The Role of the Expert Witness

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INTRODUCTION

In this chapter, we discuss general aspects of the role of the expert in court and issues faced by experts. The chapter is written largely from a Dutch perspective, so that references to the Court almost exclusively refer to a judge rather than a jury acting as a fact-finder. Notwithstanding this perspective of the authors, the concepts illustrated herein are widely applicable to issues relating to experts serving in courts outside of the Netherlands.

Although the discussions in this chapter are intended to apply to experts in forensic epidemiology, we draw extensively from writings in Law and Economics, in part because so much has been published in this area on the topic of experts and expert testimony, and in part because these writings translate well to other disciplines.

CAUSAL UNCERTAINTY AND THE EXPERT

In addition to the contributions from the fields of philosophy and epidemiology described in Chapter 4, *Causation in Epidemiology and Law*, law and economics have also provided a foundation for the importance of epidemiologic evidence of causation. Shavell indicates that there is a good economic reason to limit the liability of the injurer to the damage that he has actually *caused*. If the requirement of the causal link did not have this limiting effect, a consequence could be that, especially in cases of strict liability, a potential injurer (eg, an enterprise) would be motivated to abstain from activities that are socially useful and therefore desirable (eg, the production of pharmaceuticals). A potential liability for damage which has not been caused through the influence of the injurer would thus be considered as "crushing."[1]

Many examples exist in tort law of situations in which there is uncertainty concerning the causal relationship between the tort and the damage.[2] The following example concerns the banned drug diethylstilbestrol (DES). The product caused vaginal cancer in offspring of mothers who took DES during pregnancy. The causal link between the use of DES by the mother and the daughter's symptoms was not disputed in the associated litigation. While it was also known which manufacturers had brought DES to the market, there was uncertainty regarding which manufacturer had sold a specific product to a particular mother. Several lawsuits were brought by DES-injured offspring, in which the plaintiffs sued all the producers who had brought DES to the market at the time of their injury, although they could not provide proof of the specific manufacturer from which their mother had purchased the drug. This gave rise to a lengthy debate about whether a proportional liability rule should be used to apportion the burden of liability between the manufacturers.[3] A market share liability would be an example of such a proportionality rule. The Dutch Supreme Court, however, applied a so-called "alternative causation" rule, meaning that the DES daughters were allowed to claim full compensation from any of the manufacturers.[4] A manufacturer could still rebut the presumption by *proving* that he did not sell DES to the particular mother, but this would often be impossible in practice.[5] Hence, the result was similar to a joint and several liability rule.[6]

A second example of shifting the burden of causal uncertainty relates to the employer's liability for occupational diseases. In a well-known Supreme Court case, *Cijsouw v. De Schelde*, a victim of mesothelioma could not prove at what time he had been in contact with the fatal

asbestos fiber that caused his disease. The determination of this moment was crucial for the case since Cijsouw had worked for the defendant firm for several years, but initially the employer could not have known that it was necessary to take measures to protect his employee against mesothelioma and thus could not be liable for the injury. The Supreme Court once more shifted the risk of uncertainty concerning causation to the enterprise by holding that it was presumed that the employee had been in contact with the asbestos fiber that caused his death during the later period of his employment with the defendant.[7] This presumption could have been rebutted if the defendant had been able to prove that it was not during the later period of their employing Cijsouw that the latter was in contact with the fatal fiber.[8] Like with the DES example, the burden that was shifted to the defendant was nearly impossible to meet.

In the third example, *Nefalit v. Erven Karamus*,[9] Mr. Karamus had worked with asbestos for many years in the factory of Nefalit. Almost 20 years after he stopped working, he was diagnosed with lung cancer and subsequently died. His heirs asserted that Nefalit was liable for the cancer because it had taken too few precautions to protect Karamus. Nefalit countered by claiming that the fact that Karamus smoked for 28 years was the cause of the cancer. The district court appointed an expert, who assessed—on the basis of epidemiological data and a calculation model—that the probability that the asbestos had caused the lung cancer was 55%, and therefore the court ordered Nefalit to pay 55% of the losses. The Court of Appeals confirmed this ruling. The Supreme Court, however, argued that despite the expert evidence it was not possible to prove to what extent both factors contributed to the disease, and that the liability of the employer should be reduced by the extent to which the employee contributed to the loss. The result was proportional sharing of the loss between employer and employee.

In the first two cases, there were no expert issues associated with the decision to shift the burden of proof to the enterprise. This eradicated the issues raised in Chapter 4, *Causation in Epidemiology and Law* with regard to the admissibility and probative value of the expert opinion, since the burden was largely insurmountable. In the third case, causal attribution and losses were apportioned between the claimant and the employer.

Causal uncertainty is an important issue routinely encountered by courts outside of the Netherlands, of course. Chapter 1, *Legal Considerations of Forensic Applications of Epidemiology in the United States* and Chapter 2, *Epidemiologic Evidence in Toxic Torts* of this book describe how courts in the United States have historically handled uncertainty and how expert epidemiologic testimony can throw light on disputed issues of causality. Examples from the legal systems of other countries are abundant; causal uncertainty played a major role in the famous British Sellafield case, where an English court had to decide on the causal relationship between childhood leukemia and the nearby presence of a nuclear power plant at Sellafield.[10] Similarly, Belgian courts have been confronted with the question of whether the physical complaints of inhabitants of the community of Mellery in the Walloon Region were caused by emissions from a nearby waste site.[11]

In the preceding cases the critical question concerned how the law should approach with causal uncertainty. One general agreement in all courts relates to the liability rule described earlier, which dictates that no liability is incurred for the background risk that preexisted the harmful exposure, but that the only liability is for the excess risk created by the activity of the injurer.[12] From an economic standpoint liability for the background risk would lead to

"spillage" and thus crushing liability, and would be useless since the investments in the care of the injurer could not reduce the background risk.[13]

The law has to therefore address how the excess risk can be quantified. This can be done by establishing, via epidemiological evidence, the extent to which the risk has been increased by the injurer's activity. Epidemiological evidence can then lead to a probability of causation (PC), which indicates what the probability is that the injurer's activity caused the loss of the victim (see Chapter 3, *Methods Used in Forensic Epidemiologic Analysis* and Chapter 4, *Causation in Epidemiology and Law*). The concept of the PC is well established in radiobiology to establish the likelihood that an employee in, for example, a nuclear power plant contracted a cancer as a result of his work exposure to quantifiable levels of radiation. In 1992, the American National Council on Radiation Protection and Measurements endorsed a PC method to establish whether a certain disease was caused by radiation.[14] On the basis of this method, the American National Institutes of Health issued a statistical guide indicating the PC for certain exposure doses and circumstances.[15] The guideline from the NIH helps illustrate a streamlined example of how epidemiological measures of association can provide quantitative insights into causal uncertainty. As many situations are not nearly as tidy, the following discussion is an explication of four alternative approaches that can be examined for utility in assessing causal uncertainty in a tort.

