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Short Communication

Inductive and Deductive Reasoning in Byrom *vs.* Johns Hopkins Bayview Hospital

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Abstract

The status quo that results from medical malpractice litigation is 85,000 medical malpractice lawsuits filed per year, of which 66% are potentially frivolous. There are also 3 million claims but only 85,000 are represented. There is something wrong with this status quo, which prompts questions about traditional decision-making Traditional decision-making is inductive reasoning. Deductive reasoning is hypothesis testing. The objective evidence and the burden of proof are the same in both; except hypothesis testing has a greater level of confidence. The differences are examined in detail. Of the parties involved in dispute resolution, medical experts are essential, medical experts are doctors. Doctors are familiar with hypothesis testing and threats to validity. Doctors, who are medical experts, are duty-bound to be objective. Hypothesis testing best satisfies this duty. Nothing prohibits medical experts from using hypothesis testing when they review a case to arrive at an opinion; although, until now, none do. Yet, as doctors, it is expected of them and they can never be prohibited from doing so. In the final analysis, traditional decision-making subjectively infers a departure from the standard of care; however, hypothesis testing objectively proves it.

Introduction

Decision-making in medical malpractice is either inductive reasoning or deductive reasoning. There is also abductive reasoning, but it is an entirely different subject. Lawyers are trained in inductive reasoning.

There is no better example showing the differences between inductive and deductive reasoning than Byrom versus Johns Hopkins Bayview Hospital. The specific facts in medical records are as follows [1]:

In August 2014, 16-year-old Erica Byrom was 18 weeks pregnant when arriving in Maryland from Liberia to join her adoptive parents. She starts prenatal care, at 23 weeks. Two weeks later, she develops pre-eclampsia, is admitted to Southern Maryland Hospital, and is medevacked to Johns Hopkins Bayview Hospital, which is better equipped for high-risk pregnancies.

Sonograms are consistent with a low amniotic fluid index, absent end-diastolic umbilical artery blood flow, and intrauterine growth restriction, all signs of some chronic intrauterine condition that pre-exists admission.

Pre-eclampsia is progressive. Practitioners tell her that she needs to be delivered either by induction of labor or by cesarean section. If cesarean section is necessary, it would be classical to accommodate a small fetus. A classical section has greater maternal risks. If this is not bad enough, there is a 65% chance that the fetus is neurologically impaired.

She agrees to the induction and steadfastly refuses cesarean section unless her own life is in immediate jeopardy. On October 24th, after 22 hours of induced labor, there is a spontaneous vaginal delivery of a low-birthweight, 670-gram, 26-week, female infant with a 1-minute APGAR of O.

Erica Byrom recovers from the pre-eclampsia and is discharged. Her daughter, Zubida, remains in the NICU and is later found to have cerebral palsy.

From researching medical literature, the background risk for cerebral palsy in the general population of preterm infants

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is 10%. Because practitioners in this case determine that there is a 65% risk of neurologic impairment, there is a 35% chance of no impairment. In this case, the "incident risk" of cerebral palsy in a population of normal fetuses for not performing a cesarean section for fetal indications is 186% greater than the background risk of 10%. The incident risk is 28.6%

Opinions of medical experts establish the standard of care.

The opinions of plaintiff medical experts are the foundation for a certificate of merit. According to them, the standard of care is the duty to do no harm. The duty to do no harm is best served by a cesarean section. When obtaining informed consent, doctors should have coerced the mother into agreeing with a cesarean section.

For every plaintiff medical expert, there is a defense medical expert. They acknowledge a duty to do no harm. A cesarean section does not alter whether the fetus is compromised or not, but it does increase the risks of harm to the mother, who has every right to decide about the cesarean section.

In 2018, four years later, a lawsuit was filed. The statute of limitations is unclear. The trial starts in June 2019.

