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Conclusions – Challenges for hospitals of the future

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Almost every aspect of society today has been shaped by technological developments. Take the nature of the modern state. The historian Philip Bobbitt describes how the introduction of gunpowder to Europe rendered the medieval city states, protected by high walls, obsolete. Gutenberg's invention of the printing press, allowing for the cheap distribution of information to the masses, paved the way for the Reformation and later for revolutions. The discovery of magnetism, and thus the compass, made it possible to establish global networks, enabling exchange of people and ideas and, ultimately, the system of international trade that prevails today. The invention of the steam engine, powering both railways and mines, paved the way for the industrial revolution and, with it, the growth of major cities. These examples illustrate how technological advances have created huge societal changes that rippled out into further cycles of innovation, driving the shift from local feudalism to a global post-industrial society.

Health care has similarly been influenced by technological change. As described in the first chapter, the modern hospital owes its origins to the need to concentrate resources around laboratories, operating theatres, and X-ray facilities. Safe anaesthetics, antibiotics, and the concept of asepsis changed hospitals from places where patients increased their risk of dying simply by entering to ones that could cure or, if this was not possible, alleviate symptoms. Yet, as also noted in that chapter, many of the assumptions that underlie the concept of the modern hospital are now being challenged. Numerous examples throughout this book show how technological advances are changing the way that health care is provided. In some cases these advances are specific to health care, such as desktop kits that take over many of the functions once reserved for the laboratory, or mobile monitoring systems, such as those that can track physiological changes in patients as they go about their everyday life. For example, it is now possible to attach an ultrasound probe to a smart phone that will allow a health professional to look inside the

body of their patient even in the remotest of areas. Patients can also have their chronic conditions managed without the need to regularly travel to hospital appointments, as in the case of COPD where specialist expertise can be obtained at a distance.

Other technological advances are generic, such as advances in communications technology. The smart phone that most people carry has the computing power of a supercomputer of the 1960s. Information and images can be transmitted rapidly between teams of health professionals, ensuring that all have up-to-date information on the patient they are managing and giving access to specialist advice from experts across the world and in future to artificial intelligence to support image analysis and decision support. In some cases, in future, sophisticated image analysis software will outperform skilled clinicians.

These developments have several characteristics. First, most were not anticipated or, if they were, the consequences were often very different from what was first predicted. For example, while the discovery of insulin had, as expected, a transformational effect on the survival of young people with diabetes, it took many years before the long-term complications of diabetes, and with them the need for new models of care, became apparent. The same was true of the introduction of antiretrovirals for HIV. It is only now that the long-term complications of infection with the virus and the accompanying immunosuppression, as well as the side-effects of the medicines, are being recognized, such as increased risks of cardiovascular disease and certain cancers. Fleming's discovery of penicillin transformed the management of many common infections but within a few years the problems of antimicrobial resistance were being recognized.

Second, many have required significant changes in ways of working. The survival of patients with noncommunicable diseases has given rise to the challenges of multimorbidity, which in turn has stimulated the creation of MDT working. Advances in diagnostics and treatment have allowed many patients who once would have had to attend hospital to be managed in the community. Many technologies require the development of staff with new skills and some have led to the emergence of new disciplines – for example, interventional radiology and cardiology. Some have allowed tasks previously undertaken by highly trained professionals to be delegated to other staff and in some cases to the patient or their carers, for example monitoring blood sugar for diabetes or clotting to manage anti-coagulation. It is worth noting that

much of this change has been in advance of, rather than in response to, changes in policy to payment systems and that policy-makers and payers have often struggled to keep up with the pace of change. Regulations, payment systems, and directives can inhibit and support changes but they are only part of the story of how these technologies are adopted. There are also lessons about the way that poorly designed incentives can create over-adoption: such as the multiplication of cardiac facilities in Bulgaria due to very high profit margins that were unintentionally created by the payment system.

Third, while some of these changes have been transformational, their development and spread have generally been incremental. For example, new, safer, and more effective medicines in the same class provide clear benefits, but do not demand new models of care. Others are more disruptive, such as the earliest developments in minimally invasive surgery, the development of endoscopy, interventional radiology and angioplasty in some cases challenging established ideas about by whom and where care is provided. Another more structural example is stroke units, which have revolutionized stroke treatment over the last quarter of a century. They both improve survival and reduce long-term dependency. Moreover, the delivery of early supported discharge, which involves patient care and therapy in their own home following stroke, has been shown to shorten length of hospital stay and improve long-term recovery, thus challenging old treatment pathways.

