

‘How does understanding pathology help anticipate future healthcare requirements?’

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Introduction

The vastness of the field of healthcare makes it quite hard to pinpoint what areas can be targeted and adequately researched to offer solutions to future healthcare requirements. It seems like a never-ending cycle. A ground-breaking discovery is never enough, it’s always what are we missing? What more can we do? However as clinicians, we must always ask these questions. We must always push the envelope. As knowledge in the health sciences increases, the demand for better solutions, better technology, better treatment increases. What is the role of pathology in all of this? Can broadening our understanding of the field of pathology aid us in equipping us for the ever-evolving field of medicine? Pathology is always said to be the bridge between science and medicine (1). To adequately define the role that pathology can play in anticipating future healthcare requirements, we must first answer the million-dollar question: “what are future healthcare requirements?” This essay seeks to decipher if and how an understanding of pathology aids us with anticipating future healthcare requirements.

Future healthcare requirements

It must be clarified that although there have been magnificent breakthroughs in medical diagnosis and treatments (2), has the delivery of healthcare undergone a massive structural change? We must ask ourselves if healthcare delivery has adapted to deal with the increased surge in chronic illnesses which represents a large amount of government healthcare expenditure (3). Many healthcare and pharmaceutical companies envision future healthcare requirements to be more patient centred, where patients would play an active role in preventing diseases rather than awaiting the onset of disease then seeking out treatment (4).

The European Commission predicts the future healthcare requirements to be: “

- *a shift from care in hospitals to the provision of care closer to home - to cope with elderly patients with multiple chronic conditions, such as heart disease and diabetes.*
- *the growth of new technologies, new medical appliances and diagnostic techniques which requires technical know-how in addition to clinical knowledge*
- *the expansion of e-health, which enables distant diagnostics services, requires new ways of working.” (5)*

In August 2016, the Irish Medical Organisation stated that enhancing service provision across the health system is a key future healthcare requirements (6). Garson and Levin predicted over a decade ago that the ten trends for the future of healthcare would include “more patients, more technology, more information, the patient as the ultimate consumer, development of a different delivery model, innovation driven by competition, increasing costs, increasing numbers of uninsured, less pay for providers, and the continued need for a new healthcare system” (7). We are continuing to see these trends regularly and healthcare professionals will have to improve efficiency by increasing collaboration between researchers, clinicians and educators.

What many companies see with regards to future healthcare requirements is technology overtaking many aspects of healthcare delivery today (8-9). It is already happening with many inpatient services being offered at home. A recent study suggested that approximately eighty percent of pathologists believe that AI will become integrated in diagnostic workflows in the next decade (10).

So with the majority of companies predicting future healthcare requirements to be changed from treatment based reactionary care to prevention and the promotion of well-being (11), what role will understanding pathology play in aiding us to better anticipate these changes?

Pathology in the current clinical setting

Clinical pathology in the current clinical setting developed from the study of macroscopic organ and tissue changes at autopsies. The diagnosis and management of treatment of neoplastic disease remains the central focus of clinical pathology (2). From the days of Morgagni and his detailed autopsy

studies to the widely accepted father of microscopic pathology, Rudolf Virchow, pathology has advanced in its understanding the mechanisms of injury to the cell and the body's means of responding to and repairing the injury. We can see the evidence of this from the World Health Organisation alongside the International Agency for Cancer Research with the collaborative efforts of researchers worldwide to provide guideline for tumour classification (12). This method has led to further building of the clinical pathology database with the inclusion of genetic finding in tumour classification.

Clinical pathology has come a long way with the development of targeted therapies based on patients' tumour biopsies. It has also advanced to meet the need to determine predictive biomarkers which will be especially necessary in anticipating future healthcare requirements. The modern pathologist is asked to provide and interpret information necessary disease prevention, diagnosis and management (See Figure 1).

