Like most medical specialties occupational medicine is facing potential threats:

- **Lapse behind other fields with respect to application of emerging technology.**
- **Increased demand for health workers worldwide:** World Health Organization (WHO) Global Strategy on Human Resources for Health: Workforce 2030\(^1\), published in 2016, estimates 43.5 million health workers in 2013 and a need for 67.3 million health workers by 2030. The United Nations (UN) High Commission of Health Employment and Economic Growth estimated in 2016 a need for 40 million new health sector jobs by 2030.
- **Worldwide shortage of providers, particularly physicians and nurses:** The WHO World Health Report 2006 estimated shortages of 4.3 million health workers in 2006 and projected a shortage of 18 million by 2030\(^2\).

Thus, the question remains whether there are novel healthcare delivery models that can leverage technology to avert a disastrous shortage of health workers. In 2015, the International Occupational Medicine Society Collaborative (IOMSC) had 30 country members, and 22 of them responded to a survey, representing 26% of the world population at that time. They were asked about the future of occupational medicine in the member countries, and the responses can be summarized as follows:

- **Major changes in technology over the ensuing 10 years.**
- **Increasing focus on mental health and work/life balance.**
- **Better return-to-work policies.**
- **Greater attention to primary versus secondary prevention.**
- **Increasing demand for occupational medicine specialists.**
- **Threats from economic crisis and an aging workforce of providers.**

When asked how emerging technology will impact occupational medicine, they predicted there would be:

- **Improved training (tele-health, webinars, etc.)**
- **Telemedicine (virtual/digital medicine) with increasing scope/reach.**
- **Safer workplaces.**
- **Better record-keeping and use of data.**
- **Certain threats: new occupational hazards and the challenge of ethical concerns surrounding use of genetic information in the workplace.**

As for advances in technology that could impact paradigm shifts in the practice of occupational medicine, one must understand the meaning of the internet of things, big data, bioinformatics, precision medicine, artificial intelligence (machine learning, clinical decision support, etc.), robotics, and block chain technology. Ways in which these concepts can be applied to occupational medicine include:

- **Synchronous or asynchronous virtual visits.**
- **Virtual group appointments.**
- **Cloud-based references and health records.**
- **Modern learning practices to train and retain health workers.**
- **Improved engineering and administrative controls to reduce injuries and illness**
- **Optimal nature and periodicity of surveillance medical exams, based on analysis of big data.**
- **Application of proper work restrictions based on analysis of big data.**
• Use of remote monitoring of physiological function and environmental factors.
• Robotics for repetitive and hazardous workplace tasks.
• Artificial intelligence to enable driverless vehicles.
• Streamlined healthcare delivery through clinical decision support, voice activation of the medical record, and real-time pre-authorization and billing through block chain technology.

With respect to the last point above, proper application of technology could lead to reduced time needed for a clinical encounter, quicker documentation, reduced need for ancillary staff, and direct financial transactions with no need for an intermediary. As such, one has to wonder if, in fact, occupational medicine of the future could require fewer providers, particularly if technological advances in the workplace result in fewer workplace injuries and less occupational illness.

However, significant obstacles remain with respect to proper application of technology: inadequate power sources and internet access, equipment breakdown, privacy and firewall issues, effects of global disaster, lack of worker engagement, and minimal impact on the enormous informal economy.

Recommended actions to foster the best possible outcome include:
• International disaster preparedness through collaboration.
• Universal practice of evidence-based medicine with focus on value, not volume.
• “Low-tech” options for developing countries.
• Integration of health and safety in the workplace.
• Clear definition of roles of participation health workers
• Application of sounds ethics regarding firewalls between competing interests, guidelines on when to replace people with machines, privacy rules regarding personal data, and proper use of genetic information in the workplace.

REFERENCES