The clear message from the history of technological advances is that they cannot be ignored. Just as in the past, they will continue to shape the nature of health care and, with it, the roles of those who provide it and the ways in which they work together. To enable the hospital to support these changes rather than obstruct them, attention will need to be given to thinking more creatively and strategically about the workforce, technology, design of buildings, and the wider system in which hospitals operate.

Hospitals will need to be designed in a way that is sufficiently flexible to adapt to these changing circumstances, both in their physical design and their organizational structure. A hospital built today will be unrecognizable to doctors and nurses from the early 20th century. Resistance to change is simply pointless. Yet, too often, it takes years to take full advantage of innovation. Health care often lags far behind developments in other sectors, illustrated when, in 2017, the computer system of large parts of the English NHS were paralysed by a ransomware

attack that exploited systems using the obsolete Windows XP software. Nonetheless, health systems also demonstrate many remarkable examples of entrepreneurialism, with individual clinicians and their teams introducing innovative technology and ways of working, despite the system in which they work seemingly doing everything possible to obstruct them. The challenge, for health policy-makers, is how to encourage this entrepreneurialism in ways that maximize health gain, while not destabilizing the overall health system.

Preparing for the future

In the following section, we look briefly at some of the examples of innovation that reflect themes in earlier chapters and the opportunities and challenges that they pose for the hospital now and in the future.

We begin with the multidisciplinary team. As noted above, the growth of multimorbidity and the complexity of the responses to it, involving different groups of professionals, require completely new ways of working. A typical patient aged 75 or above may have five or six different conditions, each requiring long-term medication or other forms of therapy, not all of which may necessarily be compatible. Yet they may still be able to lead a normal life with appropriate input from different professionals. This requires a high level of organization, with seamless transmission of information. These patients are on a journey, and the challenge for the health system is to make it as smooth as possible. Unfortunately, in practice, it can be more like an exploration of an unknown land, moving from point to point almost at random, often getting lost in the process. Advances in technology can improve this process, in particular by ensuring the timely sharing of information. However, much more is needed. In particular, such teams can only operate in a culture characterized by collaboration, with flat hierarchies and mutual respect among all those involved. Creating these teams is not easy and requires deliberate work to develop and maintain them. Research in health care suggests that the appearance of teamwork may often disguise a lack of clear purpose, poorly defined membership, leadership problems, unhelpful hierarchical behaviours, and a lack of support for the team (West & Markiewicz, 2016).

MDTs in cancer care involve coordinated working among different professionals, which is required to synchronize the complex array of interventions and frequent patient contacts. Oncology MDTs can include

a broad range of health professionals with different skills including in diagnostics, oncology, pathology, radiology, surgery, nursing, and palliative care, who must work together and also alongside other professionals in psychology and psychiatry. Also professionals involved in new models of perioperative care, which emphasize improvement and consistency of outcomes for patients after surgery, are fundamentally multidisciplinary. Health professionals are drawn from a range of medical specialties, including anaesthesia, surgery, geriatric, and internal medicine, and should be led by those who can take a system-wide approach.

A related issue is the tension between generalists and specialists among health professionals. Unfortunately, in many health systems the specialist occupies a privileged position in the medical or nursing hierarchy, making it difficult to attract and retain generalists. Patients with multimorbidity will from time to time require highly specialized inputs. For example, a patient with diabetes, among other conditions, may need laser treatment on their retinas. This is a highly skilled task. They may also have kidney failure requiring dialysis, again a task requiring considerable expertise. But at the same time, they need someone who can take a holistic view of their health problems, ensuring that a treatment initiated for one problem does not exacerbate another. The growth of multimorbidity and polypharmacy as populations age presents a significant challenge to the model of narrow specialism. Patients increasingly fail to fit neatly into the way that medical specialisms have been organized.

