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The Arrogance of Certainty: Science, Risk and the Right to Be Wrong

Why we turn hypotheses into dogmas, probabilities into moral judgments and scientific disagreements into personal attacks

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ABSTRACT

Starting from the polarization observed during the COVID-19 pandemic, the author examines how difficult it has become to discuss science without turning it into moral judgment. He argues that we understand risk poorly: the same reduction can seem large in relative terms and small in absolute terms, and knowing a risk does not oblige anyone to accept it, since the decision also depends on personal values. He discusses the provisional nature of scientific knowledge, illustrated by the discovery of Helicobacter pylori, and distinguishes not knowing, being wrong and lying. He contrasts a therapeutic trial under genuine uncertainty with insistence on interventions already refuted, such as hydroxychloroquine in COVID-19, and notes that omission also carries risks. He argues that no single authority should hold absolute power over these decisions and concludes that intellectual maturity lies in accepting that someone may understand the same evidence, choose differently and still deserve respect.

KEYWORDS: *uncertainty; risk communication; evidence-based medicine; scientific consensus; patient autonomy; medical ethics*

During the COVID-19 pandemic, I noticed something that bothered me deeply. It was not only how hard it had become to discuss vaccines, medicines or preventive measures. It was how hard it had become to discuss anything at all without the conversation turning into a moral judgment.

It was enough to raise a doubt about a particular aspect of a vaccine for someone to read it as an anti-vaccine position. Questioning a recommendation could be mistaken for rejecting science as a whole. Investigating a therapeutic hypothesis was sometimes treated as if it were the same as defending its efficacy.

Before long, the question was no longer "what is the evidence?" but "whose side are you on?".

But I began to see that something deeper lay behind this inability to talk. Perhaps the real problem was not vaccination, chloroquine or any other specific controversy. Perhaps it was our difficulty in understanding risk, living with uncertainty and accepting that other people may reach decisions different from ours.

And this is especially curious in medicine, a profession in which practically every decision is made under some degree of uncertainty.

The illusion that we understand risk

We are terrible at understanding probabilities. And I say this including physicians.

Consider a hypothetical treatment capable of reducing the probability of a complication from 2% to 1%.

We can announce that it reduces the risk by 50%. Impressive, isn't it?

But we can present exactly the same result in another way: among a thousand people treated, ten are spared the complication that would have occurred without the treatment, while 990 obtain no such specific benefit.

The effect is the same. The perception changes completely.

A Cochrane systematic review showed that the way risks are presented influences how they are understood and how their benefits are perceived. Relative reductions tend to seem larger and more persuasive than absolute ones.

Now imagine that the treatment also causes a serious adverse effect in one person in a thousand.

Is it worth it?

The answer is not in the numbers alone.

It depends on the severity of the complication we are trying to avoid, the consequences of the adverse effect, the available alternatives and, above all, the value each individual places on these outcomes.

One person may consider that risk perfectly acceptable. Another may reject it.

And both may have understood the evidence correctly.

Knowing a risk does not mean being obliged to accept it.

This is precisely where we often confuse science with personal preference.

Science can estimate the probability of an event. It can identify benefits, harms and limitations. But it cannot, on its own, determine how much risk a person should be willing to take.

A surgeon may explain that a given procedure carries a small but real probability of a serious complication. The patient may understand perfectly and decide not to have the operation.

This does not signal ignorance. It may simply mean that this individual values immediate safety more than the potential benefit.

Another patient, faced with the same information, may choose the operation.

What makes these decisions legitimate is not that they are the same. It is that they are informed, free and compatible with a responsible assessment of the risks.

Science does not own the truth

There is another difficulty, perhaps an even greater one: our tendency to treat current scientific knowledge as if it were a definitive truth.

Science does not work that way.

Scientific knowledge is built through hypotheses, observations, experiments, attempts at refutation and constant revision. A conclusion considered solid today may be modified tomorrow in light of new evidence.

This is not a weakness of science. It is one of its greatest virtues.

The problem begins when we forget this characteristic and turn scientific consensus into dogma.

A remarkable example occurred in gastroenterology.

For decades, peptic ulcers were explained mainly by factors such as gastric acidity, stress and lifestyle. The idea that a bacterium could play a central role seemed unlikely, especially because the acidic environment of the stomach was believed to be hostile to bacterial survival.

Robin Warren and Barry Marshall challenged this interpretation by investigating the association between a bacterium, later named *Helicobacter pylori*, gastritis and ulcer disease.

The hypothesis met resistance. Marshall reported difficulties in publishing his results and convincing colleagues.

As evidence accumulated, the discovery transformed the treatment of ulcer disease. In 2005, the two researchers received the Nobel Prize in Physiology or Medicine.

But there is an important lesson in this story.

The hypothesis did not become true when it won the Nobel Prize.

If it was correct, it was already correct when it was disbelieved. What changed was our ability to demonstrate it and the degree of confidence we could place in it.

This should teach us a lesson in humility.

Scientific consensus represents the best interpretation of the evidence available at a given moment. It is not a vote capable of determining reality.

And the history of medicine shows that consensus can be wrong.