We assume, in describing these approaches, that expert opinions exist on the likelihood that a certain activity caused certain damage and that an epidemiologic analysis of the attributable fraction under the exposed (see Chapter 3, *Methods Used in Forensic Epidemiologic Analysis*) resulted in a PC. Thus, the expert opinion could assert that, while it is unknown that a certain exposure *did* cause a certain adverse health outcome, it can be reliable that there is a probability, for example, 30, 50, or 70%, that this is the case. The question of interest is how the legal system might deal with causal uncertainty if expert opinion cannot provide it.

Four alternative methods of dealing with this issue are as follows:

1. One could judge that as soon as it is determined that there is any statistically valid probability that an exposure causes an injury that all victims receive 100% compensation of their damage.
2. The complement of the first option is to deny any claim unless there is 100% certainty that the tort caused the injury.
3. Compensation could be awarded only when the probability that the damage was caused by the tort passed a certain threshold of, say, 50%, as described in the first four chapters of this book. This threshold rule is a form of an "all or nothing" approach: if the probability is lower than the threshold, the victim receives no compensation at all; if the probability is higher than the threshold, the victim receives full compensation. This threshold rule is known in the American system as the "more likely than not" solution, referring to the fact that the plaintiff must convince the judge that it is "more likely than not" that the damage was caused by the tort. In the hypothesis of PC of 30%, there would be no liability.
4. The final alternative is to take into account the probability that the tort caused a certain proportion of the observed injury and to award commensurate compensation based on the PC. In the hypothetical situation in which a PC is 30%, the victim can then receive compensation for 30% of his losses.

The way the law should deal with causal uncertainty has been addressed extensively in the economic literature, for instance by Rosenberg,[16] Kaye,[17] and Shavell.[18] This literature provides some interesting insights concerning the best approach to dealing with causal uncertainty, relative to the list above.

Alternatives 1 and 2

In the first alternative the victim would be awarded total compensation of damage, even if the probability that the loss was caused by the injurer's activity was relatively low (eg, a PC of 10%). If an injurer is held liable for the full amount even if there was only a 10% probability that his activity caused a loss, it can be argued that this would lead to too few incentives to invest in a socially desirable activity, such as the production of pharmaceuticals (hence, crushing liability).

Landes and Posner also provide an example of this first case.[19] Suppose that a nuclear plant wrongfully emits ionizing radiation into the environment, whereby it is established that an exposure of a certain population to the radiation increases the number of cancer cases over a 20-year period from 100 to 111. The problem is obvious that we do not know which of the 111 persons have incurred the cancer as a result of the presence of the nuclear power plant. For every separate victim, the likelihood of incurring cancer as a result of radiation has been increased by approximately 10%. If we now accepted that any of the 111 victims would be allowed to claim complete compensation of their damage from the injurer, this would not only be inefficient, but also unjust. It would indeed mean that, in 100 out of 111 cases, the injurer would have to pay compensation for damage that it never caused, and that only resulted from the background risk. Landes and Posner argue that in that particular case, if one disregards the administrative costs, the efficient solution would be the one in which each of the victims could only recover a proportion of their loss (ie, alternative 4), equal to the excess risk caused by the activity of the injurer, from the injurer.[20] In this case, that would amount to approximately 10% of the damage.

The example demonstrates that the first alternative is inefficient and unjust. By logical extension we can argue the same is true for the second alternative, in which it would be required that the victim proves with 100% certainty that his damage has been caused by the tort. The requirement would mean that in many cases injurers would escape legal consequences of activities that have created additional risk. Thus, the second alternative would result in underdeterrence. It is only the third and fourth alternatives that lead to a result that could be considered balanced.

Alternative 3

The threshold liability leads to a situation whereby the victim's claim is totally accepted if the probability surpasses the threshold of what is true more than 50% of the time, or on a "more likely than not" basis. If the probability surpasses the threshold, compensation is full, but if the probability is lower than the threshold, the victim receives no compensation at all. Despite the prevalence of this approach in many legal systems, the disadvantages of such a threshold solution are rather obvious. One problem, both from the victim compensation as well as from the deterrence perspective, is that the PC could systematically be lower

than the threshold. For example, we can assume that the PC for a certain cancer being caused by a harmful exposure is 40%. At the threshold of 50% this would mean that the enterprise responsible for the exposure leading to 40% of the disease among the exposed would systematically escape liability. Victims would not be compensated and the incentives toward accident reduction would be too low.[21] The result is both inefficient and arguably unjust, since it cannot be denied that the enterprise created certain losses. If we assume that 100 exposed cancer victims from the example file a lawsuit, then 40 out of the 100 cancer cases would have been caused by the emissions emanating from the particular enterprise. Yet, since for every individual the PC would be below the 50% threshold, the enterprise would not be held to compensate the victims in any of these cases.

In practice, the outcome may be more nuanced because the PC may differ between subgroups of victims. Confounding and effect modifying factors such as age, gender, habits (smoking, drinking, diet, exercise), the dose of the exposure (eg, the distance between the source of radiation and the location where the victim lives) may affect the PC per plaintiff. Therefore it is perfectly possible that the PC of some victims exceeds the threshold while the PC of others falls short of it. This approach would hold the enterprise liable in some cases, but not necessarily in all cases where the activity indeed was the cause of the damage.

