HealthManagement
Promoting Management and Leadership

Volume 14 - Issue 4, 2014 - Management Matrix

Radiology in 2020: Opportunities and Challenges

Prof. Moshe Graif
******@***tasmc.health.gov.il

Key Points

• Radiological technology is shifting from a “disruptive” period to a sustaining phase.

• Challenges include tissue characterisation and microresolution, affordability and the “invisible” radiologist.

• Opportunities include quantitative imaging and interventional radiology.

• In vitro diagnostics will change radiological screening policy.

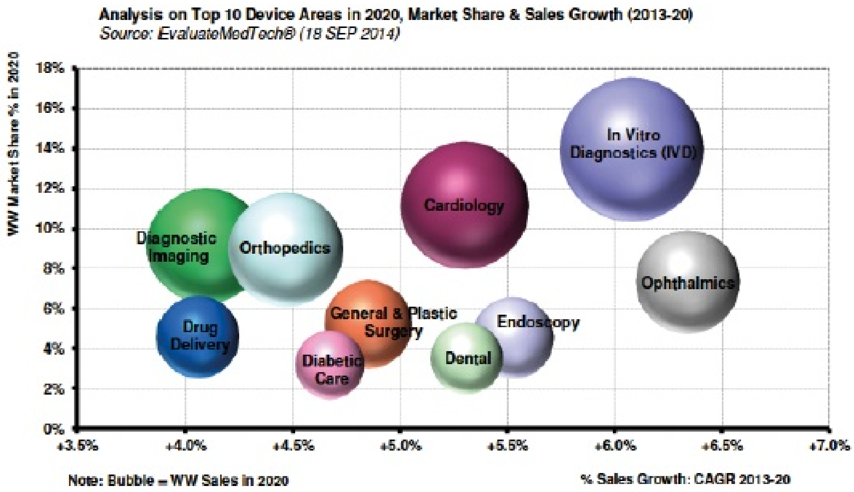
• Automation may have a mixed impact on radiology.

• Demand for radiology will continue to increase due to ageing population, and growing prevalence of chronic disease and cancer survivors.

In the last several centuries the correlation between technological advancements and humanity’s wellbeing in terms of life expectancy and world population growth is a well-established reality. A recent article in the Journal of Multidisciplinary Healthcare (Gill 2013), regarding technological innovation and its effect on public health, demonstrated that better technological innovation indicator scores were associated with better public health indicator scores. Furthermore, the study provided preliminary evidence that technological innovation shares causal relation with public health.

Since Josef Schumpeter’s paradoxical ‘Creative destruction’ theory in the 1940s (Schumpeter 1942) to Clayton Christensen (The innovator’s dilemma) nowadays (Christensen 1997), there is a trend to classify innovations into two main types. Sustaining or incremental innovations (“Evolution not a revolution”) consist of continuous improvements of an existing well-established product, which generally will get increasingly complex and more expensive, and inevitably will hit a point where it will offer more performance than the customers need, want, or can afford. This happens because manufacturers tend to preserve high profit market shares and avoid potential ‘cannibalisation’ of their own products by a new disruptive development. Disruptive, or radical (“game-changers”) innovations on the other hand, are usually introduced by new entrants, and replace an existing product with a simpler and more affordable technology or business model (as personal computers replaced mini and mainframe computers, or the digital camera replaced traditional film-based photography).

A typical innovation cycle is composed of three phases: introduction, growth and maturation. While the growth period is characterised by an exponential curve course, the maturation phase shows a significant slowdown as the technology approaches its physical or fiscal ceiling, or both. In the case of radiology, the 40 year disruptive period that started in the seventies represented the ‘golden age’ of radiology. Every modality which emerged in those years became a breakthrough in modern medicine. However, the last decade seems to mark the beginning of a shift from the exponential disruptive phase of the current technology into a sustaining phase, which is characterised by the saturation of the innovative momentum of the technology. Ultra-expensive equipment such as the various hybrid technologies is a classic representation of such sustaining innovation trends.



The Challenges

Two major goals in medical imaging have yet to be met. The first is the problem of the lack of an exact, noninvasive, image-based, tissue characterisation, and the other is microresolution, which will enable an earlier detection of a lesion, a microscopic metastasis (less than 0.2mm) or the exact edges of a detected lesion.

In Vitro Diagnosis

In vitro diagnosis is a major challenge. An early diagnosis can make a big difference in survival rates. It is known that the process of tumour formation can be picked up in the bloodstream before being sizeable enough to be detected by conventional methods. In vitro diagnostics (genomics, proteomics) therefore have the potential to provide a disruptive solution to earlier diagnosis of a disease and its follow-up. Furthermore, in vitro testing will be less expensive and more accessible (being based on a simple blood test), which will increase the compliance of larger populations for screening purposes. It will simplify medical research in terms of costs and timeliness. Thanks to advances in molecular diagnostics, and to drugs becoming increasingly linked to diagnostic tests, the field of in vitro diagnostics continues to grow more swiftly than the med-tech and devices market (see Figure 1).

Upon clinical maturation of in vitro diagnostics, current radiological screening policy will change profoundly. Screening by radiology will practically vanish, but radiology in general will be far from losing ground. In vitro diagnosis (due to its highly sensitive nature) will generate an immense volume of positive cases (both true and false). Every case will necessitate an investigation for a tumour or disease of 'unknown origin'. Once detected it will require workup for further clinical approaches, such as operability, total tumour burden, and guidance to further diagnosis and therapy.