This does not mean that it is often wrong, nor that anyone who disagrees with it is a misunderstood genius. It simply means that consensus should not be confused with a truth immune to questioning.

Being wrong is not the same as lying

Perhaps one of the greatest distortions of contemporary debate is the confusion between three radically different situations: not knowing, being wrong and lying.

When someone puts forward a hypothesis that has not yet been demonstrated, that person is not necessarily lying.

They may be mistaken. They may be partly right. They may have perceived something that current instruments cannot yet demonstrate. Or they may simply have formulated an unsupported hypothesis.

A lie requires the intention to deceive. An error does not.

It seems an obvious distinction, but it has vanished from many discussions.

Note the difference between these statements:

"We do not have enough evidence to say that this treatment works."

"Current evidence suggests that this treatment does not work."

"Robust studies have shown no clinically relevant benefit under the conditions investigated."

These are different conclusions, with different degrees of confidence.

None of them, by itself, justifies attributing dishonesty to whoever formulated the original hypothesis.

And there is a fourth statement, increasingly common:

"Anyone who defends this idea is anti-science."

That is an accusation about the person, not an analysis of the hypothesis.

In my view, we are developing a culture in which disagreeing is no longer a natural stage of thinking and has come to be read as a flaw of character.

This is dangerous for any society. For science, it is especially harmful.

Because every discovery begins, in some way, with someone asking whether what everyone considers true really is true.

But there is a fundamental caveat.

The fact that a hypothesis rejected today may be confirmed in the future does not mean that all hypotheses deserve the same credibility.

An idea supported by consistent observations, biological plausibility and reproducible results does not carry the same weight as speculation that has been repeatedly tested without success.

The right to question a conclusion does not remove the obligation to present evidence.

And the willingness to change one's mind must exist on both sides.

Those who defend the consensus must accept new evidence. Those who contest it must accept the possibility that their hypothesis is wrong.

The risk of trying and the risk of doing nothing

In medical practice, this discussion stops being philosophical and becomes a matter of concrete decisions.

Imagine a patient who has suffered for years from persistent symptoms. Conventional treatments have brought limited benefit. Then the possibility arises of using a herbal substance with some biological plausibility but still insufficient clinical evidence.

What should be done?

The automatic response of some professionals would be to reject the intervention because its efficacy has not been demonstrated.

But I believe other questions must be asked.

What is the real risk of the substance? Are there drug interactions? Is the quality of the product reliable? What would the financial cost be? Would the attempt replace a treatment of proven efficacy? Is there any reasonable possibility of benefit? How would we assess whether it worked?

If the risks are genuinely low, the costs limited and no effective intervention is abandoned, there may be room for a carefully discussed therapeutic trial, where ethically and legally permissible.

This is not the same as claiming that the treatment works.

It means recognizing that clinical decisions can be made even in the face of incomplete evidence.

Naturally, not every herbal product is safe. Natural substances can also cause toxicity, interactions and significant adverse effects. And the absence of reported complications does not, by itself, demonstrate safety.

We must also consider the risk of doing nothing.

Omission is often perceived as a neutral choice, but it is not. Delaying treatment, leaving symptoms in place or letting a disease progress can also have consequences.

Every decision carries risk. Including the decision not to decide.

On the other hand, there is an essential difference between trying an intervention in the face of genuine uncertainty and insisting on one whose ineffectiveness has already been demonstrated in adequate studies.

The story of hydroxychloroquine in COVID-19 helps illustrate this distinction. Early in the pandemic, investigating existing drugs was a legitimate strategy in the face of a new disease. However, later clinical trials did not show a reduction in mortality with hydroxychloroquine in the treatment of COVID-19 and identified an increase in adverse effects.

The evidence changed the justification for using it.

A hypothesis that deserved investigation did not automatically become an effective treatment just because there were people willing to take on its risks.

This is how science should work: allowing investigation, but also recognizing when the results do not support the hypothesis.

When a scientific discussion becomes a moral judgment

The pandemic exposed another phenomenon that I find particularly disturbing.

We began to classify entire people on the basis of a single opinion.

Questioning a specific aspect of a vaccine's safety could be read as rejecting all vaccines. Defending vaccination could be read, at the opposite extreme, as denying any adverse effect.

Both are oversimplifications.

COVID-19 vaccines have shown important benefits in preventing severe disease and death. This does not prevent their risks from being studied, nor recommendations from taking into account age, clinical conditions, immunological history and epidemiological context.

On the contrary, analyzing these differences is part of good science.

But the debate often stopped focusing on these particulars.

We created identity categories. On one side, the supposedly enlightened. On the other, the supposedly ignorant.

The result was that labels replaced arguments.

And labels are extraordinarily efficient tools for ending a conversation without having to answer the argument presented.

This did not happen only with COVID-19.

The same dynamic appears in discussions about diet, medicines, surgery, public policy, new technologies and practically any subject that involves personal values and uncertainty.

The curious thing is that many people defend science with an attitude that runs counter to the scientific spirit: they refuse questions, dismiss doubts and treat disagreement as a personal offense.

