Epidémiol. santé anim., 1997, 31-32

EXPLAINING RISK ANALYSIS - FROM A SINGLE LECTURE TO A WEEK LONG COURSE: EXPERIENCES GAINED AND LESSONS LEARNED

Wooldridge M.[1], Kelly L[1]

Depuis la mise en oeuvre, il y a près de trois ans, d'un service d'analyse de risque dans le département d'Epidémiologie du Laboratoire Vétérinaire Central (de Weybridge), nous avons accumulé une expérience considérable sur l'usage et les abus de l'analyse de risque auprès de nos collègues d'une large variété de disciplines, dans l'esprit de leur expliquer les circonstances dans lesquelles l'analyse de risque peut leur être de quelque utilité. Cette activité de formation continue constitue toujours une partie intégrante de notre travail, tandis que nous poursuivons des études d'analyse de risque proprement dit, et nous développons l'enseignement des méthodes et des techniques d'analyse de risque auprès d'un public plus spécialisé. Cette expérience englobe aussi bien une conférence introductive donnée à des étudiants dans le cadre d'un "Master of Sciences" qu'un cours d'une semaine à destination de vétérinaires fonctionnaires d'un état d'Europe de l'Est. Les cours les plus complets comportent des notions sur les sources de données, l'évaluation des systèmes de surveillance, l'évaluation qualitative du risque et une introduction à son évaluation quantitative. Seulement certains de ces étudiants ont déjà reçu une formation préalable en épidémiologie, et pour beaucoup d'entre eux, l'anglais n'est pas leur langue maternelle.

Cet article décrit le comment et le pourquoi du choix des thèmes et de leurs supports que nous développons dans nos enseignements, tout particulièrement les plus complets d'entre eux. Nous nous y attachons plus spécialement aux considérations pratiques, comme les stratégies à envisager pour dépasser les difficultés résultant des différences considérables de niveau de connaissance entre les participants, ainsi que de leur degré de connaissance de la langue. Nous avons recours à des exemples empruntés aux situations épidémiologiques locales, à des schémas simples pour illustrer des problèmes complexes, et à des exercices ou des jeux de rôle qui mettent les participants en situation active. Les difficultés que nous avons rencontrées, les solutions que nous y avons apportées, les leçons que nous en avons retirées sont discutées, tant nous pensons que cette expérience pourra être utile à tous ceux qui souhaitent organiser de tels cours sur l'analyse de risque destinés à une audience internationale de vétérinaires pratiquant des langues différentes.

BACKGROUND

Since setting up a Risk Analysis Unit within the Epidemiology Department at the Central Veterinary Laboratory (Weybridge) in 1994 our work has divided into three major areas:-

- Explaining risk analysis to potential customers and colleagues, and what it can and cannot do.
- Undertaking risk assessments, both qualitative and quantitative.
- Lecturing and teaching on the methods and techniques of risk analysis to national and international veterinary colleagues, many of whom (but not all) have an epidemiological background.

This paper will examine particularly the last of these three activities. However, we have found that in the initial stages, the requirements in both the first and last of these activities are similar, centring around explanations of what is meant by risk analysis, and when it is appropriate to use the techniques.

PERCEPTIONS OF RISK ANALYSIS

With both potential customers (mainly the decision-makers) and scientific collaborators, and amongst students of risk analysis, the same initial problems have included (in differing degrees):-

- Confusion over terminology, particularly the terms risk analysis and risk assessment. This is not surprising since the methodology (and terminology), grew up in a variety of disciplines (eg engineering, the nuclear industry, space travel), before it was used relatively recently in the animal health and veterinary sphere.
- The misconception that risk analysis is inflexible and replaces judgement (often with 'a number'), rather than being a tool in aiding decision-making.
- Confusion over the difference between estimating the magnitude of a risk ('science-based'), and deciding on what levels of risk are acceptable or can be tolerated ('value-based').
- Doubt as to the value or necessity of a new methodology.

BASIC TEACHING TOPICS

Whatever the length of time involved in a teaching session on risk analysis, there are certain topics which we routinely include, as follows:-

- Risk analysis - the basics (to include the terminology which we use).
- Sources of data for use in risk assessments.
- Qualitative risk assessment - theory and practice
- Quantitative risk assessment - theory and practical introduction.

When required we have also included:-

- Surveillance as a framework for data gathering.

[1] Epidemiology Department, Central Veterinary Laboratory, Addlestone, Surrey, KT15 3NB, U.K.

Obviously, depth of detail depends upon the time available. Even when dealing with potential customers and collaborators discussions touch upon all these aspects in order to clarify what we are offering, and to overcome the confusions and misconceptions detailed earlier.

