Reflections on Technology Advances Since Apollo 11

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IT HAS BEEN AN EXCITING YEAR celebrating the success of the Apollo 11 mission to the moon on July 20, 1969. Where were you on that summer day when history was made? The 50th anniversary documentaries, news reporting, interviews with astronauts and mission control team members, and the celebration held at the Kennedy Space Center were all inspiring and a great reminder of just what a heroic feat that undertaking was. I was nearing my tenth birthday at the time of the landing, which my family watched on our brand-new RCA portable color TV, and could not have processed all the information written about the mission or its success. That is why revisiting the lunar landing during this anniversary has been so meaningful to me.

A point made many times by news reporters during this coverage was that when President John F. Kennedy issued the challenge that America would send astronauts to the moon, the country lacked much of the technology and computing power that would be necessary to plan and execute a successful mission. The president's challenge led to an incredible undertaking to innovate and create all the parts and pieces that would allow Neil Armstrong, Edwin "Buzz" Aldrin, and Michael Collins to achieve the moon landing and help the mission team members meet this grand challenge.

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It was wonderful to hear about this innovation, the people behind it, the culture that created it, and how the mission's success led to an entire generation of people pursuing science and technology careers, many of my contemporaries among them. One colleague whose entire career was spent in the aerospace industry has been a large benefactor to the National Air and Space Museum and had the privilege of enjoying a private tour of many nonpublic Apollo 11 artifacts, including watching the restoration of Neil Armstrong's space suit.

When I think about my career in pharmacy, albeit 35 years, not 50, I am also reminded of the tremendous innovations in technology and computing that have truly changed the face of the profession and helped the patients pharmacists serve. My first prescription-filling experience occurred on a standard typewriter. My first association management position included annual meeting invitations prepared for 3,000 individuals by a team of administrative personnel using three-part paper on IBM Selectric correcting typewriters. My MBA management information system course occurred during the advent of the first personal computer. By the time my pharmacist career began, the pharmacy had installed its first computer, compliments of the earliest PBM (pharmacy benefit manager) network that would be processing prescription claims electronically.

Drug utilization review (DUR) was in its infancy. The first item-level database, Medi-Span, was only a decade old. Insurance coverage was growing, but the majority of prescriptions were still paid in cash. Drug interactions and the role of the CYP450 were not commonly understood. The role of genetics in drug metabolism was not mainstay. Small molecule discoveries were growing, but the era of biotechnology had yet to arrive.

The passage of the 1989 Medicare Catastrophic Coverage Act was a key catalyst for the profession's widespread adoption of computer technology for prescription processing. The growth in prescription medicine as a primary therapeutic modality led to the widespread use of DUR. The profession's agreement in 1989 that pharmacy's mission was to help people make the best use of their medicines through the process of pharmaceutical care

led to further innovation about how to support this mission and process. By the mid-1990s engineers had created the first pharmacy automation systems, and during the next decade widespread barcode-based workflow management systems were put in place to promote patient safety and reduce dispensing errors. This was fueled in part by the 2000 report, "To Err Is Human: Building a Safer Health System" by the Institute of Medicine (National Academies Press). Integration of clinical and dispensing systems began and is still occurring under the guidance of the Pharmacy Health Information Technology Collaborative with the support and input of leaders from the American Society for Automation in Pharmacy (ASAP). Additionally, further track-and-trace technologies are being implemented as a result of the 2013 Drug Quality and Security Act of 2013.

Today, when I am practicing at the pharmacy, the technology footprint is everywhere. The majority of prescriptions are received electronically, and the pharmacy management systems are designed to allow quick entering of information and adjudication/correction of insurance claims. Data entry double-checking, prescription filling, production verification, and DUR review are all supported by an array of clinical information systems. Forced documentation of DUR issue resolution helps provide clarity across personnel shift transitions. Data verification double-checking is routine. In addition to prioritization and management by computer algorithms, these tasks are increasingly being spread among different pharmacies within a commonly owned entity across a variety of geographic locations. Point-of-sale (POS) systems allow payment processing and help support the business with various features. The best POS software allows the pharmacist to track inventory and sales, manage employees, grow customer relationships, and analyze data. The software is also integrated with outbound systems to drive clinical offerings at the pharmacy.

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It truly is astounding to think about the innovation and implementation of technology and computing systems during a short few decades. What will the next decades bring? Like the current administration's newest challenge to return to the moon, what will pharmacy's grand challenges be like in the years ahead? It provides much food for thought and discussion with colleagues. **CT**

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