It is perfectly possible to defend a scientifically correct conclusion for intellectually inadequate reasons.

Likewise, a person may formulate a mistaken hypothesis and still be practicing genuine scientific thinking, as long as they are willing to test it and revise it in light of the evidence.

Being right is not the same as thinking scientifically.

Who, after all, has the right to decide?

We now come to the hardest question.

If science is provisional, if risks are probabilistic and if people place different values on consequences, who should draw the line between an acceptable intervention and an unjustifiable experiment?

The patient? The physician? The professional council? The State? The scientific consensus?

I believe none of them should hold absolute authority.

Patients should have the autonomy to take part in decisions about their own bodies. However, this autonomy does not oblige a professional to carry out an intervention they consider unjustifiable.

Physicians should have intellectual freedom and room for responsible innovation. But this freedom does not authorize exposing patients to disproportionate risks for the sake of personal convictions.

Scientific institutions and regulatory bodies should set safety standards, evaluate evidence and protect the population from abusive practices. However, their decisions must be well founded, transparent, open to review and open to rational challenge.

Scientific consensus should inform these decisions, not replace critical thinking.

And there is an important difference between strictly individual decisions and those that affect third parties.

In communicable diseases, for example, personal choices can change the risks for other people. Individual autonomy remains relevant, but it now coexists with collective responsibilities. Any restrictions, in turn, must be justified by evidence, necessity and proportionality.

The solution is not to eliminate these tensions. It is to acknowledge them.

In evidence-based medicine, a good decision should integrate the best available scientific knowledge, clinical expertise and the patient's values. This conception has been present since the classic writings of David Sackett and colleagues.

This is not about abandoning science in favor of personal preference.

It is about recognizing that evidence is indispensable, but does not decide on its own what a person should value.

The freedom to be wrong

There is something that worries me even more than the possibility of a mistaken theory becoming popular.

It is the possibility of building an environment in which people are afraid to ask questions.

If the price of disagreeing is ridicule, professional exclusion or automatic association with some discredited group, many will simply stop questioning.

And a scientific community that does not tolerate uncomfortable questions runs the risk of confusing conformity with knowledge.

This does not mean that every opinion deserves equal space in a medical guideline, nor that unfounded hypotheses should guide treatment. The freedom to investigate does not imply the right to offer potentially harmful interventions without justification.

But we need to preserve a basic distinction between the right to think, the right to investigate and the responsibility to act.

I may have a hypothesis. I may try to demonstrate it. I may disagree with the prevailing interpretation. I may publish arguments that run against the majority.

And I may be wrong.

In fact, I will probably be wrong many times.

That is part of the process.

What I may not do is turn my conviction into absolute certainty, hide contrary evidence or impose unjustified risks on other people.

The same requirement should apply to those who hold positions of authority.

A respected researcher may be wrong. A medical society may be wrong. A guideline may need to be changed. A professional council may make decisions that, decades later, will be considered inappropriate.

Acknowledging this possibility does not weaken institutions. It should make them more accountable.

What we should really be teaching

Perhaps we are teaching people to look for answers when we should also be teaching them to ask good questions.

What is the absolute benefit of a given treatment?

What is the risk of a complication? Over what period? Compared with what?

What do we know with reasonable certainty? What do we merely suspect? What evidence could make us change our minds?

What are the consequences of acting? And what are the consequences of not acting?

How much of our disagreement is scientific, and how much simply stems from different personal values?

These questions would be far more useful than classifying someone as for or against a given intervention.

An intellectually mature society should be able to live with provisional conclusions, recognize individual differences in the acceptance of risk and allow hypotheses to be discussed without turning every disagreement into a moral conflict.

It should also understand that tolerating an idea does not mean agreeing with it.

We can respect someone's right to formulate a hypothesis and, at the same time, rigorously demonstrate that it is not supported by the available evidence.

We can respect a patient's autonomy and still refuse an unjustifiable intervention.

We can trust science without treating scientists as infallible authorities.

And we can recognize the benefits of an intervention without denying its risks.

Perhaps this is the hardest form of thinking: holding two seemingly conflicting ideas without needing to eliminate one of them.

Science is our best instrument for understanding the natural world precisely because it admits the possibility of correcting its own mistakes.

Its value lies not in promising that we will never be wrong, but in offering methods to find out when we are.

That is why I am increasingly wary of anyone who is absolutely certain about complex questions. Not because all opinions are equivalent, but because excessive certainty often eliminates the curiosity that would allow them to be improved.

Twenty years from now, some of the conclusions we defend today will have been modified. Others will be even better demonstrated. And perhaps we will discover that some people considered mistaken were perceiving something we could not see.

We do not know which.

That is exactly why we need to keep investigating, discussing and confronting hypotheses with reality.

Science does not need people who are never wrong. It needs people willing to discover that they are wrong.

And perhaps true intellectual maturity lies not in convincing everyone to take the same risks or believe the same things.

Perhaps it lies in accepting that someone can understand the same evidence, make a choice different from ours and still deserve respect.

Because the opposite of science is not doubt.

It is the arrogance of believing we no longer need to doubt.

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