

for the oil- and natural-gas-driven Russian economy. O'Sullivan connects Vladimir Putin's increasingly aggressive foreign policy directly to that mounting challenge. "From a U.S. policymaking perspective, we need to be prepared for Russia to try to compensate for these kinds of losses," she says. "The natural-gas boom means Europe now has other options for meeting its energy needs if Russia becomes too difficult to deal with." This means that while Russia will remain a big exporter of energy to Europe, it will struggle to politicize this trade as it has in the past. As a result, Putin has had to adhere to European Union laws and regulations that he previously had the leverage to avoid.

As for China, another key foreign-policy interest, O'Sullivan argues that the United States should capitalize on every opportunity for the two countries to work together constructively. "This new energy environment has led a lot of countries to question how committed the United States is going to be to Middle Eastern stability going forward," she notes, and this worries the Chinese. They are increasingly dependent on external sources of energy, from the Middle East in particular, just as the United States is becoming more self-sufficient. For this reason there is "an opportunity for us to have a conversation about how to work together toward a common end: achieving greater stability in a critical part of the world."

Although much of *Windfall* focuses on the potential benefits if America realizes its position of energy strength, the book is quick to warn against what O'Sullivan calls the country's dangerous "unrequited love" for achieving total energy independence. In order to become truly independent and essentially function as an island economy, the United States would have to enforce dramatic isolationist and protectionist policies that she considers inefficient, costly, and ultimately counter to the

nation's best interest. She points to the aftermath of Hurricane Harvey as an instance when being connected to international markets was of critical importance: "When our refining capacity went down on the Gulf Coast, there were some hiccups, but pretty soon after, we just started importing from other sources. Being connected to global markets allows for us to be resilient."

If Americans are able to look beyond their enduring obsession with energy independence and use the energy boom to further the country's international power, she declares, the benefits could be exponentially higher. ~OSET BABÜR

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PALEO-EPIDEMIOLOGICAL INVESTIGATIONS

The New Rub on Knee Pain

AN WALLACE HAS TRAVELED across the country examining skeletons in the basements of museums and in the backroom closets of medical institutes. He's seen 2,576 of them, to be exact, driven by an interest in just one thing: their knees. One-fifth of the U. S. population suffers from knee os-

teoarthritis (OA), a painful and debilitating disease caused by the femur grinding against the tibia. But Wallace, a postdoctoral fellow in human evolutionary biology, and his adviser, Lerner professor of biological sciences Daniel Lieberman, wondered if OA had always been so common. Although clinicians who treat the disease have noted an increase in the number of cases, which now typically end with knee replacement, no one had tried to quantify the prevalence of the disease across centuries.

The two researchers realized they could study this public-health problem using an approach dubbed "paleo-epidemiology." The bone-on-bone rubbing that occurs at the end stage of the disease, when all the cartilage is gone, leaves a glass-like polish on bone surfaces that is unmistakable, Wallace explains. It's unambiguous and easy to measure accurately, and is what he was looking for in the skeletons he studied. But the magnitude of what he found was unexpected. By comparing skeletal evidence from the prehistoric and industrial eras to that from the postindustrial era, and carefully controlling for differences in the way the skeletons from the various periods were collected, Lieberman and Wallace found that the prevalence of the disease had *more than doubled* since World War II.

"This is not a trivial change," Lieberman says. "A doubling that fast can only be caused by a change in environment. And that means that if we can identify what



An osteoarthritic knee, the polished femur clearly visible, from a 600-year-old skeleton housed in the Peabody Museum.

those environmental shifts are, we can figure out ways to prevent the disease.”

The common belief, he explains, is that knee osteoarthritis is unpreventable. Clinicians who treat OA typically cite cumulative wear and tear on the knee joint as a principal cause of the disease. As people, on average, live longer and weigh more than in the past, the thinking goes, the prevalence of OA naturally increases. But the new research shows this is wrong.

By controlling for factors such as age and body mass index (BMI)—matching physically and demographically similar individuals across the industrial and post-industrial eras—the researchers were able to eliminate both increased longevity and obesity as causes of the spike they discovered. That doesn't mean obesity is *not* a factor: “It can increase your risk of osteoarthritis considerably,” explains Wallace. But obesity can't explain the recent, sudden spread of the disease.