Alternative 4

The alternative to the threshold approach is the proportional award approach. Applied to the prior example this would mean that if the probability that the victim's damage was caused by the injurer's activity was 40%, the victim would be compensated for 40% of his losses. From an economic perspective, the advantage of this proportional liability is that it exposes the injurer precisely to the excess risk (in this case the additional number of cancer cases) that was caused by the (assumed wrongful) activity of the injurer in each case, provided that all potential injurers and all victims are present in the tort case. The enterprise will then, returning to the previous example, have to compensate 40% of all the damage of every particular victim, which amounts at the aggregate level to the same as compensating 40 out of 100 victims whose illness would have been caused by the enterprise.[22] This approach also accounts for the fact that the PC may differ between subgroups.

The result of the proportional liability approach is that the injurer will receive optimal incentives for prevention, since he is precisely exposed to liability for the risk, which was caused by his activity.[23] A proportional liability rule therefore provides optimal incentives for injury reduction.[24]

There are, of course, several caveats that accompany the proportional liability approach. One caveat is that in the examples we so far assumed that the expert can always make some kind of assessment of the PC. In practice, however, in some cases it can be extremely difficult to make an accurate assessment of probabilities that a certain activity may cause certain damage. Some argue that the PC approach is something like a lottery.[25] It is reasonable to argue that one should not expect too much of statistical evidence, and further that reasonable epidemiologists can disagree about the magnitude of an association that is used for a basis of a PC. Such difficulties will always be present when causation is uncertain, however, regardless of methods. The fact that one cannot rely on the myth of scientific *certainty*

should not be an argument in favor of the unbalanced alternatives described above (alternatives 1 and 2).

The choice between the threshold or the proportional liability approach is one that is disconnected from the expert's process of estimating a PC. The question of interest is how the law should deal with the estimate. We posit that the proportional approach is a better and more balanced alternative to the all or nothing approach associated with the threshold rule.

A second caveat is that a proportional liability rule may incur higher administrative costs than a threshold rule. A threshold rule rules out many liability claims, whereas in case of a proportional liability rule, even the smallest probability could in theory lead to a claim. However, this argument of administrative costs could be an argument in favor of a threshold that is applicable to the proportional liability approach, for example, 10% PC under which no compensation is paid at all and the application of the proportional liability rule only to cases above the threshold. One could equally make the argument that in cases where the PC is, for example, 90%, the claimant receives 100% compensation.

The proportional liability rule has been defended by several American scholars and is also defended in the economic analysis of law.[26] The discussions have noted that an advantage of the approach is that the negative consequences of causal uncertainty are limited, and that a proportional liability rule is less rigorous than the all or nothing threshold approach.[27] The proportional liability rule would indeed mean that all victims (possibly with the exception of those with a very low PC) can claim a proportion of their damage equal to the amount by which the defendant contributed to the loss. Thus the exposure to liability of the enterprise corresponds only with the amount to which it contributed to the risk.[28] This proportional liability rule could, more particularly in cases of product liability, take the form of the market share liability.[29]

THE ROLE OF THE FORENSIC EPIDEMIOLOGIST AS AN EXPERT

So far, we have only lightly touched on the role of the epidemiologist as an expert in addressing causal uncertainty. We now turn to the specific role that the expert could play in that respect.

A first question that one could raise is why an epidemiologist should at all be involved as an expert in assisting the court in solving issues of causal uncertainty. Chapters 1, 2 and 4 of this book have already answered this question rather exhaustively. There are, however, several economic arguments to support such involvement as well. First is the superior knowledge that the qualified epidemiological expert possesses in the evaluation of health risk. The epidemiologist can therefore obtain and process information at lower cost than the parties or Court. An argument can therefore be made that involving an epidemiological expert can lower information costs. Since the economic goal of tort law is to minimize the *total* injury costs (thus including administrative costs) this seems a desirable effect.[30]

Further, by dint of training and experience, the forensic epidemiological expert can provide better quality and more reliable information on causality than the parties or Court. Involvement of an epidemiologist can hence guarantee that issues of causation and more particularly epidemiological questions can be answered in such a way that damages will

be more accurately attributed to the injurer. Hence, involving the epidemiological expert better allows tort law to reach its goal of prevention by better exposing the injurer to the amount of damages that corresponds with his contribution to the accident risk. When asked why the epidemiological expert would be better able than the parties involved or the judge to provide information necessary to let tort law function optimally, the reason is the specialized education and studies followed by the epidemiologist expert, including, for the forensic epidemiologist, unique applications designed to assess questions relating to causal uncertainty applicable to individual circumstances (see the applications of FE described in Part III *Applications of Forensic Epidemiology* of this book for examples). Such an expert is undoubtedly better informed than the court of relevant insights and the latest developments in his area of expertise.

Since a forensic epidemiologist is regularly confronted with similar questions (eg, related to the calculation of a PC), he enjoys the advantage of the experience that benefits the *repeat player*.[31] Being a repeat player he can use prior experience to obtain accurate information more quickly and hence at lower cost than a less experienced expert or a fact-finder. Judges in most legal systems are not specialized, and even if they cannot be expected to have the degree of requisite knowledge and expertise to investigate complex issues relating to epidemiology and causality. From a social perspective one cannot expect a judge to make the educational and time investment that would provide him with the ability to assess the likelihood that a tortious act was a cause of a specified injury. The socially preferable solution is to use the experience and expertize of the forensic epidemiologist who will be able to answer particular questions at relatively low costs, and can hence inform the judge. It is, in other words, the simple economics of labor specialization that explains why it makes sense to use experts in complex cases involving causal uncertainty.

A third advantage can be obtained if an *independent* expert is used. A potential problem with the expert information provided by the parties involved in the tort case is that they have, to a large extent, opposing interests.[32] The victim has an incentive to overstate the likelihood that his injury was caused by the tortious act, and the injurer has an incentive to argue that there is no evidence that the tortious act is related to the claimed damage. An independent court-appointed expert can focus entirely on the question of how the causation issue in the specific case should be assessed as adequately and in the most balanced manner possible. He is not exposed to strategic considerations providing incentives to increase or reduce the probability that the tortious act was causally related to the damage. This option is rarely available in US courts, but is common in European venues.

