using virtual and mixed reality devices, according to Moro and McBride. These symptoms resolve quickly after taking off the device, but they will likely limit the duration of study and how much information can be conveyed in one setting, Moro said.

"Currently, a lecture can run for 2 hours, and students can quite happily sit there each week and absorb the information," Moro said. "Within virtual reality, we had optimal times of 10 minutes, maximum."

Both Moro and McBride agreed that these new tools would supplement rather than replace modalities like lectures, online content, 3D-printed models, imaging, and cadavers.

"It is clear that cadavers are the optimal way to learn; however, in a modern medical and biomedical curricula, there are considerable supervisory, ethical, and financial constraints on students spending enough time with these specimens," Moro said. These new tools just add to the teaching toolbox, added McBride, offering another way to increase student access and engagement.

Moro said that the use of this kind of technology in clinical education has reached a tipping point, driven by rapid advances in easy-to-use consumer technologies designed by major firms like Facebook, Samsung, and Microsoft.

"For years educational technology has gone through hypes and failures," Moro said. "All of a sudden the world's biggest tech companies are investing in this space. These devices are ready for consumer use, and as such, they are unlike the many teaching tech tools that have come before them." ▪

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The JAMA Forum

The Good and Bad News of Health Care Employment

David M. Cutler, PhD

Health care has long been one of the bright spots in the US employment situation. As people have moved out of manufacturing, health care has been a prominent landing place. Just this year, health care passed retail trade to become the largest employer in the economy. Furthermore, health care is a relatively stable industry. Because demand for care remains relatively constant across recessions and expansions, health care employment declines less in recessions than does employment in other industries.

However, economists prefer not to see health care as a jobs program. Every person employed in health care is one less person available to work in other industries. Thus, people should work in health care only if the extra care is more valuable than the output would be in some other industry. If health care employment is expanding because of additional administrative burdens or because clinical personnel are being hired to perform unnecessary procedures, the additional employment will not be worth the cost. Suspecting that this is the case, economists are wary whenever they see news that health care employment is rising.

Even as the growth of medical spending has slowed in recent years, health care employment has continued to increase. Between 2010 and 2016, health care employment grew by 1.7% annually, the same pace as national employment growth. Are these additional workers adding value or are they a waste of resources? To get some insight into this, I looked at data on health care employment in 2010 and 2016. The news is both good and bad.

The Bad News: Lots of Administrative Workers

The bad news is that health care employs a wealth of nonclinical workers. In the medical system as a whole in 2016, there were 22 times as many nonphysician and nondentist workers as there were physicians and dentists. About 17% of these employees were registered nurses (RNs), 46% were other health care workers (technicians, home health aides, nursing aides, and others), and 37% were nonmedical workers (such as business managers and office assistants).

To put this in perspective, compare physician offices with comparable other professionals. In physician offices in 2016, there were 5.8 nonphysician employees for every physician. The comparable figures are 1.9 for law offices and 1.8 for accounting practices. Somewhat surprisingly, dental offices are about as employee-heavy as physician offices, with 7.5 nondentist personnel per dentist (though many of these are dental assistants). If changes could be made so that physicians' offices would not need half of the additional nonphysician employment relative to law offices, the savings would be on the order of $7 billion annually.

The Good News: Employment Growth Seems Valuable

The good news is that the growth in employment does not seem to be associated with increased administrative expense. Physicians' offices in 2016 had about the same ratio of nonclinical personnel to physicians as they had in 2010. The same is true of the medical sector as a whole. And the number of people employed in very specific administrative tasks such as computer support, medical records technicians, and data entry is virtually unchanged.

If not administrative work, what are all the new employees in the past 6 years doing? Most of the increased employment is for clinical tasks, 2 areas in particular. About 27% of the increased employment is personal care aides. The aides are predominantly employed in home health care, community care facilities for the elderly, and substance abuse and mental health facilities. The increase in aides is not surprising and is likely valuable,

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reflecting the aging of the population and the increase in people struggling with substance abuse problems. It is likely, although not certain, that many of these aides save money overall. Salaries for personal care aides are relatively modest (about $25 000 annually, without benefits), and they allow some people to live in the community who might otherwise need institutional care.

Another 25% of the increased employment is among RNs. The bulk of the new RNs work in hospitals, but employment is also expanding in physicians' offices, outpatient care centers, and home health agencies. Part of the growth of RNs is skill upgrading; even as employment of RNs is expanding, employment of licensed practical nurses (LPNs) is falling. This may be good for care quality; some studies suggest that better trained nurses are associated with improved health outcomes, although the literature on this is not entirely clear. But even with the reduction in employment of LPNs, there is net growth of nurses in hospitals.

The reason hospitals are hiring more nurses is not entirely clear. Even with recent coverage expansions, inpatient days are falling, but hospitals now provide a lot of outpatient care as well. It is possible that the increase in RNs employed by hospitals is just an extension of the growth of outpatient care overall, and that hospitals as a whole are providing more services than they used to.

The remaining employment growth beyond aides and nurses is a mix of practitioners and health care technical workers: therapists, technicians, and the like. The distribution of these employees is similar to that for RNs, consistent with increased use of outpatient care.

Implications

Health care seems to have reached an administrative truce: the number of administrative workers is high but not growing rapidly. Clinical employment is growing, but the overall growth is relatively modest and in some cases cost saving. Employment trends thus suggest a continuation of relatively stable cost growth for the next few years. If that is the definition of success, the outlook is good.

I suspect that is not the real goal, however. Rather, the goal is to see reductions in spending. For this to happen, some combination of 3 things must occur. First, we need to examine the wages of health care workers. Are workers paid too much, and if so which ones? Wage adjustments are painful, but sometimes necessary. Second, we need to look at what services are provided that needn't be. If the growth of outpatient services is not entirely necessary or inpatient facilities are overused even at their current smaller scale, that will free up workers to meet other health care needs. Importantly, these data allay a concern that reducing unnecessary care will lead to unemployed workers. In contrast, the need for skilled medical care workers is rising even as some parts of medical care decline.

Third, we need to move beyond the truce in the administrative arms race and into an actual reduction in administrative workers. Even as the health care industry has adopted computers on a widescale basis, the number of administrative workers has not declined. Finding ways to reduce the administrative burden of medical care would go an enormous way to making medical care more affordable. ■

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