RISK ANALYSIS AND RISK ASSESSMENT - WHAT IS THE DIFFERENCE ?

Confusion over terminology - this is the first hurdle to overcome.

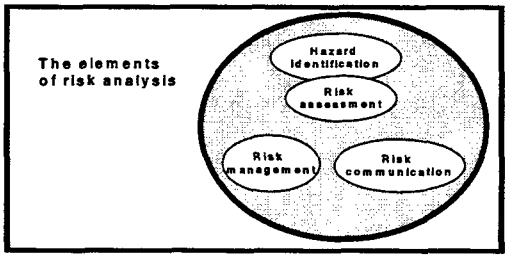
- A uniform system would be the ideal, but is not situation; we therefore had to decide which one we will use.
- Some students have used a different system, and have firmly held views about the 'correct' terminology; others are simply puzzled.
- Without care, lengthy discussions on semantics can ensue, eating into the time available for teaching

We tackle this problem by acknowledging that some people may prefer to use other terminology, but that for our course, we will define and use one set of terms:-

- **IN WORDS**

Risk assessment: The process of evaluating the risk resulting from a hazard. May be qualitative, semi-quantitative or quantitative.
Hazard: Something which is potentially harmful, to humans, other animals, plants or the environment.
Risk Analysis: An 'umbrella' term comprising:-
Hazard Identification & Risk Assessment,
Plus Risk Management and Risk Communication.

- **DIAGRAMATICALLY**



RISK ASSESSMENT - DEFINING THE QUESTION

'What is the actual risk which you need to estimate?' This question regularly causes difficulty; often it is not realised that the question itself requires careful consideration. That is, before assessing a risk you need to know, or decide, exactly which risks you are interested in. We illustrate with an example used for teaching.

- We wish to import a group of cattle from 'country X'. Two of the many possible 'risk questions' are shown.

Question A	Question B
What is the risk of this particular group of cattle passing any infectious pathogen to any of our indigenous livestock?	What is the annual risk of cattle intended for import and selected from the population from which this group came being infected with Foot and Mouth Disease (FMD) virus?
Differences in these questions	
Risk for *this import group* only wanted	Risk of infection for the intended *imports per year* wanted
Risk of infection with *any infectious pathogen* wanted	Risk of infection with *FMD virus* specifically wanted
Import group defined: no further selection needed	*Method of selection* for import? Random from the population or selection criteria?
Risk to any indigenous livestock wanted: *exposure and transmission potential relevant*	Onward exposure & transmission risk not part of this question, so not wanted

- Sometimes it is not clear until you start thinking about a problem in detail exactly which are the risks you wish to estimate. It may be necessary to re-frame the original risk-question.

HAZARD IDENTIFICATION

The importance of a thorough hazard identification (HI) is often not appreciated, and usually needs stressing. Unless a particular hazard is specified (eg FMD in Question B above) this is essential. One true (but non-veterinary) example which illustrates this:-

- A safety assessment was being carried out on a large motorway bridge in the USA
- A number of obvious hazards were identified (eg ship ramming pylon, concrete cracking, metal rusting, etc)
- Risk of collapse assessed for these hazards: bridge passed OK for use
- ***Result:*** Bridge collapsed, automobiles thrown into river, occupants died.
- ***Cause:*** A small bolt with metal fatigue - which HAD been noted in at least one report BUT ignored in this HI.

A potential veterinary comparison:

- What is the risk of viral pathogen P, recorded as causing fatal disease in species S1, infecting and causing disease in species S2?
- Obvious hazard: Pathogen P. Not easily missed in HI!
- Less obvious hazard: A potential mutation of pathogen P to P' with more virulence for species S2. Easily overlooked in HI.
- ***Consequences:*** Possibly severe; eg an epidemic of P' fatalities in species S2.

PATHWAYS FROM HAZARD IDENTIFICATION TO ADVERSE OUTCOME

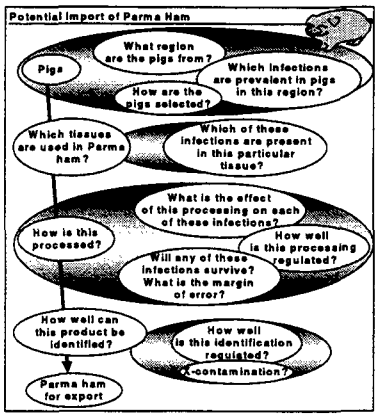
For both qualitative and quantitative risk assessments it is essential to outline the pathways by which the hazard identified can lead to the unwanted outcome(s). It is our experience that:-

- Students often find these pathways hard to visualise and construct.
- Familiar examples using locally relevant problems aid understanding.
- There is a large *perceived* difference between constructing the pathways for a qualitative risk assessment and for a quantitative one.

