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Introduction

THE BEST-SELLING PARENTING book of all time is *Baby and Child Care*, by the American paediatrician Benjamin Spock. First published in 1946, the book advised parents to be loving and to trust their instincts—a welcome change from the rigid, disciplinary approach that had been promoted in previous years. Spock's book quickly became the favourite childcare manual for new parents. It sold more than 50 million copies in over 40 languages, making it one of the most popular books ever published. At one point in American history, it was said, only the Bible had sold more.

In the 1958 edition, Spock made a small change to the book's text. He started recommending that babies be put to sleep on their fronts, rather than on their backs, as he'd suggested before. Spock said that infants lying on their backs were more likely to choke on their own vomit and that the position might flatten their heads. His recommendation was mirrored by many other sources—and parents enthusiastically followed the advice. The proportion of babies that slept on their fronts rose steeply in the United States and some other Western countries during the 1960s and 70s. My mum, who still has her worn copy of Dr Spock's book, obediently laid me and my sister in our cots this way.

One reason the advice changed was a study published in 1945 by an eminent paediatrician called Paul Woolley Jr. He examined—and dismissed—the idea that young babies who front-sleep might be at risk of suffocation because they were not yet strong enough to lift up their heads. He said he'd done studies in which he covered babies with different types of bedding and then analysed the air they breathed. The only time he detected a risky drop in oxygen or increase in carbon dioxide level, he wrote, was when he covered infants tightly with a rubber sheet and secured it at the sides. This was as unconvincing as it was bizarre: Woolley did not report how many babies he had studied or give details of his methods. But because Woolley was an eminent figure in his field, what he said carried a lot of weight. The influential 'blanket experiment' probably helped persuade Spock to recommend front sleeping, along with reports that this position genuinely improved the breathing of infants who were born preterm.

Something more sinister was starting to happen to babies in some Western countries around this time: a growing number of them were dying suddenly and inexplicably in their cribs. By 1964, around 25 out of every 1,000 children in the United States were dying from sudden infant death syndrome or SIDS. (Today that figure is around 1 out of 1,000.) "It is difficult to read a city newspaper over an extended period of time and not be impressed by the frequency with which infants appear to be asphyxiated in their beds," read one report.

The cause of the rising deaths was a matter of fierce debate. Some, like Spock, thought that infants choked on vomit. Others had different ideas. In 1960, scientists proposed that some babies suffered an allergic reaction to milk when they regurgitated a little of their milky stomach contents and then inhaled it. These researchers studied guinea pigs that had been sensitised to cow's milk and found that many of the animals died quickly

and quietly when they breathed in milk. It was a stretch to say that what happened in guinea pigs also happened in human babies—but the 'aspiration hypothesis' gained traction nevertheless. From the 1940s to 1970s, this and other theories swirled around while the number of deaths from SIDS steadily climbed. An epidemic, it was eventually called.

What was missing in all this was evidence from rigorous empirical research. Sudden infant death is fortunately a rare event. To find a cause, there was a need for careful studies comparing a group of babies who had died from SIDS with similar 'control' babies from the same community and of the same age, sex and background health. When carefully conducted, these case-control studies could reveal differences between the two groups that might explain the babies' deaths.

In 1965, researchers in the UK published the first well-conducted case-control study, comparing over 100 children who had died under two years of age with a control group. The study noted ominously that cases were "found face downwards rather more frequently" than the controls, but the data did not pinpoint any particular cause.

The second case-control study, published in 1970, compared around 140 babies who had died in Northern Ireland with a similar number of matched controls. The data hinted that sleeping position was linked to increased risk, but the association was not deemed statistically significant. The researchers were sifting through lots of possible risk factors and dismissed this one as unimportant.

It took another 16 years for doctors to see the link between sleeping position and SIDS. In 1986, Susan Beal, a paediatrician

who studied hundreds of SIDS cases in South Australia, was the first to report that the death rate was higher in children who slept on their fronts. In 1990, a study in *The British Medical Journal* found that SIDS infants were nearly nine times more likely to have been sleeping on their fronts than those in a comparison group and were also more likely to have been more heavily wrapped.