The plaintiff's attorney uses inductive reasoning and argues that "*more likely than not, at 26 weeks, the fetus is normal prior to birth. If not for the failure to perform a Cesarean section, Zubida Byrom would still be normal.*"

The defense attorney uses inductive reasoning and argues that "*more likely than not, at 26 weeks, the fetus has neurologic injury prior to birth. Even if there is a Cesarean section, Zubida Byrom would still have neurologic injury.*"

On July 1, 2019, the jury returned a $229-million plaintiff verdict [2].

Discussion

As will be shown, the Byrom case ends differently with deductive reasoning. With deductive reasoning, decision-making is different in 2 major respects.

First, inductive reasoning is subjective; deductive reasoning is objective.

In inductive reasoning, the specific facts, which is the medical intervention, are compared to the virtual principle, which is the standard of care. In deductive reasoning, the virtual principle is compared to the specific facts. This assures that the premise of the virtual principle is transparent and is not assumed.

The premise behind this virtual principle is that the duty to do no harm. It begins at the first encounter and ends with the last, which collectively represents 10 distinct duties. These duties run in sequence; once a duty is satisfied, the next duty begins. This is how doctors are trained.

In inductive reasoning, the duty to do no harm stands alone. Hence, inductive reasoning is qualitative.

In deductive reasoning, the duty to do no harm is separated into the 10 duties. Each duty corresponds with a specific phase. The standard of care and the medical intervention are divided into 10 phases. Hence deductive reasoning is objective (Table 1).

Second, inductive reasoning is qualitative; deductive reasoning is quantitative.

By convention, the burden of proof is preponderance of evidence, which corresponds to 50% probability plus a "vague value". At the very least, this burden of proof has a level of confidence of around 51% and a type-1 error of around 49%. The level of confidence is the odds of being right. Type-1 error is the odds of being wrong.

With inductive reasoning, this "vague value" is a "scintilla". The preponderance of the evidence is expressed by the mantra "more likely than not". "More likely than not" is qualitative. The level of confidence is still around 51% and the type-1 error is still around 49%. "More likely than not" is an educated guess.

With deductive reasoning, the "vague value" is a "tangible 45%". Ninety-five percent confidence is quantitative. Conclusions have a level of confidence of 95% and a type-1 error of 5%. This is concrete proof.

With deductive reasoning, the duty to do no harm is expressed as the 10 specific duties.

At trial, there is no doubt of the medical intervention because it is documented in the medical record. The doubt is about the standard of care. In general, the standard of care adjusts to circumstances in order to avoid doing harm. The medical intervention is a facsimile of the standard of care after the adjustment.

Table 1: The 10 phases and their corresponding duties.

1.	**Presentation Phase**- duty to determine all risks that present at the initial encounter.
2.	**Investigation Phase** -duty to perform a complete medical workup, which examines these risks.
3.	**Analytical Phase** – duty to analyze the results from the medical workup to determine their relevance to these risks.
4.	**Diagnostic Phase** – duty to prepare a workable diagnosis or diagnoses that apply to these risks.
5.	**Options Phase** – duty to determine alternative treatments for the diagnosis or diagnoses. Some treatments are more invasive than others.
6.	**Informed Consent Phase** – duty to acknowledge patient autonomy and disclose all risks and complications for the alternative treatments.
7.	**Selection Phase** – duty to recommend the safest most effective treatment from among the alternative treatments.
8.	**Technical Phase** – duty to cautiously manage the selected treatment and to avoid unnecessary risks.
9.	**Recovery Phase** – duty to manage the progress of the technical phase and to avoid and/or to manage any risks that arise afterward.
10.	**Discharge Phase** – duty to identify and to provide follow-up care for any risks that remain at the final encounter.

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In high-risk pregnancies, the standard of care embodies maternal and fetal indications for Cesarean Section. In the Byrom case, the medical intervention embodies only a maternal indication. This occurs from the adjustment to the circumstance of patient autonomy.

Inductive reasoning concludes with this comparison. This one difference, alone, is enough to make an educated guess about a departure from the standard of care.