Some legal scholars have pointed to disadvantages of involving an expert. Meadow and Sunstein have argued that, rather than relying on an expert's impression of the scientific evidence, a judge should rather rely on purely statistical information in cases of, for example, medical malpractice.[33] The suggestion ignores the fact that experts in epidemiology typically compiled the statistics in the first place, and that the determination of whether the statistical information can be validly applied to the unique circumstances of an individual case requires the expert assessment of all the facts and how they fit within what has been previously described. Indeed, this task is precisely the kind of analysis that is described in the latter chapters in this text, in which data are accessed and analyzed *ad hoc* for the unique circumstances of a case as part of a forensic epidemiologic analysis.

IS THE EXPERT ALWAYS AN EXPERT?

There is substantial empirical evidence, as well a common experience, that experts, like all people, are subject to various types of bias. The most common bias from which experts suffer is a too large of trust in their own expertize; ie, overconfidence. In one study of this form of bias it was demonstrated that experts had largely overestimated the precision with which they could predict the likelihood of a meltdown of the nuclear core in a nuclear installation. In another study it was demonstrated that experts showed an irresponsibly large trust in the stability of the Teton Dam based on their personal assessments, notwithstanding a number of problems that had occurred during the construction of the dam. The Teton Dam collapsed in 1976.[34]

Slovic and others point to several factors that may cause experts to underestimate specific risks, including:

- The failure to recognize that human failure can largely influence the effectiveness of technological systems. The authors cite to the nuclear incident at Three Mile Island, where operators repeatedly wrongly assessed problems with the nuclear reactor and failed to intervene in time.
- The underestimation of the integral functioning of technological systems. The authors cite to the failure of engineers to discover that the reason for the failure of the DC-10 after its first flights was a decompression in the cargo part of the plane which led to a destruction of vital control systems.

Translating these technology-related failures to epidemiological terms, in both of the cases described above there were multiple concurrent causes of the problem that were incompletely investigated. The advantage held by experts is that they have more technical knowledge than the parties or the Court. This advantage can be abused to the benefit of the expert. Parker stresses this problem in a detailed study concerning the American rules related to the admissibility of scientific evidence.[35] His reasoning applies to the role of epidemiological experts in the assessment of causal uncertainty. Producing information creates costs for parties and thus profit for those supplying the information. By involving experts in the assessment of causal uncertainty an interest group is created, which can try to serve its own interests, even if these interests do not necessarily match with those of the parties involved or the Court. Parker holds that the goal of procedural law is to exclude these so-called "public choice" problems as much as possible from the civil trial. One way of doing this is by organizing the system in such a way that only the parties involved have an interest in the outcome of the case.[36] However, the expanding scope of liability and increasing amounts of compensation lead to increasing "returns on litigation." This means that parties are incentivized to rely on experts in order to increase their likelihood of a positive outcome in the case.[37]

Another source in expert error is in the systematic over- or underestimation of probabilities associated with a set of facts, or the lack of calibration. As an example, physicians commonly overestimate the survival probability for a patient with cancer. In part the error stems from the fact that experts often base probabilities theoretical models containing subjective assumptions, and in some cases the expert assumptions are no more accurate than assumptions made by non-experts. Appropriately performed epidemiologic investigation, following the

methods described in Chapter 3, *Methods Used in Forensic Epidemiologic Analysis* are inherently less susceptible to errors of calibration.

Empirical evidence shows that judges are skeptical concerning the results of an investigation by experts when the experts have been hired by the parties involved. On the other hand, empirical evidence also shows that judges often have difficulties in understanding what can be complex and technical testimony provided by experts.[38] Another potential issue is that an expert with an impressive curriculum vitae is more likely to be given credence by the Court than a lesser credentialed but still qualified expert. This can lead to a situation in which the judge believes the testimony provided by the expert, not because of the credibility of the testimony as such, but because it is delivered by the particular expert.[39]

Tomlin and Cooper show that in court cases there is the danger of the following downward spiral: when one party would involve an expert who would, for example, make an objective and correct assessment of causal uncertainty, for example, for the victim, there is a danger that this party loses if the defendant in the same case would use an expert who would subjectively understate the likelihood that the damage of the victim was caused by the defendant. If both parties mutually expect that subjective information concerning the PC will be presented, this leads to a type of prisoner's dilemma, whereby one party cannot afford to "bid" less than the other party with regard to exaggeration of claims. Failure to engage in symmetrical exaggeration on the part of the party that provides objective information could result in losing the case unfairly.[40] The situation can result in a system whereby exaggerations by both parties (and their experts) are not only structurally possible, but neither party has sufficient incentive to provide any objective and accurate information. Like any expert, the forensic epidemiologist is not excluded from this potential conflict of interest. Although he may follow an evidence-based or data-driven approach, bias may still be present in his interpretation and presentation of this information. Conversely, a fair analysis of data should be reproducible and thus verifiable, and carries with it a greater degree of reliability than strictly medical opinions regarding causality.

What cannot be denied is that more wealthy parties (typically the enterprise versus the victim) can hire the most expensive experts, and more of them. While more expensive experts are often (but not always) better qualified and often (but not always) more experienced than less expensive experts, they may also be incentivized to provide an analysis that is favorable to the retaining party.

A problem that has been extensively dealt with in the literature concerns the fact that merely by being paid by one of the parties, the quality of the opinion provided by the expert can change. In the words of Mandel: "money changes everything."[41] This may be especially problematic in cases where no scientific certainty exists yet and hence differences of opinion may exist. This could lead a party to hire an epidemiologist of whom it is known (eg, through his publications) that he has a favorable view on the position defended by that particular party.