Eventually, the weight of evidence was impossible to ignore: Spock's advice about front-sleeping had been lethally incorrect. In 1991, the UK launched a 'Back to Sleep' campaign, which encouraged parents to put babies down on their backs. A year later, the American Academy of Pediatrics recommended back-sleeping. Other countries were also making the switch.

As back-sleeping became the norm, the incidence of SIDS dropped like a stone—by as much as 70% in some countries. This provided the strongest evidence of all that front-sleeping increases the risk of sudden infant death, even though it is still not fully understood why. Today, parents are advised to minimise the risk by always putting infants to sleep on their backs, by sharing a room with their baby and by avoiding loose bedding, overheating and smoking.

The advocacy of front-sleeping by Spock and others is now understood to have been one of the most lethal pieces of unsubstantiated advice in the history of child health. What makes it more tragic is that the link with infant death might have been detected earlier.

Of course, it's easy to see with hindsight something that was not clear at the time. The association between SIDS and front-sleeping was difficult to detect without large numbers of cases

and controls. Some studies over the years hinted at an increased risk from front-sleeping, but they had too few children in them to be statistically sure.

The solution in this situation is for scientists to combine data from studies as they go along. That way, they can build up information on a widening group of cases and controls. The weight of evidence accumulates until it's enough to tip the scale.

In 2005, when a research team in the UK did this by going back and combining data from historical studies on SIDS, they were shocked. There had been sufficient evidence that front-sleeping significantly increased risk as early as 1970, when the numbers from just the first two studies were pooled. At this point, the data showed that front-sleepers were three times as likely to die as those who slept on their backs. If this had been noticed, scientists could have tested whether advising parents to adopt back-sleeping lowered the death rate. Instead, parents were commonly advised to put their babies to sleep on their fronts for at least another 18 years. The UK research team calculated that at least 50,000 deaths in the USA, Europe and Australasia—and incalculable grief of parents—could have been prevented if evidence from research on SIDS had been synthesised and acted on in 1970.

The SIDS tragedy is a powerful cautionary tale in science. It shows that advice based on unsubstantiated opinion like Spock's can do terrible harm. It reveals how important it is for scientists to conduct careful studies to find causes. And it illustrates how vital it is to not rely on one study—but to synthesise all of them in order to understand the body of evidence as a whole.

I first became interested in writing a book about evidence in May 2013, when I visited London's impressive Royal Society of

Medicine. I was there to interview Iain Chalmers, a doctor and researcher, as part of work on my previous book. Chalmers is incredibly self-deprecating, despite his work having helped probably millions of people around the world. (He told me I'd recognise him by looking for someone who was short, fat and balding.) As a science journalist, I was already steeped in the world of research and medicine, but my conversation with Chalmers would change how I thought about both.

In the 1960s, Chalmers realised that much of what he'd been taught in medical school was wrong. Most decisions about treatment were based on someone's opinion ("do this because I think it's right") or conventional wisdom ("do it this way because that's how it's always been done"). This meant that two doctors with differing opinions might give a patient different advice for the same predicament. Chalmers was troubled by this. What was he supposed to believe? He later realised that some children in his care probably died because he handed out wrong advice that he'd been taught.

Inspired by a doctor called Archie Cochrane, Chalmers realised that a better way to work out whether a treatment helps or harms is through evidence generated by scientific research. One of the most powerful experimental methods for testing treatments is a randomised controlled trial, in which similar people are randomly assigned to receive a therapy or not. If those in the treatment group clearly improve more, on average, than those in the control group, it suggests the therapy is effective. Scientists also carry out observational studies—such as the SIDS ones—in which they carefully observe groups of people to try and unpick the causes of disease.

Empirical evidence generated through careful experimental and observational research is the most reliable way to find out

whether a treatment is effective.[1] The history of medicine is littered with examples of practices that were once assumed to work and later found through research to be useless or harmful—front-sleeping being one tragic example.

Although these scientific methods have been around for decades, the 'conventional wisdom and questionable opinion' style of practising Western medicine predominated all the way up to the early 1990s. But then a handful of pioneering doctors in Canada, and others including Chalmers, challenged the way things were done. They argued that medical practices should be based on evidence from empirical research, such as randomised trials, rather than the hunches of doctors. This approach was radical when it first emerged; a lot of established physicians didn't like annoying upstarts like Chalmers questioning their authority. But it quickly caught on, sparking a revolution known as evidence-based medicine, which raced around the world and has become the foundation of medicine in many countries today.