- Clear simple pathway diagrams can be very helpful, but classic 'scenario tree diagrams' with many branches tend to confuse.

Therefore we try to illustrate exercises with problems with which the students will be familiar, and use simple diagrammatic pathways to build from the concept of qualitative risk assessment to that of quantitative.

QUALITATIVE PATHWAY FRAMEWORK



Left: Typical demonstration example
Below: Typical student exercise, tailored for local relevance

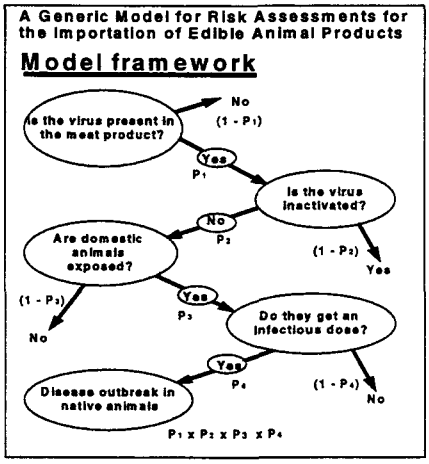
Students to divide into four groups; each group to consider one of:-
(A) Importation of Friesian heifers from Malaysia.
(B) Export of poultry meat to Japan.
(C) Importation of ostriches from Zimbabwe.
(D) Export of supermie (egg noodles) to China.
All are risk assessment topics relevant to your country.
Following the method just demonstrated:-

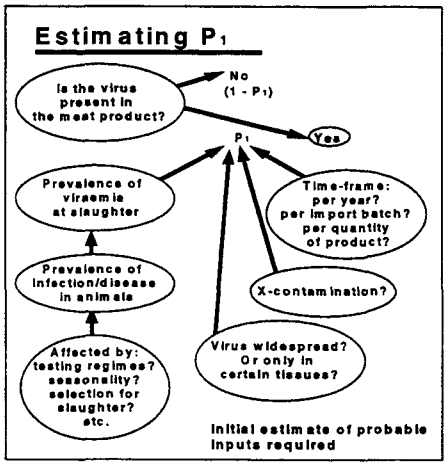
- Specify the risk you wish to assess.
- Undertake a hazard identification with the data available.
- List the kinds of information which you would need to collect to undertake this risk assessment, grouped and ordered in a way which you think is appropriate to facilitate a qualitative risk assessment.
- Time allowed: Exercise: One hour. Presentation: 5 minutes

TRANSITION TO QUANTITATIVE RISK ASSESSMENT PATHWAYS

We demonstrate the logical steps, following a similar method to the qualitative exercise. In this example we have:-

- The risk from the hazard (virus in product) in model pathway format, with probabilities attached
- Some suggested data (model inputs) for estimating P1.
- *To answer typical question:* Where does the P value come from?





PRACTICAL QUANTITATIVE RISK ASSESSMENT EXERCISES

Aim of session: For students to be able to construct a short stochastic spreadsheet risk assessment model.

- Not included in shortest courses.
- For many students, this stage is the biggest 'leap', with the greatest risk of 'losing' them.
- Typical questions/problems encountered: see box opposite.

Strategy: frequent re-caps and student activities.
Example: exercise in uncertainty and variability

What is a probability?
What is a distribution?
How do I use a spreadsheet?
What is the difference between uncertainty and variability?
What is the difference between a stochastic and a deterministic model?

- **Uncertainty.** Each student writes down their estimate of the prevalence of Newcastle disease in their own country. Estimates collected and plotted on a frequency distribution histogram (using an acetate) to demonstrate uncertainty.
- **Variability.** Two students of differing heights stand together. They are asked if they were to measure their height, would they then know their height with certainty (Yes: not uncertain). But would they be the same (No: variable).
- **Emphasised:** Can reduce uncertainty but not variability by measurement; both can occur together.

TYPICAL FIRST MODELLING PROBLEM

A country wishes to export cows to your country. In a survey of 1500 randomly chosen cows from that country, 50 were found to be infected with a disease that you want to keep out of your country. Assume that you will import 200 cows. How many of these will be infected?
Demonstrates: Use of beta and binomial distributions. ***Take-away notes:*** Contain full spreadsheet solutions.

CONCLUSION

Real-life risk assessment is complex. A short course should realistically only attempt to cover the principles. Quantitative risk assessment is best introduced in 'bite-sized' chunks, with frequent re-caps.