As a consequence the fastest-growing area in hospital medicine in the USA has been in the specialism known as “hospitalists” (Wachter & Goldman, 2016). These are often internal medicine specialists (although they can be drawn from other disciplines) and are now appearing in paediatrics and other areas. Their role is to act as coordinators of patient care within the hospital and to co-manage cases with some specialties. Social complexity and difficulty in discharging patients as a result are also problematic and the hospitalist movement has been criticized for not paying sufficient attention to these issues (Gunderman, 2016). The chapter on frailty offers a similar model of a general physician with specialist skills for managing complexity, but shows the importance of services that can cross the boundary between the hospital and other types of care and address patients’ wider needs. Although this has been focused on older people, these issues of complexity are not confined

to the old. The question of the optimal balance between specialist and generalist care has not been answered.

In countries where primary care is the main provider of care for chronic diseases, the increasing levels of demand and the large and growing body of scientific knowledge involved in managing chronic conditions mean that there is a need to help primary care doctors, nurses, and other clinicians in their work and in keeping up to date. Hospital specialists in areas such as endocrinology, respiratory medicine, nephrology, cardiology, rheumatology, etc., have a key role in supporting the management of conditions such as diabetes, heart failure, and asthma, overseeing the administration of complex treatments and providing feedback and help with activities such as quality improvement and process redesign. This may require new skills, different approaches to patient consultations, and a change in the relationship between hospitals, primary care, and patients. The key aspects of this include:

- Rethinking the traditional outpatient model based on referral to a specialist.
- Improving case management skills of health professionals to ensure that the patient's problem is dealt with or that the patient is quickly referred to another professional who can deal with that problem.
- Health professionals working proactively to identify risks for the patient and engaging with them to address these. Often these may require action to deal with non-medical problems in the patient's life that are making compliance with treatment plans difficult.
- Considering and developing strategies for population health and prevention. This will include specialists taking a more direct interest in these areas, including secondary prevention for their existing patients and more active involvement in health promotion for the wider population.
- Specialists acting as consultants and overseers of networks of care and supporting other professionals. This means that the type of patient they deal with will often be more complex.

These challenges have led to a great deal of interest in the creation of various types of integrated care organizations that bring together primary and specialist care, and which potentially can deliver care that meets the characteristics described above. Many of these changes to the relationship between the hospital and its wider system will support integrated care but it is easy to underestimate the scale of the changes in work processes and operating models for hospitals and the staff who

work in them that the full development of these models will require. If integrated care systems can deliver on their promise of reducing the use of hospitals, then there are some major challenges as to how to reduce fixed costs if there are reductions in the use of hospital facilities.

The growth of specialism and the narrowing of many specialist fields mean that all but the largest hospitals will not be able to have the full range of expertise on site. The growth of digital technology means that laboratory and imaging expertise does not necessarily need to be in the same location, or even the same country, as the patient. The development of communications technology also offers the opportunity to spread expertise across distances. This can support the growth of specialist referral networks with escalation criteria and standardized protocols. These networks are increasingly common in cancer, neonatal care, neurosurgery, and many rare diseases where there is already a strong trend towards centralization because of a strong body of evidence that for certain types of care – particularly complex care, some types of surgery, and cancer care – higher volumes are associated with improved outcomes.

Referral networks are also found in high volume areas such as maternity services, where different parts of the network will have rules for accepting or transferring patients relating to the level of risk involved. Sometimes these may include retrieval services to ensure the safe transfer of critically ill patients. The organizational arrangements to allow for rapid transfer and return of patients need to be agreed across the network and properly managed or will be a cause of some tension.

The development of hospital networks run by groups such as Helios and Asklepios in Germany, and IHH, Apollo and Parkway in Asia, and which are also increasingly found in other European countries, partly reflects a growing idea that there are economies from both scale and standardization. Agreeing a common approach to a procedure, such as hip replacement, allows for procurement savings but also creates the potential for benchmarking and improvement across a wide network with managed processes to make this happen, as opposed to relying on hospitals joining such approaches voluntarily.

The growth of technology and a strong emphasis on efficiency have had the effect of shortening lengths of stay and increasing the intensity of work in hospitals. This trend will continue and will put increased demands on staff, facilities, and engineering and means that the proportion of beds run as critical or high dependency care is likely to rise.

