at 0.01%.

We talk about the power of a test, not the weakness of the idea that is tested. Language gets inverted in that peculiar way. Statistical significance somehow becomes common sense significance and people seem to interpret statistical significance as having some real world meaning other than a sign of our ignorance. We have debates where a change in a statistical test is seriously mistaken for a change in reality. My current favorite in this regard deals with interpreting whether cancers are caused by occupational exposures in lead smelter and lead battery workers, depending upon whether a one-tailed or two-tailed test is used.

If scientific understanding hinges on one- or two-tailed tests, or the like, a simple prescription is to do more studies, make more observations. Sometimes this is not possible. To use Al Weinberg's expression, it may be a trans-scientific problem. Either we know how to do it but we can't do it, or we are just not smart enough to think of an experiment, or we cannot think of an ethical experiment. But these limitations do not apply to most cases. Rather, we just can't wait for more findings, we must act on whatever we know. Therein lies the rub and this is what we will be discussing for the next couple of days.

This is the dilemma. As scientists, we should delay until we know much more. As responsible citizens, we appreciate the need to act, whether we advise industry, government, or public interest groups.

In risk assessment, the distinction has been made between known victims and statistical victims. Especially in the past year, that distinction has broken down considerably. You can see what has happened in the poignant faces of the people of Love Canal, in the veterans exposed both to Agent Orange in Viet Nam and to fallout of atomic weapons in the U.S., in the people of Middletown affected by Three Mile Island, in the women in Oregon who suspect they have been affected by aerial sprays. All of a sudden, the unknown victims become known, at least to themselves.

We are working under a new pressure. We are under a time limit not only for the decision makers we advise and report to, but also for the people who feel they are victims - albeit, in many cases, mistakenly. I am not sure how we can cope with that. In the coming days we must sharpen our science and our consciences as well.