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The Physician in the 21st Century

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INTRODUCTION

From Hippocrates to Osler, the sacrosanct physician-patient relationship has been paramount. Hippocrates is best remembered for the Oath that bears his name[1], often recited at medical school graduations, which places the patient first and foremost in the physician encounter. More than two thousand years later, William Osler, the renowned professor of medicine at Johns Hopkins Hospital and Oxford, wrote that the premier quality of a good physician is "aequanimitas", meaning calmness and patience[2]. The foundational idea of the personal, caring relationship between physicians and patients has clearly withstood the test of time. Perhaps it can serve as a guidepost for the enormous changes coming in medical care in the 21st century. Indeed, across the ages of advances in scientific discovery, the special nature of the physician-patient relationship, exemplified by compassion, has been the mainstay of medicine.

But a confluence of forces, unique to the 21st century, has the potential to change this noteworthy historical course and, as a result, present new and distinctive demands on the traditional medical education curriculum. These forces may perhaps be best characterized as a series of "disruptions" and include: *patient empowerment* through access to medical knowledge; *globalization* through interlinked health economies and services; and *technology,* especially through the growing development of artificial intelligence in medical practice.

Patient empowerment through access to knowledge

For century upon century, the medical practitioner was viewed as the sole recipient of a body of knowledge to be put to good use in the care of the patient, as the patient's knowledge of medicine was severely limited. However, the growth of internet-based knowledge dissemination has dramatically changed the dynamic of the patient-doctor relationship. As a result, the doctor no longer stands alone as the source of medical knowledge, but rather works in cooperation with an informed patient. Decision-making in the context of care is increasingly a joint decision or perhaps even a negotiation, with the patient interacting with multiple providers and information sources.

As health technology continues its inexorable – and exponential – advances, it will be increasingly common for individuals to wear devices (attached or implanted)

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that monitor various bodily functions and to use the "information cloud" as a dominant focus for their medical decision making. As many of these interactions occur outside the physician-patient encounter, they add a difficult and complicating factor for the role of the physician. The growing trend of patient empowerment through knowledge acquisition requires that a new approach to medical diagnosis and treatment be developed in the education of medical students and other healthcare professionals.

Globalization of the health economy and medical services

Healthcare is transitioning from an intensely local service to one that is more worldwide in scope. For example, the phenomenon of "medical tourism" is still in its relative infancy but is likely to pick up significant speed as communication and transport technologies continue to evolve. The traditional rules of engagement between patients and providers, such as the conditions for medical licensure and scope of practice criteria, will be much more fluid than they are today. Patients will seek optimal and affordable healthcare options wherever they may be located. As a result, the interlinking of healthcare economies between countries and regions will create new provider systems that were unimaginable even a decade or so ago, eventually evolving into a global medical practice environment. Medical educators must respond to these growing forces with curricula that link knowledge and skill development on a worldwide basis.

Technology and artificial intelligence

The digital revolution, begun in force with the arrival of the internet late in the last century, is now marching forward with exponential speed. In particular, the growing field of artificial intelligence presents a provocative question: will smart machines replace humans like the internal combustion engine replaced horses? Indeed, with scientific advances and evolving medical machines, a "new physics" of patient care is being created[3], which has profound implications for the practice of medicine and the education of physicians, based on four underlying principles[4].

1. Care anywhere

This refers to the observation that technology is moving the care of patients not requiring highly-advanced care from clinics and offices to wherever patients happen to be, as monitoring systems report continuously on a growing set of biological and other parameters.

2. Care in teams

This suggests that the sacrosanct doctor-patient relationship will gradually be replaced by relationships with multiple healthcare professionals. This substantive change in the dynamics of the patient-provider relationship presents the challenge of gaining the most value from team care. Care by teams also implies a necessary recalibration of the scope of practice for each member of the clinical team, such that the most efficient and effective care is provided.

3. Care by large data sets

This recognizes that the amassing of huge medical repositories for both patients and populations is inevitable, and that a new interpretive and function infrastructure is required to manage all this data. As a result, the locus of decision-making is shifting from the individual clinician's mind and experience to an algorithmically-based collaboration with exponentially growing databases.

4. Care by machines

This may ultimately prove to be the most challenging arena for medical practice in the 21st century, as machines gradually outperform humans in a variety of medical tasks. Machines' abilities don't decline with age and can improve with updates; they don't get tired or become subject to typical human weaknesses. With considerable progress being made in artificial intelligence, many futurists place no limits on this potential[5].

Impact on medical education

The evolutionary path of 21st century medicine suggests that substantial changes in the medical school curriculum are necessary to keep medical education relevant and effective. To emphasize this point, contrast the state of practice 30 years ago (in the 1980s) with what the state of practice 30 years from now might be like (note that many of our current students will still be in practice

in 2050!), keeping in mind that the pace of technologic change over the next 30 years will far outpace the dramatic technologic changes of the past 30 years[6]. It is abundantly clear that a new type of physician will be immersed in a practice world we can only begin to describe. The following trends provide some of the basis for what will require significant curricular change.

1. Knowledge acquisition and management

The traditional approach of absorbing and being tested on facts will be significantly modified to emphasize the ability to obtain relevant information in real time via electronic means. The curriculum will emphasize knowledge acquisition throughout all years of training, with the goal for graduates to become highly-versed in the interpretation of clinical data and analytics that derive from the manipulations of large data sets by computers.

2.Expert analysis

The role of the physician will shift from being a content expert to performing expert analyses. Because the amount of information collected on a given patient − including genomics, metabolomics, and other findings − will exceed the human capacity to process it, results will be analyzed using algorithms by advanced computers that will also have access to the world's medical literature and clinical trials databases. Computer-generated probability lists will require that clinicians be expert in the analytics required to interpret the findings and make recommendations to patients.

3. Effective teamwork

Because the physician will be working with a large team of health providers, the curriculum will include developing and practicing the skills of effective team work and team decision making. The relatively siloed approach to health professions education today will use an interprofessional education model throughout the entire curriculum. The health professions will view themselves less like guilds and more as part of healthcare delivery teams.

4. Technology management

New evaluative skills are also necessary, particularly in the arena of technology development. With an increased focus on cost and quality, physicians will become skilled at high value medical practice. In a real sense, physicians will master the art of "managing the machines" – before the machines manage them!

There are many challenges in implementing the curricular changes suggested above, including: finding time in the curriculum; training the faculty in the necessary teaching skills; and having the various accreditation bodies willing, flexible, and supportive of the changes. Despite the various points of resistance, a comprehensive overhaul is necessary if medicine is to keep pace with the changing healthcare delivery system.

CONCLUDING COMMENT

Given the dramatic changes coming to the world of medicine in the 21st century, serious thought followed by action is required to answer the question: "what is the role of the physician going to be?". Perhaps an answer can be found in this commentary from the American College of Physicians:

> "Suffering with the patient" is author Joseph Campbell's classic definition of compassion in medicine. It is an imaginative leap into another's shoes, one that enables us to appreciate firsthand something of what it feels like and means to be that particular patient. Compassion involves deep feeling for others, becoming present with and responding to what we can understand of another person's predicament[7].

It is essential, in my opinion, for organized medicine and medical educators to begin a deep and long-term discussion about how this relationship can best be maintained. This discussion must probe into a deeper understanding of the reality of the human touch. How, for example, can the different roles of humans and machines be managed, and how should our education practices be transformed? If healing, whether emotional or physical, is an experience of life, is it one that technology can never replace? Ultimately, the physician in the 21st century, regardless of technological developments, will need to offer *compassion* to patients, something so distinctively human that it should become the central focus of the new medical education curriculum.

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