Chalmers' insight went further than this. He understood that looking at one study at a time could be problematic. Some scientific studies produce misleading results if they are poorly done or through chance alone. Some, like the early SIDS studies, are too small to detect an effect. Drawing a conclusion from one study risks being like the blind men in the parable who try—and

1. I use the term evidence in most of this book as shorthand for 'evidence from empirical research,' meaning information collected by careful observation and experimentation. There are other types of evidence, including evidence in a court of law and evidence that people accrue based on their own lived experience. The word evidence means information indicating whether a belief or proposition is true or valid. The word derives from the Latin *evidens*, which means obvious, apparent or clear. Even in scientific research, the word is used in different ways: a study in 2024 found 54 different definitions of evidence across health and social science.

fail—to describe an elephant by feeling only one part of its body. In research, assessing the totality of rigorous evidence is usually the best way to reveal whether a treatment really works.

In 1993, Chalmers and a group of like-minded folk started a pioneering group called the Cochrane Collaboration, which was dedicated to synthesising evidence from clinical trials to reveal what works to improve health. They adopted a technique called a systematic review, in which scientists systematically comb the world's academic literature for all studies that can answer a question, and then statistically combine the results. (Other types of 'evidence synthesis' combine research in different ways.)

Today, tens of thousands of systematic reviews exist in medicine and they are used to create recommended guidelines for doctors about how to treat patients. These reviews have brought about life-saving changes in medicine, including the adoption of antenatal steroids to save the lives of premature babies and improved care for people with breast cancer and stroke. Systematic reviews are the invisible bedrock of knowledge on which modern medicine is based.

Learning about systematic reviews and evidence synthesis was eye-opening to me, even though I work at *Nature*—one of the leading science journals in the world. We've published some of the most important scientific advances ever made, from the discovery of the neutron to the structure of DNA to the sequence of the human genome. I've written and edited hundreds of news articles about key advances myself.

And yet I realised that most scientists today still trade in the currency of the single academic publication, publishing one paper after another because that's how they make their names. Hardly any of them spent time trying to make sense of what the world already knows by synthesising existing evidence.

Chalmers once called this the "scandalous failure of science to cumulate evidence scientifically."

That medicine should be based on empirical scientific evidence sounds glaringly obvious now, but few people aside from doctors realise that the term evidence-based medicine is barely 35 years old. I didn't, until my conversation with Chalmers piqued my interest and I started reading more. I quickly learned that evidence-based medicine is part of a bigger movement—dubbed an evidence revolution. Before long, I was interviewing people who are passionate about evidence in fascinating disciplines that I'd never explored before.

For decades, some researchers have been conducting randomised trials to test the effectiveness of social policies, just like doctors test a drug. These include programmes designed to boost employment or education, or to cut crime. One of the earliest experiments, in 1981, randomly assigned perpetrators of domestic violence in Minneapolis to be arrested or cautioned. The results suggested that arrest cut the rate of repeat violence—and led to sweeping (and controversial) changes in police practice in many countries. There are now several thousand randomised trials and other studies that test ways to cut crime, and evidence-based policing is gaining traction across the world, including in Scotland Yard, the famed headquarters of London's Metropolitan Police.

Schools, like police forces, are also increasingly informed by evidence from research. There is a growing mountain of randomised trials showing that some practices in education—like giving students meaningful feedback and good-quality tutoring—are particularly good at helping children learn.

Others, like streaming kids according to ability and reducing class size, are not as cost-effective. Evidence-based education has not revolutionised schools in the way that evidence-based medicine transformed hospitals—but some researchers are intent on changing that.

Other fields have embraced evidence to differing extents. In development economics, the revolution took off like a rocket when, in the mid-1990s, some economists started using randomised trials to test whether programmes, such as buying textbooks for schools and offering incentives to vaccinate children, could help families living in poverty. This approach rapidly swept development economics and won three researchers—Esther Duflo, Abhijit Banerjee and Michael Kremer—a Nobel Prize in 2019. These researchers are sometimes called 'randomistas' because of their devotion to randomised trials.