A second effect has been to move work and specialists, who have been traditionally based in hospitals, to ambulatory settings, creating new ways of delivering care and requiring different approaches to giving specialist advice for inpatient care.

While advances in technology have brought many benefits, they have also created new challenges. One relates to the challenge of providing effective health care to people living in remote areas. As has been noted, the management of conditions such as myocardial infarction, gastrointestinal bleeding, stroke, and major trauma have been transformed by the introduction of new methods to intervene actively to tackle the fundamental problem, whether it be a blocked artery or catastrophic bleeding. Yet for this to be achieved, there is a need for rapid diagnosis, followed, equally rapidly, by definitive treatment. If these are delayed, the treatment is simply ineffective. Yet in some places, where the population density is low, it will never be possible to provide such definitive diagnosis and treatment sufficiently close to where people live. This will require new and imaginative solutions involving the training of multiskilled doctors and other clinical staff, technology for remote advice and support, and rapid transfer or retrieval services. Remote areas tend to be more explicit with their local population about the limits and capabilities of local services and what will happen in the event of a serious emergency than those in more populous areas.

There are challenges as well as opportunities from the increasing role played by information technology. There is a danger that feeding the system with data can take priority over interacting with the patient. Patients frequently complain that the health professional spent the encounter looking at a screen rather than at them. Health professionals complain that they spend so much time entering data that they are unable to engage in conversation with the patient. Yet in other sectors this challenge has been addressed. There are many new means of entering data, ranging from barcodes to the use of voice recognition software. Unfortunately, in the health sector these appear to be difficult to implement and are significantly under-exploited.

The way forward

We conclude with four recommendations. In producing this book, we have been struck by the lack of fora within which those working in hospitals, those responsible for their design and operation, and those

responsible for the policy environment in which they operate can come together to exchange ideas. There are many innovative models of care around Europe but far too few have been evaluated and, where they have been, the findings are not easily available. There is now clear expectation that those responsible for introducing therapeutic innovations, such as new medicines or surgical procedures, should evaluate them and share the results. This is not the case with innovative models of care. There is a clear need to create mechanisms that would enable this to happen.

The second relates to the hospital workforce. The roles and responsibilities of health professionals have changed remarkably over the past few decades. They will continue to do so. In many cases these transitions are managed easily and effectively. Yet in others, they are not. There are sometimes legal and regulatory barriers to change, as well as financial incentives that act as barriers to effective working. There is a danger in sweeping all of these away, as they can provide much-needed protection for health workers, who in many countries are inadequately rewarded for their commitment and dedication. But on the other hand, there is a need for sufficient flexibility to allow them to develop as circumstances change.

The third relates to the hospital and its wider environment. It is abundantly clear that the hospital is only one part of the health system and for many patients the boundary between it and the rest of the health system can act as an impenetrable barrier. Many contemporary advances, in particular those that seek to bring sophisticated treatment to patients as quickly as possible, require models of care that reach beyond the hospital into the patient's home. Similarly, there is a need to ensure that the process of being discharged from hospital is as smooth as possible, and is not seen simply as a means of emptying a bed for the next admission. This means that hospitals need to be planned as part of the wider system in which they sit, both in terms of the opportunities to work differently with primary care and community-based services, but also as a part of a wider network with other hospitals and specialist centres. This also means that traditional approaches that use beds as the currency for planning hospitals is now inadequate and potentially misleading or unhelpful.

The final recommendation relates to connectivity. This means connectivity within and beyond the hospital. It means connectivity through information technology but also in person. Indeed, it particularly means in person. Yet it is necessary to recognize that connectivity has a cost

as well as benefits. Time spent in meetings is time not spent treating patients. Too often, meetings are organized where those attending see little point. They feel that their time is being wasted, little is relevant to them, and they spend most of the meeting on their tablets and smart phones, engaged not with those in the room but with those outside it. In time, they drift off, finding excuses to stop attending. There is a clear need to find new ways of communicating in which the benefits outweigh the costs.

It is impossible to know what the hospital of the future will look like, just as it was impossible to say what the future of travel would be before the Wright brothers took their first flight. All that can be said is that the future will be different from the present. What is important is that structures and systems are put in place that have sufficient flexibility and ability to learn as circumstances change.

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