1999 Science in Society Journalism Awards

Magazine

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“The (Political) Science of Salt”

Science

Part One: The salt controversy

Three decades of controversy over the putative benefits of salt reduction show how the demands of good science clash with the pressures of public health policy.

> "Science ... warns me to be careful how I adopt a view which jumps with my preconceptions, and to require stronger evidence for such belief than for one to which I was previously hostile. My business is to teach my aspirations to conform themselves to fact, not to try and make facts harmonize with my aspirations."
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> — Thomas Huxley, 1860

In an era when dietary advice is dispensed freely by virtually everyone from public health officials to personal trainers, well-meaning relatives, and strangers on check-out lines, one recommendation has rung through 3 decades with the indisputable force of gospel: Eat less salt and you will lower your blood pressure and live a longer, healthier life. This has been the message promoted by both the National Heart, Lung, and Blood Institute (NHLBI) and the National High Blood Pressure Education Program (NHBPEP), a coalition of 36 medical organizations and six federal agencies. Everyone, not just the tens of millions of Americans who suffer from hypertension, could reduce their risk of heart disease and stroke by eating less salt. The official guidelines recommend a daily allowance of 6 grams (2400 milligrams of sodium), which is 4 grams less than our current average. This "modest reduction," says NHBPEP director Ed Roccella, "can shift some arterial pressures down and prevent some strokes." Roccella’s message is clear: "All I’m trying to do is save some lives."

So what’s the problem? For starters, salt is a primary determinant of taste in food — fat, of course, is the other — and 80% of the salt we consume comes from processed foods, making it difficult to avoid. Then there’s the kicker: While the government has been denouncing salt as a health hazard for decades, no amount of scientific effort has been able to dispense with the suspicions that it is not. Indeed, the controversy over the benefits, if any, of salt reduction now constitutes one of the longest running, most vitriolic, and surreal disputes in all of medicine.

On the one side are those experts — primarily physicians turned epidemiologists, and administrators such as Roccella and Claude Lenfant, head of NHLBI — who insist that the evidence that salt raises blood pressure is effectively irrefutable. They have an obligation, they say, to push for universal salt reduction, because people are dying and will continue to die if they wait for further research to bring scientific certainty. On the other side are those researchers — primarily physicians turned epidemiologists, including former presidents of the American Heart Association, the American Society of Hypertension, and the European and international societies of hypertension — who argue that the data supporting universal salt reduction have never been compelling, nor has it ever been demonstrated that such a program would not have unforeseen negative side effects. This was the verdict, for instance, of a review published last May in the Journal of the American Medical Association (JAMA). University of Copenhagen researchers analyzed 114 randomized trials of sodium reduction, concluding that the benefit for hypertensives was significantly smaller than could be achieved by antihypertensive drugs, and that a "measurable" benefit in individuals with normal blood pressure (normotensives) of even a single millimeter of mercury could only be achieved with an "extreme" reduction in salt intake. "You can say without any shadow of a doubt," says Drummond Rennie, a JAMA editor and a physiologist at the University of California (UC), San Francisco, "that the [NHLBI] has made a commitment to salt education that goes way beyond the scientific facts."

At its core, the salt controversy is a philosophical clash between the requirements of public health policy and the requirements of good science, between the need to act and the institutionalized skepticism required to develop a body of reliable knowledge. This is the conflict that fuels many of today’s public health controversies: "We’re all being pushed by people who say, ’Give me the simple answer. Is it or isn’t it?’ " says Bill Harlan, director of the office of disease prevention at the National Institutes of Health (NIH). "They don’t want the answer after we finish a study in 5 years. They want it now. No equivocation. ... [And so] we constantly get pushed into positions we may not want to be in and cannot justify scientifically."

The dispute over salt, however, is an idiosyncratic one, remarkable in several fundamental aspects. Foremost, many who advocate salt reduction insist publicly that the controversy is a) either nonexistent, or b) due solely to the influence of the salt lobby and its paid consultant-scientists. Jeremiah Stamler, for instance, a cardiologist at Northwestern University Medical School in Chicago who has led the charge against salt for 2 decades, insists that the controversy has "no genuine scientific basis in reproducible fact." He attributes the appearance of controversy to the orchestrated resistance of the food processing industry, which he likens to the tobacco industry in the fight over cigarettes, always eager to obfuscate the facts. "My considerable experience indicates that there is no scientific interest on the part of any of these people to tell the truth," he says.

While Stamler’s position may seem extreme, it is shared by administrators at the NHBPEP and the NHLBI, which funds all relevant research in this country. Jeff Cutler, director of the division of clinical applications and interventions at NIH and an advocate of salt restriction for over a decade, told Science that even to publish an article such as this one acknowledging the existence of the controversy is to play into the hands of the salt lobby. "As

long as there are things in the media that say the salt controversy continues," Cutler says, "they win." Roccella concurs: To publicize the controversy, he told *Science*, serves only to undermine the public health of the nation.