Elsewhere, the revolution has been slow to take hold. In 2018, I met Eric Barends, a charismatic figure wearing a T-shirt saying "Keep calm and ask for the evidence." Barends is fighting a lonely battle to turn management into an evidence-based field while living out of an old school bus in California. I'd run a large team of people at *Nature* using a patchwork of common sense, advice, tips from training courses and popular books. It was humbling to realise that a lot of standard management practices—like performance appraisals—are not supported by strong evidence showing they help. Evidence-based management offers a more rational way to run a team based on research, but struggles to gain traction in the face of business books and management fads.

The evidence revolution is filled with passionate rebels like Barends—evidence warriors fighting to change their fields. I've met quite a few over the several years and numerous interviews

it took to research this book. Many of them—like Barends—stumbled on the story of evidence-based medicine, and then a lightbulb went on in their heads. It dawned on them that practices in *their* field were based on conventional wisdom, just like those in medicine once were. Inspired, they started doing randomised trials or squirrelling away evidence into systematic reviews to find out which practices really work. Once they'd seen the compelling logic of using science this way, they found it hard to do anything else.

These people share a simple belief that if we did less of the things that science shows don't work and more of the things that do, the world could be a better place. This is logical, intuitive—and, as it turns out, extraordinarily hard to achieve.

The COVID pandemic—which ripped around the world as I was writing this book—exposed some of the biggest obstacles to evidence. Research did help chart a route out of the pandemic: vaccines, which were shown to be effective in randomised trials, saved millions of lives. Organisations also struggled to synthesise and act on the available evidence on drugs, masks and other issues quickly enough, in part because studies were gushing out so fast. This problem has continued: in 2022, over three million academic articles were published in science and engineering—over 50% more than in 2012. This firehose of research makes efforts to synthesise and make sense of it harder but more important.

Another opposing force that COVID highlighted is the growing rejection of evidence. During the pandemic, world leaders like US president Donald Trump ignored and twisted evidence from research and an epidemic of misinformation

made it hard to distinguish real facts from 'alternative' ones. Scientists worry that the erosion of trust in evidence is worsening under Trump's second presidency, and AI could undermine it too. AI-powered chatbots like ChatGPT can churn out misinformation and generate credible-sounding but potentially misleading summaries of research.

Despite these headwinds, the evidence revolution has been quietly advancing. In autumn 2024, hundreds of scientists attended a Global Evidence Summit in Prague to discuss how policies based on evidence can solve critical problems such as climate change and poor health. In late summer 2025, a group of major scientific funders announced they were investing over $120 million in AI-powered systems to supply evidence syntheses to governments worldwide. Evidence was being discussed at the United Nations, because evidence-based policies are one of the most promising ways to achieve global goals such as cutting hunger and poverty. Setbacks are inevitable, but most researchers are resolute in their belief that evidence can help improve the world.

There's another reason that I find this movement so compelling. Understanding evidence is empowering. It allows people to think more critically about the claims they encounter in their own lives—that a wonder drug will improve health, a government policy will bolster schools, or a parenting fad will benefit children. It gives us more confidence to ask for evidence behind a claim and consider it when making decisions.

Take parenting, for instance, which is rife with contradictory advice and unsubstantiated claims. When my children were born, I approached parenting as I did management: by cobbling

together advice from books and the internet, and by learning as I went along. I wish I'd understood how much evidence there was that could help. Some parenting programmes—such as one called Triple P, which emphasises clear, positive feedback and rules—have been shown in multiple randomised trials to improve outcomes for children. In other cases, there is not enough evidence to provide clear answers—such as how much screen time is appropriate for kids. Either way, weighing up the evidence with a family's own values and circumstances can potentially help parents reach more confident decisions about what to do.

Some scientists told me that when they came across the ideas of evidence-based medicine, it changed how they viewed the world. I've found that too. Now when I receive a medical diagnosis, I search for systematic reviews to get an overview of potential treatments. When I interview scientists about their latest study, I try to ask whether the wider body of research points to the same conclusion.

Evidence rarely provides certainty. Often the evidence simply isn't there, or is hard to find, or is complex and contradictory—and new studies can come along that overturn existing ideas. But it can reduce uncertainty and improve decisions—and that can be life-changing. I hope this book helps you figure out what claims to believe, what actions work and, sometimes, what to do.

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