Affordability

Another major forthcoming challenge is af fordability. Although imaging accounts for just 5% of the total healthcare expenditure, yet it is the fastest growing medical service and therefore raises concern about future costs. Unaf fordability is driven by the increasing cost of imaging technology, fast growing utilisation, and overutilisation.

The golden age of radiology was characterised by focusing on the "flashy technology". The operational mode was lagging behind. Radiology today, although digital, doesn't operate as a quantitative tool. Interpretation is a subjective art based on intuition, and is still using manual scoring. It was more convenient to pick the 'low hanging fruit' than to provide robust quantitative repor ting (limited software and shortage of radiologists have contributed their share to this).

Opportunities

Quantitative imaging, improved communication technology and interventional radiology represent the areas with major growth potential.

Quantitative Imaging

Quality imaging is about precision and evidence-based medicine. It requires standardisation and reduction of variability across devices, patients and time. Objective and quantitative metrics will allow the phenotyping and "personalisation" of a disease by imaging, in an individual or population.

Improved Communication Technology

Improved networking and communication wi ll of fer active shar ing of databases (data ava i labi l i t y any t ime, anywhere), such as Picture Archiving and Communication Systems (PACS), Radiological Information Systems (RIS) and Integrating the Healthcare Enterprise (IHE). Decision support technology will improve utilisation management by enabling better justification, appropriateness, and economically responsible 'value-based radiology' in the spirit of 'accountable care.'

Telemedicine offers better use of human resources by recruiting and employing radiologists independent of geographical location and time zone. Workflow management will have improved analytic tools to assist in clinical prioritisation, and the pre-detection of abnormal cases, with faster reporting of urgent findings.

Interventional Radiology

Interventional radiology is a great opportunity as it retains two major disruptive elements, i.e. minimising invasiveness and lowering costs. Newer techniques that will reduce radiation to both patient and physician, and smarter semiautomated guidance sof tware will shorten the procedure time and improve safety. This may also carry mixed feelings whether it is a challenge or opportunity from the radiological point of view, as it will fuel the ongoing turf battles with other clinicians, and may change the current operational model, which will become increasingly interdisciplinary.

Connected Devices

By 2020 there will be more than 50 billion devices connected to each other and to the internet, with medical devices being the third largest component. Medical and healthcare aspects of the "internet of things" include telemonitoring, emergency notification systems, and portable laboratory testing. Radiology-related "i" features include e-health data exchange, teleradiology and actual devices with U.S. Food and Drug Administration (FDA) clearance, such as smartphone ultrasound, and displays for remote radiological reading and accessibility. Portable devices such as handheld ultrasound machines utilised by operators from disciplines with limited training in medical imaging are supposed to revolutionise the diagnostic approach (Topol 2012). However, the use of low level handheld equipment by operators with limited skill and training will generate a trail of imaging follow-up studies performed by experienced radiologists using high-end equipment to sort out the true from false positive.

The "Invisible" Radiologist

Another current issue considered as a challenge concerns the 'invisible role' of the radiologist in the modern medical practice. The prevailing image is that of a radiologist situated in the 'back office', secluded in a dark small cubicle, with minimal contact with the patients. This is not surprising when considering that many radiologists have chosen their medical specialty, fully realising the lack of patient contact it entails. Samuel Shem articulated this notion well in his renowned novel *House of God*, by describing radiology as an N.P.C. (No Patient Care) specialty (Shem 1978). Nevertheless, modern clinicians are on their way to becoming invisible as well. Virtual Skype visits, robotic surgery, robotic rounds and telemonitoring are becoming part of the digitalised practice of medicine.

The' invisible doctor' and 'faceless patient' represent the identity crisis of modern medicine, based on reductionism, objectivism and digitalisation, which is induced by the "purely scientific" approach. This was also well summarised by Eric Topol in his book *The Creative Destruction of Medicine* (Topol 2012): "Reliance on remote monitoring and avoiding hospitalisation or in-person office visits can be tempting physicians into "treating the digital information instead of the individual".

"Wireless wellness" will generate an overwhelming amount of imaging volume, and as radiology is basically an "intuitive art", it will initially increase dependency on radiologists. Nevertheless, automated autonomous reading systems that will be developed to "help" the interpretation process, thus simplifying interpretation of a significant portion of the work, may have a mixed impact on radiology, as non-radiologists may have the opportunity to take an increasing role in supervising and providing interpretation, rendering some of the radiologists redundant. This will also make radiologists more invisible, and the risk is that radiologists may lose their say and influence on imaging healthcare policies and decision-making processes.

The automation and digitalisation of the medical art is a huge challenge. Automation is at its best when employed upon "textbook" cases, but it cannot perform tasks that involve perception and manipulation, creative and social intelligence, and dealing with emotional situations.

Although changes in radiological practice may occur, as in the case of screening for cancer, the bottom line is increased demand for imaging services, despite economic restraints and the advent of new in vitro diagnostic tools.

Factors increasing the future demand for radiology include the ageing population, and the growing prevalence of chronic diseases and cancer survivors. In vitro testing will create demand for imaging workups through its increased sensitivity and potential overdiagnosis. Last but not least, changing geopolitics will generate a growing demand for imaging devices and services in the unsaturated growing economies, which hold a vast untapped potential for expansion in patient care.

Published on : Sat, 8 Nov 2014