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COMMENTARY

How Bad Is the Government's Science?

Policy makers often cite research to justify their rules, but many of those studies wouldn't replicate.

By Peter Wood and David Randall

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Half the results published in peer-reviewed scientific journals are probably wrong. John Ioannidis, now a professor of medicine at Stanford, made headlines with that claim in 2005. Since then, researchers have confirmed his skepticism by trying—and often failing—to reproduce many influential journal articles. Slowly, scientists are internalizing the lessons of this irreproducibility crisis. But what about government, which has been making policy for generations without confirming that the science behind it is valid?

The biggest newsmakers in the crisis have involved psychology. Consider three findings: Striking a “power pose” can improve a person’s hormone balance and increase tolerance for risk. Invoking a negative stereotype, such as by telling black test-takers that an exam measures intelligence, can measurably degrade performance. Playing a sorting game that involves quickly pairing faces (black or white) with bad and good words (“happy” or “death”) can reveal “implicit bias” and predict discrimination.

All three of these results received massive media attention, but independent researchers haven't been able to reproduce any of them properly. It seems as if there's no end of “scientific truths” that just aren't so. For a 2015 article in *Science*, independent researchers tried to replicate 100 prominent psychology studies and succeeded with only 39% of them.

Further from the spotlight is a lot of equally flawed research that is often more consequential. In 2012 the biotechnology firm Amgen tried to reproduce 53 “landmark” studies in hematology and oncology. The company could only replicate six. Are doctors basing serious decisions about medical treatment on the rest? Consider the financial costs, too. A 2015 study estimated that American researchers spend \$28 billion a year on irreproducible preclinical research.

The chief cause of irreproducibility may be that scientists, whether wittingly or not, are fishing fake statistical significance out of noisy data. If a researcher looks long enough, he can turn any fluke correlation into a seemingly positive result. But other factors compound the problem: Scientists can make arbitrary decisions about research techniques, even changing procedures partway through an experiment. They are susceptible to groupthink and aren't as skeptical of results that fit their biases. Negative results typically go into the file drawer. Exciting new findings are a route to tenure and fame, and there's little reward for replication studies.

American science has begun to face up to these problems. The National Institutes of Health has strengthened its reproducibility standards. Scientific journals have reduced the incentives and opportunities to publish bad research. Private philanthropies have put serious money behind groups like the Meta-Research Innovation Center at Stanford, led in part by Dr. Ioannidis, and the Center for Open Science in Charlottesville, Va.

There's more to be done, and the National Association of Scholars has made some recommendations. Before conducting a study, scientists should “preregister” their research protocols by posting the intended methodology online, which eliminates opportunities for changing the rules in the middle of the experiment. High schools, colleges and graduate schools need to improve science education, particularly in statistics. Universities and journals should

create incentives for researchers to publish negative results. Scientific associations should seek to disrupt disciplinary groupthink by putting their favored ideas up for review by experts in other sciences.



PHOTO: DAVID KLEIN

A deeper issue is that the irreproducibility crisis has remained largely invisible to the general public and policy makers. That's a problem given how often the government relies on supposed scientific findings to inform its decisions. Every year the U.S. adds more laws and regulations that could be based on nothing more than statistical manipulations.

All government agencies should review the scientific justifications for their policies and regulations to ensure they meet strict reproducibility standards. The economics research that steers decisions at the Federal Reserve and the Treasury Department needs to be rechecked. The social psychology that informs education policy could be entirely irreproducible. The whole discipline of climate science is a farrago of unreliable statistics, arbitrary research techniques and politicized groupthink.

The process of policy-making also needs to be overhauled. Federal agencies that give out research grants should immediately adopt the NIH's new standards for funding reproducible research. Congress should pass a law—call it the Reproducible Science Reform Act—to ensure that all future regulations are based on similar high standards.

Each scientific discipline needs to accept responsibility for its share of the irreproducibility crisis and incorporate strict standards into its procedures. The goal must be to reinvigorate the tradition of scientific inquiry. What the crisis teaches is that the scientific spirit lies with those who constantly test for that fundamental requirement of truth—that a result can be reproduced.

Mr. Wood is president of the National Association of Scholars. Mr. Randall is the NAS's director of research and a co-author of its new report, "The Irreproducibility Crisis of Modern Science."

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