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

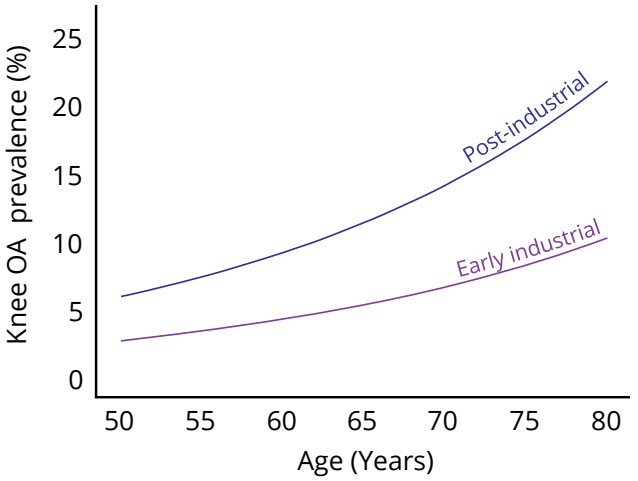
The common belief, he explains, is that knee osteoarthritis is unpreventable. Clinicians who treat OA typically cite cumulative wear and tear on the knee joint as a principal cause of the disease. As people, on average, live longer and weigh more than in the past, the thinking goes, the prevalence of 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 with guinea pigs, comparing rates of OA between active and inactive animals.



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

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 osteoarthris 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,

Fowler explains, because post-acute care is the source of a lot of variation in Medicare spending; financial consolidation, the researchers speculated, might be a potential explanation.

The group (including co-authors David Grabowski and Haiden Huskamp, professors of health care policy at HMS, and Robert Gambrel and David Stevenson of Vanderbilt) pulled their data from the Provider Enrollment, Chain, and Ownership System (PECOS): a database of every medical provider in Medicare, with granular information about every investor owning a 5 percent or greater share in each provider (though it doesn't show how large a share the investors hold—only that it's at least 5 percent). "What's really novel about this paper is the use of this dataset," Fowler notes.

The team considered only institutional investors in their analysis. They then looked at the financial links between healthcare providers within the same region—a hospital and a skilled nursing facility (a type of long-term, post-acute-care provider) in a single state, for example. An investor with shares in a hospital in Boston and skilled-nursing facilities in Seattle, for example, wouldn't count as common ownership under their rubric.

The findings are striking: the percentage of hospitals with a link to other healthcare facilities (including acute-care hospitals, skilled-nursing facilities, home health agencies, long-term care hospitals, inpatient rehabilitation facilities, and hospice agencies) via a common owner almost doubled during the study period. That might be in part because the share of healthcare providers with *any* corporate investor increased significantly during the same period (from just over one-quarter to more than one-half), across each of the six types of facilities studied. In other words, corporate investors' share of providers has simply increased over time, just as it has in the economy overall. "Our results have potential implications for how we think about competition between and across sectors," says Grabowski. "If an investor jointly owns several hospitals within a market, are these hospitals really competing with one another on cost and quality?"

What might this mean for regulators? Common investor ownership, unlike formal mergers, is not currently regulated, but can be deemed illegal if the behavior of investors is construed to produce collusion among different companies. The analysis doesn't claim a causal relationship between common ownership and the quality or cost of healthcare, but financial consolidation across the industry can create anti-competitive incentives that are bad for patients.

"If you're a particularly expensive patient," Fowler explains, "then the hospital might [have an incentive to] refer you to a skilled-nursing facility that's *not* under common ownership, because you're sort of a burden. If you're a patient with less risk, then a doctor might have incentive to refer you to a provider within the same common ownership."

It's not clear how a financial link between healthcare facilities could translate into this sort of decisionmaking at the level of individual doctors. But investors can influence companies in many ways—for example, through their votes on business decisions at shareholder meetings. Much work remains to be done, by academics as well as regulators, on the dynamic between investors and industry competition. At a minimum, Fowler and Grabowski suggest that there is a need for more transparency in these relationships; mandated disclosure of large-scale common investors could be the best next step. That would benefit not just researchers and regulators, Grabowski says, but patients as well. Both groups, presumably, would want to know if there is any investor linkage among healthcare providers.

—MARINA BOLOTNIKOVA

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