After interviews with some 80 researchers, clinicians, and administrators throughout the world, however, it is safe to say that if ever there were a controversy over the interpretation of scientific data, this is it. In fact, the salt controversy may be what Sanford Miller calls the "number one perfect example of why science is a destabilizing force in public policy." Now a dean at the University of Texas Health Sciences Center, Miller helped shape salt policy 20 years ago as director of the Center for Food Safety and Applied Nutrition at the Food and Drug Administration. Then, he says, the data were bad, but they arguably supported the benefits of salt reduction. Now, both the data and the science are much improved, but they no longer provide forceful support for the recommendations.

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That raises the second noteworthy aspect of the controversy: After decades of intensive research, the apparent benefits of avoiding salt have only diminished. This suggests either that the true benefit has now been revealed and is indeed small, or that it is nonexistent, and researchers believing they have detected such benefits have been deluded by the confounding influences of other variables. (These might include genetic variability; socioeconomic status; obesity; level of physical exercise; intake of alcohol, fruits and vegetables, or dairy products; or any number of other factors.)

The controversy itself remains potent because even a small benefit — one clinically meaningless to any single patient — might have a major public health impact. This is a principal tenet of public health: Small effects can have important consequences over entire populations. If by eating less salt, the world's population reduced its average blood pressure by a single millimeter of mercury, says Oxford University epidemiologist Richard Peto, that would prevent several hundred thousand deaths a year: "It would do more for worldwide deaths than the abolition of breast cancer." But even that presupposes the 1-millimeter drop can be achieved by avoiding salt. "We have to be sure that 1- or 2-millimeter effect is real," says John Swales, former director of research and development for Britain's National Health Service and a clinician at the Leicester Royal Infirmary. "And we have to be sure we won't have equal and opposite harmful effects."

Decades have passed without a resolution because the epidemiologic tools are incapable of distinguishing a small benefit from no benefit or even from a small adverse effect. This has led to a literature so enormous and conflicting that it is easy to amass a body of evidence — what Stamler calls a "totality of data" — that appears to support a particular conviction definitively, unless one is aware of the other totality of data that doesn't.

Over the years, advocates of salt reduction have often wielded variations on the "totality of data" defense to reject any finding that doesn't fit the orthodox wisdom. In 1984, for instance, David McCarron and colleagues from the Oregon Health Sciences University in Portland published in Science an analysis of a national health and nutrition database suggesting that salt was harmless. They were taken to task in these pages by Sanford Miller, Claude Lenfant, director of NHLBI, and Manning Feinleib, then head of the National Center for Health Statistics. Among their criticisms was that McCarron and colleagues had not "attempt[ed] to square their conclusions with the abundance of population-based and experimental data suggesting that dietary sodium indeed plays an important role in hypertension." At the time of the letter, however, Lenfant's NHLBI was about to fund perhaps the largest international study ever done, known as Intersalt, precisely to determine whether salt did play such a role. And even Stamler, the motivating force behind Intersalt, was describing the literature on salt and blood pressure at the time as "replete with inconsistent and contradictory reports."

One-sided interpretations of the data have always been endemic to the controversy. As early as 1979, for instance, Olaf Simpson, a clinician at New Zealand's University of Otago Medical School, described it as "a situation where the most slender piece of evidence in favor of [a salt-blood pressure link] is welcomed as further proof of the link, while failure to find such evidence is explained away by one means or another." University of Glasgow clinician Graham Watt calls it the "Bing Crosby approach to epidemiological reasoning" — in other words, "accentuate the positive, eliminate the negative." Bing Crosby epidemiology allows researchers to find the effect they're looking for in a swamp of contradictory data but does little to establish whether it is real.

This situation is exacerbated by a remarkable inability of researchers in this polarized field to agree on whether any particular study is believable. Instead, it is common for studies to be considered reliable because they get the desired result. In 1991, for instance, the British Medical Journal (BMJ) published a 14-page, three-part "meta-analysis" by epidemiologists Malcolm Law, Christopher Frost, and Nicholas Wald of the Medical College of St. Bartholomew's Hospital in London. Their conclusion: The salt-blood pressure association was "substantially larger" than previously appreciated. That same year, Swales deconstructed the analysis, which he describes as "deeply flawed," at the annual meeting of the European Society of Hypertension in Milan. "There was not a single person in the room who felt the [BMJ] analysis was worth anything after that," says clinician Lennart Hansson of the University of Uppsala in Sweden, who attended the meeting and is a former president of both the international and European societies of hypertension. Swales's critique was then published in the Journal of Hypertension.

Just 2 years later, however, the NHBPEP released a landmark report on the primary prevention of hypertension, in which the government first recommended universal salt reduction. The BMJ meta-analysis was cited repeatedly as "compelling evidence of the value of reducing sodium intake." This spring, however, it was still possible to get opinions about the BMJ review from equally respected researchers ranging from "reads like a New Yorker comedy piece" and the "worst example of a meta-analysis in print by a long shot" to "competently done and competently analyzed and interpreted" and a seminal paper in the field.