In the words of Sales and Shuman:

> There is a great deal of skepticism about expert evaluation. It is well known that expert witnesses are often paid very handsome fees, and common sense suggests that a financial stake can influence an expert's testimony, especially when it is technical and esoteric and hence difficult to refute in terms intelligible to judges and jurors. More policing of expert witnessing is required, not less.[42]

Other literature points to the fact that, assuming an independent expert tries to provide his opinion in an honest and objective way, the attorney acting for the party is only obligated to get the client the desired result. In those cases where differences of opinion may exist and answers are not always clear cut, there may be pressure on the expert to provide testimony that is more favorable to the position of the party who hired him.[43]

The question arises as to whether the fact that experts are hired by adverse parties necessarily jeopardizes epidemiological risk calculations. Tomlin and Cooper hold the somewhat jaundiced view that as long as both sides exaggerate in the same way and the judge subsequently chooses an average position, the outcome may be approximately right.[44] An example, taken from economic experts, illustrates the point. If the actual damage is known to be €100,000, and the expert for the plaintiff estimates the damage at €150,000 and the expert for the defendant at €50,000, there should not necessarily be a problem as long as the judge assumes that the truth is exactly between the two values, and uses €100,000 for the damage. The same principle could be applied to epidemiological measures. However, an important assumption in this example is that the amount to which both sides exaggerate their estimation is equal and that the Court is aware of this. The assumption is not necessarily realistic, however, and may lead to the Middle Ground Fallacy described in Chapter 14, *Medical Negligence Investigation* in which the error rate of two divergent opinions is grossly unequal, and thus using the mid-point between the two opinion is unfairly favors the party with the most exaggerated claim.

REMEDIES

The Judge as "Gatekeeper"

In the United States, an important task is awarded to the judge to verify the reliability of information provided by (party) experts in Federal Rule 702 that reads:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify there too in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

This Rule 702 followed inter alia a 1993 Supreme Court decision in the case *Daubert v. Merrell Dow Pharmaceuticals* (see Chapter 1, *Legal Considerations of Forensic Applications of Epidemiology in the United States* and Chapter 2, *Epidemiologic Evidence in Toxic Torts*).[45] The decision requires the trial judge to verify whether the reasoning followed by the expert as well as the applied methodology are scientifically sound. The judge equally has to verify whether the expert's reasoning and method could also be adequately applied to the facts in the case.[46] On the basis of the Daubert ruling it is hence held that the judge has a role as the evidence "gatekeeper." The process of gatekeeping consists of verifying on the basis of the *Federal Rules of Evidence* and the case law of the Supreme Court whether the reasoning and method followed by the expert was appropriate and a fit for the facts of the particular case. In the American procedural context the judge is mainly considered as a "gatekeeper" since he is the "gate" through which the evidence reaches the jury. However, the criteria

for admissibility of expert testimony developed in the United States in this context are also relevant when the judge has to verify the admissibility of expert testimony in a civil law context in the case.

The core of the American case law on evidence and the legal doctrine that has been developed from it holds that an important task lies with the judiciary to verify whether the information provided by the expert has been obtained according to appropriate scientific standards and methods and whether it is useful to answer relevant questions. This task is considered especially important when party appointed witnesses are used. The result of this verification by the judge could be that the judge would exclude expert testimony that does not meet these criteria. This would in turn provide the parties (and their experts) an incentive to strive for more objectivity when providing expert testimony to the courts. Tomlin and Cooper, however, show that in practice it is often difficult to reach this rather idealistic goal. Research indicates that 48% of the judges in state courts are of the opinion that they are not adequately prepared to assess the quality of what is often very complex and diverse expert testimony that is presented to them.[47]

That judges are, in some cases, quite capable of examining the quality of expert testimony in a critical way is seen in the interesting case *In Re Silica*.[48] In this case the district court in Texas declared expert testimony inadmissible because the expert had not followed applicable scientific standards.[49] The case dealt with a mass tort claim whereby experts would have established that 9000 plaintiffs suffered from silicosis. The Court, however, established that it was not the clinical experts, but rather the lawyers who had determined the criteria by which the diagnosis of silicosis would be established. Moreover, it appeared that most of the plaintiffs had never seen the medical expert who was providing the diagnosis, and that the experts had only examined files. Discovery in the case turned up the fact that the experts reviewed and verified 75 files per day, taking, on average, 4 min per file in order to arrive at the diagnosis of silicosis. The Court held that within the medical profession there are specific scientific criteria that have to be followed to arrive to a diagnosis of silicosis, and the criteria had not been followed in the case.[50] The Court further held that the medical experts never considered the victims as patients, but merely as clients of the lawyer. The district court concluded that it was financial motives that were the reason for the specious methods followed by the experts. The case served as an excellent demonstration that when experts clearly violate a professional and ethical norm, it is not difficult for the judge to reject the testimony.

Posner points to the fact that a second control mechanism for expert methods consists of the fact that even partisan experts should have an interest in following minimal scientific and methodological standards for the simple reason is that if they do not, their expert testimony will be declared inadmissible.[51]

Finally, one can also point at the fact that an expert can be a *repeat player*. As such he can therefore have a reputational motive to provide objective expert testimony. With epidemiologic experts the expert is often also academically active, publishing scientific papers, and maintaining a reputation for scientific integrity in his or her work. It would be highly problematic for an epidemiologist to proffer an opinion as an expert witness that differed with what he had previously asserted in academic publications.[52] Thornton and Ward argue that the market provides incentives to experts to strive at least for a minimum quality in their expert testimony work. When, for example, economists provide expert testimony on lost earnings and it appears that their estimations vary depending upon the retaining party;

this can quickly jeopardize the reliability of that expert in the eyes of the Court.[53] Ideally, market forces should therefore lead experts not merely to say what their clients and clients' lawyers want to hear. In some European courts, court-appointed experts are selected from a predetermined list. To some extent this fact can provide incentives to experts for providing more objective testimony.[54]

Self-Regulation/Certification

The economic theory of regulation as well as the sociology of professions has shown that professional groups will always strive to obtain protection for their professions. When possible they will strive for a protection of their title and for a monopoly on certain services, usually supported by (self-) regulation. The economic argument to support self-regulation has always been the information asymmetry: experts themselves would have excellent information on the quality of the services they provide, but the parties who use those services (either lawyers or the judge) would not be able to sufficiently control the quality of the services.[55] These are the types of arguments that one will often hear from the experts themselves, for example, to defend the mandatory membership of an association in order to be able to call oneself an "expert." Economists warn of the danger of when membership of such an organization becomes a precondition for exercising the profession, the remedy (limitation of competition) is often worse than the disease (information asymmetry). The well-known consequences of concentration on the market may emerge: agreements on prices and price increases can be the result. Minimum standards on quality could be agreed upon, but the experience with the (self-) regulation in other professions shows that they often have few incentives to strive for a high quality.[56] The problem is less of an issue in the practice of forensic epidemiology, mainly because it is a relatively new discipline. Nevertheless a warning here is justified.