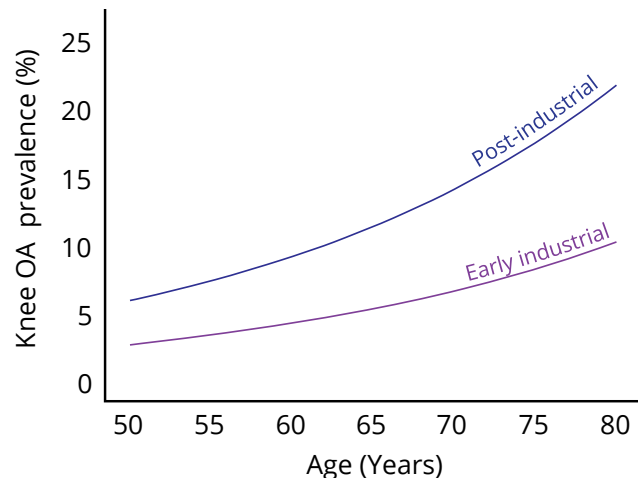
The level of OA didn't shift, essentially, for thousands of years, Lieberman points out, among either prehistoric Native American hunter-gatherers and farmers, or industrial-era workers. The spike came suddenly, in the postindustrial period, and the pattern of injury changed, as well.

Trauma to the knee joint often leads to OA. “People fall off a cliff, get kicked by a horse, snap their ACL, or get a meniscal tear,” says Lieberman, and these insults can increase the risk of OA as much as eightfold. “Most of the people we studied in earlier populations who had OA had it in *one* knee”—a hallmark of the traumatic case. “What's happening increasingly today,” he continues, “which we showed

in a 2017 paper in *Proceedings of the National Academy of Sciences*, is that more and more people are getting the disease in both knees. That suggests there is something else going on.”

Lieberman and Wallace don't know what that “something” might be, but are testing the hypothesis that physical inactivity, which increased with the mid-twentieth-century shift to service-sector employment

in the American economy, is an important factor. That theory might seem counterintuitive for a disease thought to be caused by wear and tear, but some potential mechanisms by which exercise protects joints are known: physical activity promotes the growth of hydrophilic proteins that store water and thus lubricate joints, Lieberman notes, and there is evidence that within cartilage, such activity affects the production and turnover of collagen. (Exercised animals, for example, have more cartilage in their joints, older data show.) Furthermore, exercise strengthens muscles, protecting joints from overloading at moments of strain, and also lowers inflammation. To test this, Lieberman and Wallace are currently running a controlled experiment in the lab



After controlling for gender, ethnicity, and body mass index, the data clearly show an increased prevalence of knee osteoarthritis in post-industrial populations at all ages.

SOURCE: STEVEN WORTHINGTON/HARVARD INSTITUTE FOR QUANTITATIVE SOCIAL SCIENCE

with guinea pigs, comparing rates of OA between active and inactive animals.

Underlying the research, Lieberman explains, is a suspicion that OA is a case of human physiology being partly maladapted to modern environments. “We're looking at osteoarthritis as a mismatch disease,” he says, “and trying to figure out how an evolutionary perspective leads to different hypotheses than would a purely clinical perspective.”

~JONATHAN SHAW

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HEALTHCARE MONOPOLY

A New Challenge for Antitrust

IN THE last few years, a new type of financial consolidation has caught the attention of antitrust regulators. Institutional investors—big companies like Fidelity and BlackRock—today own 70 percent of publicly traded stocks, according to some estimates, which means that one big investor could own significant shares of the companies that nominally compete within the same industry. Two 2016 studies found that this relationship may have had a *causal* effect that produced higher prices for consumers

in the airline and banking industries. Now a new analysis published in *Health Affairs* finds that this type of informal consolidation among investor-owners has nearly doubled in at least one sector of the healthcare industry during the last decade. Between 2005 and 2015, the percentage of acute-care hospitals that share significant ownership with post-acute facilities and hospices grew from 24.6 to 48.9 percent.

Earlier studies of consolidation in healthcare, says lead author Annabelle Fowler, a

Ph.D. candidate in health policy at Harvard Medical School (HMS), have focused on formal mergers—what people typically imagine when they think of companies exercising monopoly power. “We wanted to peel away that layer and see who the underlying investors are, and [ask if] there are any ties across these sectors that we might not be able to immediately see, but that might have implications for the care people receive.” The team focused on common ownership of acute and post-acute facilities,