Deductive reasoning begins with this comparison. When comparing a phase in the standard of care to its counterpart in the medical intervention, if there is no difference, the background risk of a complication, which in this case, is cerebral palsy, is not exceeded. The risk of cerebral palsy from this phase of the medical intervention equals the background risk of 10%.

If there is a difference, the background risk is exceeded. This is the "incident risk". The risk of cerebral palsy from this phase of the medical intervention equals 28.6%.

This demonstrates the quantitative and objective character of deductive reasoning.

These characteristics are absent in inductive reasoning. At trial, the plaintiff's attorney and the plaintiff's medical experts assume that this 26-week fetus is normal before birth. Yet, they never stated their reason for this assumption or their version of the standard of care, which validates their reason. Neither are their reason nor their version of the standard of care challenged by the defense attorney.

At trial, the premise, that underlies the virtual principle, i.e., the standard of care, is opaque because the standard of care is only the duty to do no harm. The one thing assumed about the plaintiff's attorney's version of the standard of care is it includes maternal and fetal indications for cesarean section. The defense attorney agrees.

In deductive reasoning, nothing is assumed. There are 9 other phases in the standard of care. The technical phase is the only phase in which the standard of care differs from the medical intervention. All the other counterparts in the remaining 9 phases are the same.

If the defense attorney uses deductive reasoning, a data sample of 10 phases emerges, which represents the medical intervention. In this data sample, nine phases are 10%, and one, the technical phase, is 28.6%.

Deductive reasoning has a step absent in inductive reasoning- hypothesis testing.

The null hypothesis postulates that "there is no statistically significance difference between the risks of cerebral palsy from standard of care when compared to the medical intervention".

To test the null hypothesis, this data sample is entered into the single sample T-test. The population means a background risk of 10%. The level of significance is 0.05, which corresponds to 95% confidence. The result is the p-value. The p-value is 0.171718.

The *p* - value is greater than the level of significance and the null hypothesis is retained. The medical intervention comports with the standard of care. This decision-making has a level of confidence of 95% and a type-1 error of 5%.

This places the plaintiff's attorney, who uses inductive reasoning, at a distinct disadvantage. To overcome this disadvantage, the plaintiff's attorney must also use deductive reasoning and produce a version of the standard of care to be compared to the medical intervention.

For a medical intervention to depart from the standard of care, the plaintiff's attorney's version of the standard of care must reflect the circumstances of a 26-week fetus, which is no different from any other 26-week fetus. This includes (1) an interpretation phase in which findings of sonograms are misinterpreted as not consistent with chronic intrauterine conditions, (2) a diagnostic phase that misdiagnoses a 26-week fetus as having risk of cerebral palsy no greater than 10%, (3) an informed consent phase that misinforms the mother of a probability no greater than 10% that the fetus will develop cerebral palsy, (4) a selection phase that misdirects the mother into choosing a cesarean section for fetal indication, and (5) a technical phase that is undertaken because of the misperception that a cesarean section for fetal indication will prevent cerebral palsy.

In this case, the background risk is 10% but the incident risk is 100%. The data sample has 5 phases with an incident risk of 100% and 5 phases with a background risk of 10%. With hypothesis testing, the p-value is 0.007478. The p-value is less than the level of significance and the null hypothesis is rejected. There is 95% confidence that the medical intervention departs from the standard of care.

However, the degree of distortion in the phases of the standard of care necessary to reject the null hypothesis crosses the line of absurdity and is transparent.

Conclusion

In the final analysis, deductive reasoning makes it virtually impossible to make a medical intervention, that comports with the standard care, appear as if it departs from the standard of care and vice versa. Also, hypothesis testing supplies 95% confidence. A level of confidence of 95% and a type-1 error of 5% beats a level of confidence of around 51% and a type-1 error of around 49% any day of the week.

As a consequence, on February 2, 2021, the Maryland Court of Special Appeals found: "...the evidence presented at trial was not sufficient to support findings of either negligent treatment or breach of informed consent... We reverse the judgments [3]."

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