It is interesting to notice that also experts active in the domain of assessing personal injury may have the tendency to strive for a recognition, mandatory membership of an organization, and certification. For example, an expert in the Netherlands was noted to have complained about the fact that being an expert in the Netherlands is to a large extent unprotected and hence in principle anyone can call himself a "traffic accident expert."[57] The tendency exists to require membership of a certain professional organization of experts as a quality label. This may create the danger of monopoly to the extent that only those experts would be considered as having the necessary quality. This has occurred in the Netherlands, where there is an institute of "register experts,"[58] as well as in Belgium.[59] From an economic perspective, one should appraise such professional associations with caution. Here, the well-known advice of Adam Smith applies; that when merchants come together the danger always exists that they will use the occasion to make agreements that increase their personal benefit to the detriment of social welfare.[60]

The same concern applies to the practice in many countries to work with the so-called lists of experts. Such lists may be relied upon by courts for appointed experts, or they may be used to bolster the credibility of a party-appointed expert. In some cases, the criteria by which an expert is included on a list is unclear, one is registered on such a list of experts. To the extent that list inclusion is not solely related to professional qualifications and experience, but also being known to the judiciary this may be problematic. Moreover, even if the list only contains

experts of high quality, working only with experts from such a list is already problematic in the sense that it excludes competition. Being on the list then in fact creates a property right that may again increase prices. The list then effectively creates a barrier to entry for new (equally good or perhaps better) experts who enter the market and would not be on the list yet. To the extent that courts use such lists they should thus be sufficiently dynamic to accommodate a changing environment, having free entry, and not be exclusive in the sense that others who equally provide reliable and objective expert testimony should not be allowed and welcomed by the courts as well.

In sum, one has to realize that the danger that a (party-appointed) epidemiological expert will not always serve in all objectivity the public interest should not necessarily be an argument to remedy this danger with the potentially more risky remedy of a restriction of competition (via certification). Other, more proportional, remedies, such as a control by the judge of the testimony provided by party-appointed experts and some of the other remedies discussed below seem more appropriate.

Standardization

Another remedy to consider is standardization of the way in which the expert performs research and analysis, and thus arrives at opinions. The advantage of such standards is that the judge can *ex post* verify whether the examination by the expert has been carried out according to the established professional and scientific standards. This of course supposes that these rules are made explicit in a public standardization. This proposal has received support in the literature. Mandel is in favor of laying down ethical standards for experts.[61] Also Posner indicates that it should be possible for the judge to verify whether the expert testimony corresponds with the methodological standards applicable to the particular profession.[62] This would according to Posner allow excluding "junk science" and could serve as an admissibility test of expert evidence.

Although epidemiology has developed standards on how to conduct scientific research, this text is the first attempt to summarize the methods employed in the reliable application of forensic epidemiology methods to a wide variety of issues involving causal uncertainty.

Court-Appointed Experts

Elliott discusses the problem that the legal system typically considers all experts equal. Hence, it remains difficult for a court to distinguish good from bad information. The fact may provide parties incentives to hire experts of whom it is known that they represent extreme points of view.[63] As a possible solution Elliott suggests that less use be made of party-appointed experts and more of experts appointed by the courts or employed by government.[64] Schwartz is critical of Elliott's suggestion, noting that he has a too rosy view of what experts are able to do.

An argument in favor of court-appointed experts instead of party experts is that party-appointed experts commonly provide diametrically opposing opinions. This contretemps may lead to a costly search for information that may not provide any additional clarity. The situation raises the danger that the court would resolve the contradiction by rejecting the testimony of either party-appointed experts as they are perceived as unreliable and therefore

not useful.[65] Such a judicial reaction ignores the very real possibility that one expert is correct and the other is not.

Posner provides support for a court-appointed expert, but proposes a model that is sometimes used in cases of arbitration.[66] The model he proposes is the one whereby two party-appointed experts would together decide to appoint a third independent expert. The latter would then have the task to increase the reliability of the expert testimony provided, but also to "translate" the expert evidence for the judge. In this respect it is correctly noted that the mere fact that parties have appointed their own expert is as such not necessarily a reason for the judge to appoint a court expert. The court expert should hence not be seen as a "super expert" who should do better than the party-appointed experts, but rather as someone who can intervene to increase the reliability of the expert evidence when the information provided by the party-appointed experts diverges too strongly; a mediator of sorts.

Capacity Building of the Judiciary

From the prior discussion, it is clear that interpreting evidence that is provided by an epidemiological expert can pose difficulties for the Court in some cases. The kind of standardization of methods provided by this text is helpful, however, as it allows the Court to, at a minimum, assess whether the analysis took place according to professional standards and norms. Judges who perform frequent reviews of epidemiologic testimony would benefit from education concerning the methods of the discipline. It is for this reason that the School of Law at Maastricht University, the Netherlands offers courses in basic forensic epidemiology for the judiciary (www.forensicepidemiology.nl).

Peer Review

Peer review is a possible solution to the problem of biased and/or low-quality expert opinions as well.[67] If a panel of peers of the expert could provide expert review of the methods and opinions of the expert and draw the conclusion that the methods are reliable and the opinions sound, this could offer the Court some assurance that the evidence is reliable. The process does not have to be an onerous experience for the expert, as deficiencies that may be identified in the peer review process could be addressed and rereviewed.

CONCLUDING REMARKS

We began this chapter by stressing the fact that causal uncertainty can be reliably addressed via an estimate of the PC following a methodologically sound forensic epidemiological analysis. If the PC is determined to be appropriately assessed, then the Court can use the information by applying a proportional liability or causal threshold approach.

Economic research indicates that from a theoretical perspective the use of party-appointed experts is not necessarily problematic. The mere fact that an expert is handsomely paid by one of the parties does not allow for the inference that the expert will serve the interests of that client and his lawyer in an exaggerated or dishonest way. If such a thing does occur there are market-based correction mechanisms that may work to remedy the problem. The fact that

many epidemiologic experts are not only repeat players as experts (and thus have an interest in representing consistent opinions in varying capacities), but equally have other capacities (eg, in an academic setting) provides incentives to the expert to not solely serve the interests of the client. In addition, the Court may sanction expert evidence that clearly violates professional standards either by excluding the evidence, or the Court may choose to appoint its own expert.

ENDNOTES

1. *See* Shavell, S., 1987. Economic analysis of accident law, 108; a similar point is made by Trebilcock, M.J., 1987. The social insurance – deterrence dilemma of modern North American tort law: a Canadian perspective on the liability insurance crisis. San Diego Law Review (24), 929–1002.
2. *See* on this topic also the many publications of Akkermans and more particularly his dissertation A. Akkermans, 1997. Proportionele aansprakelijkheid bij onzeker causal verband.
3. For an overview of how several European countries, as well as Israel, the United States, and South Africa deal with proportional liability, *see* Gilead, I., Green, M.D., Koch, B.A. (Eds.), 2013. Proportional Liability: Analytical and Comparative Perspectives. De Gruyter, Berlin.
4. For a discussion of alternative causation under German law, *see* Köndgen, J., 1991. Multiple causation and joint tortfeasors pollution cases according to German law. In: van Dunné, J.M. (Ed.), Transboundary Pollution and Liability, the Case of the River Rhine, pp. 99–106, and the interesting article of Bodewig, Th., 1985. Probleme alternativer Kausalität bei Massenschäden. Archiv für die civilistische Praxis (AcP), 505–558.
5. Note, however, that the Dutch Supreme Court only considered the causation question. Formally, it still has to be decided whether bringing DES on the market was in itself wrongful. *See* Hoge Raad October 9, 1992, 1994 Nederlandse Jurisprudentie (NJ), 535 (C.J.H.B.). *See* on this case, Spier, J., Wansink, J.H., 1993. Joint and Several Liability of DES Manufacturers: A Dutch Tort Crisis. International Insurance Law Review (IILR), 176–181.
6. So J. Spier in J. Spier (Ed.), 1996. The Limits of Liability, Keeping the Floodgates Shut, pp. 123–124. For a critical economic analysis of joint and several liability, *see* Tietenberg, T.H., 1989. Indivisible toxic torts: the economics of joint and several liability. Land Economics (65), 305–319 and *see* below 3B.
7. Spier, J. (*supra* note 6), 124–125.
8. Hoge Raad 25 June 1993, 1993 NJ, 686.
9. Hoge Raad 31 March 2006, 2011 NJ, 250.
10. Gardner, M., 1990. Results of a case–control study of leukemia and lymphoma among young people near Sellafield nuclear plant in West Cumbria. British Medical Journal, 423–434.
11. For a discussion of that case see Lavrysen, L., 1995. Judicial responses in the nineties to Dutch (and German) shipments of waste to Belgium in the eighties. Maastricht Journal of European and Comparative Law (MJ), 219–243.
12. *See* Bergkamp, L., 2001. Liability and Environment, 287–289.
13. Rosenberg D. (*supra* note 16), 865–866.
14. National Council of Radiation, protection and measurement statements no. 7, September 30, 1992; *see also* Bond, V., 1981. The cancer risk attributable to radiation exposure: some practical problems. Health Physics, 108–111.
15. *See* on these tables also Ketchum, L., 1985. Epidemiologic tables. Law groundwork for future radiogenic cancer claims. The Journal of Nuclear Medicine, 967–972.
16. Rosenberg, D., 1984. The causal connection in mass exposure cases: 'public law' vision of the tort system, Harvard Law Review (HLR), 851–929.
17. Kaye, D., 1982. The limits of the preponderance of the evidence standard: justifiably naked statistical evidence and multiple causation. American Bar Foundation Research Journal, 487–516 and *see* Gold, S., 1986. Causation in toxic torts: burdens of proof, standards of persuasion, and statistical evidence. Yale Law Journal (YLJ), 376–402.
18. Shavell, S., 1985. Uncertainty over causation and the determination of civil liability. Journal of Law and Economic (JLE), 587–609.
19. *See* Landes, W., Posner, R., 1983. Causation in tort law: an economic approach. Journal of Legal Studies (JLS), 109–134 and Landes, W., Posner, R., 1987. The Economic Structure of Tort, 242.

20. Landes, W., Posner, R. (*supra* note 19), 124.
21. Shavell, S. (*supra* note 1), 115.
22. So Shavell, S. (*supra* note 1), 116.
23. So Bergkamp, L. (*supra* note 12), 290–291.
24. *See* this discussion on proportional liability Makdisi, J., 1989. Proportional liability: a comprehensive rule to apportion tort damages based on probability. North Carolina Law Review, 1063; Landes, W., Posner, R., 1984. Tort law as a regulatory regime for catastrophic personal injuries. JLS, 417–434 and Robinson, G., 1985. Probabilistic causation and compensation for tortuous risk. JLS, 797–798. For a discussion of the possible legal foundations of a proportional liability rule see Akkermans, A.J., 1997. Grondslagen voor proportionele aansprakelijkheid bij onzeker causaal verband. In: van Boom, W.H., Jansen, C.E.C., Linssen, J.G.A. (Eds.), Tussen 'Alles' en 'Niets'. Van toedeling naar verdeling van nadeel, 105–115.
25. *See* Estep, E. (*supra* note 9), 259–304. Very reluctant toward accepting statistical evidence in trials is also Tribe (Tribe, L., 1971. Trial by mathematics: precision and ritual in the legal process. HLR, 1329–1393), who argues: "mathematical evidence is more misleading than helpful."
26. Rosenberg, D. (*supra* note 16), 851–929; Shavell, S. (*supra* note 18), 587–609. Also the Dutch Attorney General Hartkamp defended a market share liability in the DES case ([1992] Tijdschrift voor Consumentenrecht (TvC), 241–258). In addition Spier pleaded in favor of a proportional liability for latent diseases in his inauguration address (Spier, J., 1990. Sluipende schade), as did Akkermans, A. (*supra* note 224) in his dissertation.
27. *See* Brüggemeier, G., 1991. Liability for Water Pollution under German Law: Fault or Strict Liability. In: van Dunné, J. (Ed.), Transboundary Pollution and Liability: the Case of the River Rhine, 88–91.
28. Robinson, G., 1985. Probabilistic causation and compensation for tortuous risk. JLS, 798.
29. *See also* Widmer, P., 2000. Causation under Swiss Law. In: Spier, J. (Ed.), Unification of Tort Law: Causation, 112–113.
30. Calabresi, G., 1977. The Costs of Accidents. A Legal and Economic Analysis, fifth printing. Yale University Press, New Haven, 24 ff.
31. Galanter, M., 1974. Why the 'haves' come out ahead: speculations on the limits of legal change. Law and Society Review (9).
32. This is to a large extent also due to the adversarial trial. Thus it is often forgotten that in a way parties also have concurring interests, being that the case is handled quickly and at relatively low costs.
33. Meadow, W. and Sunstein, C.R., 2001. Statistics, not experts. Duke Law Journal (51), 629–646.
34. For a summary of these studies, *see* Slovic, P., Fischoff, B. and Lichtenstein, S., 2000. Rating the risks. In: Slovic, B. (Ed.), The Perception of Risk, Earthscan, London, pp. 109–110.
35. Parker, J.S., 1995. Daubert's debut: the supreme court, the economics of scientific evidence, and the adversarial system. Supreme Court Economic Review (4), 1–56.
36. Parker 1995, 37, *supra* note 35.
37. Parker 1995, 35, *supra* note 35.
38. *See* Tomlin, J.T., Cooper, D., 2006. When should judges appoint experts?: A law and economics perspective. Bepress Legal Series (Working Paper 1699). http://law.bepress.com/expresso/eps/1699, p. 10.
39. *See* Sarvadi, D.G., Blackwood, A.L., May/June 2007. Expert testimony in the silica-cases: the fallacy of scientific objectivity – some observations. Journal of Chemical Health & Safety, 34.
40. Tomlin, J.T., Cooper, D., 2007. Expert testimony, technical advisors, and the determination of damages. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=902434, p. 11.
41. Mandel 1999, 113, *supra* note 1.
42. Sales, B.D., Shuman, D.W., 2005. Experts in Court. Reconciling Law, Science, and Professional Knowledge, American Psychological Association, Washington, pp. 6–7.
43. In the words of Thornton and Ward: "This tends to create strong if sometimes subtle pressure upon the economist to directly or indirectly advocate the position of the side that has hired him." Thornton, R., Ward, J., 1999. The economist in tort litigation. Journal of Economic Perspectives (13), 101–112, at 106.
44. Tomlin and Cooper 2006, 11, *supra* note 38.
45. 113 S Ct 2786 (1993).
46. *See* on this Daubert case law and the subsequent Supreme Court case law also "Reliable Evaluation of Expert Testimony" (note) (116), Harvard Law Review 2002–2003, 2142–2163 and Werden.
47. Tomlin and Cooper 2006, 5, *supra* note 38.

48. *In Re Silica Products Liability Litigation*, no. 2:05-CV-00121 (S.D. Tex. 30 June, 2005).
49. *See* for a discussion of this interesting case Sarvadi and Blackwood 2007, *supra* note 39.
50. These were based inter alia on an X-ray of the chest, a prior history of exposure to silica and the exclusion of other possible sources of the disease.
51. Posner, R.A., 1999. The law and economics of the economic expert witness. Journal of Economic Perspectives (13), 94–95.
52. Posner 1999, 94, *supra* note 51.
53. Thornton and Ward 1999, 108, *supra* note 43.
54. The use of lists does, however, not go undisputed. To the extent that courts would only appoint experts on the list and not others of equally good quality these lists could lead to an effective monopoly. We will discuss this problem in the next subsection. However, removing a bad expert from a list could provide appropriate incentives to the expert for a higher quality testimony, even when being party appointed.
55. *See* generally on self-regulation Ogus, A.I., 2000. Self-regulation. In: Bouckaert, B., De Geest, G. (Eds.), Encyclopedia of Law and Economics, vol. V, Cheltenham, Edward Elgar, 587–602 and Ogus, A.I., 1995. Rethinking Self-regulation. Oxford Journal of Legal Studies 15, 97–108.
56. *See* the contributions in Faure, M., Finsinger, J., Siegers, J., Van den Bergh, R. (Eds.), 1993. Regulation of Professions: A Law and Economics Approach to the Regulation of Attorneys and Physicians in the U.S., Belgium, the Netherlands, Germany and the U.K. Maklu, Antwerp.
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58. Nederlands Instituut van RegisterExperts (NIVRE).
59. Associatie van Belgische EXperten (ABEX).
60. Smith, A. An Inquiry into the Nature and the Causes of the Wealth of Nations, fifth ed. The Modern Library, New York, reprint 1937, 127–128.
61. Mandel 1999, 119, *supra* note 1.
62. Posner 1999, 94, 95, *supra* note 51.
63. Elliott, E.D., 1989. Toward incentive based procedures: three approaches for regulating scientific evidence. Boston University Law Review (69), 492.
64. Elliott 1989, 501 ff, *supra* note 63.
65. Posner 1999, 93, *supra* note 51. *See also* Lee, T.V., 1988, 484, 488, *supra* note 48.
66. *See* Posner 1999, 96, *supra* note 51.
67. Alemanno, A. Science and Risk Regulation: The Role of Experts in Decision-Making and Judicial Review. In: Vos E. (Ed.), European Risk Governance Its Science, Its Inclusiveness and Its Effectiveness, CONNEX Report Series Nr 06, p. 65 ff.