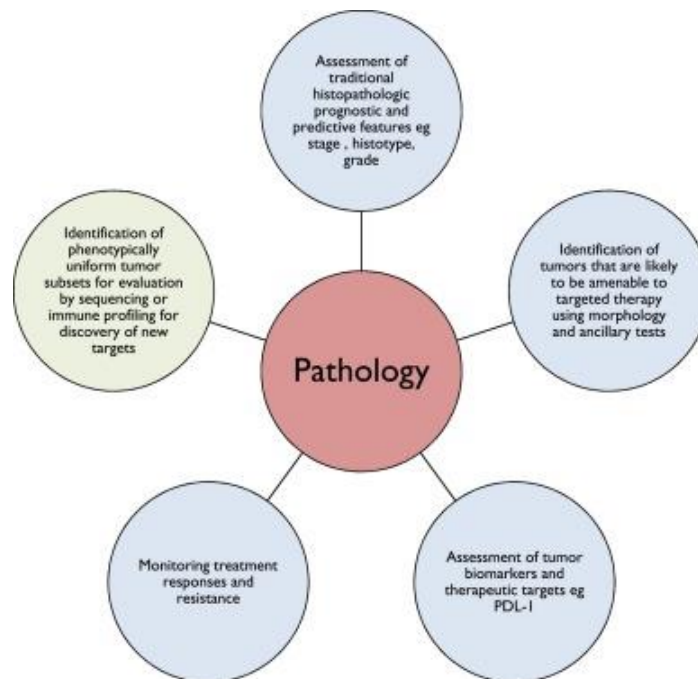


Figure 1. Pathology and its central role in targeted therapy. Taken from *Cancer Targeted Therapy Strategy: The Pathologist's Perspectives*. <https://pubmed.ncbi.nlm.nih.gov/29189158/>

It has been said that approximately ninety percent of the work of pathologists is still done by performing various staining methods that doctors came up with over a century ago (8). This is despite the all the current advancements in biotechnology, invention of blood drawing robots and synthetic

organ tissues etc. The diagnostic process still lies at the Nike trainers wearing feet of the pathologist looking at tissues with a microscope in a lab.

Understanding pathology

Our knowledge of infectious diseases extends into antiquity (13). The value that the field of pathology adds to the clinical setting cannot be underestimated. Pathology has always formed the basis of clinical reasoning. Those that came before us showed us what worked and what failed, and aided in solidifying the foundation of what pathology is today (14).

A fundamental understanding of how pathology plays a massive role in forensics, cancer staging and identifying the causative agents in infection and targeted clinical disease management is key for any physician. In order to better understand pathology, one must first understand what it brings to the metaphorical clinical table and banish the ill-conceived notion that pathology is a field that only deals with death (15). If there is no basic understanding of pathology as the root of which many aspects of clinical medicine stem from in the core years of medical school, one might consider the hours spent in tutorials, anatomy labs and giant lecture halls to be futile. Successful medical treatments are borne of the basis of understanding of what is happening at the cellular level, and we cannot anticipate future healthcare requirements if medical schools are producing physicians that can only prescribe medications based on rote learning of symptoms. What happens when a new disease phenomena presents itself and the memorized mnemonics we have locked away in our hippocampus aren't able to give us an answer?

With future healthcare requirements seeming to be based on patients being aware of risk factors of disease and healthcare moving into a prevention based delivery of healthcare model (4), the old phrase 'prevention is better than cure' takes on an entirely new meaning.

Understanding pathology helps to anticipate future healthcare requirements

Pathology has always been lauded as the marriage of medicine and science. It has been said that pathology main goal is to provide information (16). The only way pathology can keep up to speed with fast advancing biotechnology and medical treatments, is to continue to provide the information that governs clinical decision making.

Understanding pathology entails taking into account all the subspecialties of the field, including but not limited to anatomic pathology, cytopathology, dermatopathology and molecular pathology. If one does not understand the value the pathologist brings to the multidisciplinary team, our clinical efforts would amount to nothing. As pathology heads towards the inevitable path of sub specialism, there will be assuredly be an increased need for interdisciplinary education and training (17). One cannot disregard the importance of sub specialism in pathology, as with the explosive advances in health sciences over recent decades, it is extremely difficult for individuals to stay abreast with every new development that occurs in the medical field.

From the very first day of medical school, it has been drilled into us to only make clinical decisions based on evidence-based practice and this is the true essence of understanding the field of pathology. Bridging the gap of cultural differences between pathologists and clinical practitioners will aid in improved patient outcomes, in timely delivery of patient care and in anticipating future healthcare requirements.

Shaping medical school curricula with the aim to better equip future doctors who will be dealing with these increased future healthcare requirements, we must ensure we are training physicians who fully grasp and understand the part pathology plays in patient disease management and treatment (18).

A physician knowing the correct steps and when to contact the pathologist for further diagnostic assessments is crucial for efficiency in futuristic prevention based healthcare.

If medical education does not undergo a change in the approach of how current students are taught to understand the field of pathology, there is a risk of producing physicians that may lack the certain characteristics that set physicians apart from other healthcare professionals, namely distinguished

expertise based on a deep understanding in biomedical science and understanding the pathological aspect of diseases (19). We must let go of the idea that the biopsy sample, once collected goes to a magic place that churns out answers for us and then suddenly we know what to do next (like I would have thought previously!). I used to think the cure for cancer would be easily achievable but until my exposure to molecular medicine this year and subsequent understanding of the concept of apoptosis and the tight regulation of the cell cycle and DNA replication, and despite the cell's best efforts to stop things from going wrong, things still go wrong! Although we are making tremendous breakthroughs (20), there is still a long way to go.

A small study of medical students in Germany suggested that a thorough understanding of pathology in medical schools can be implemented by the use of tutorials, autopsies and supplementary computer based learning tools (21). Major factors in the quick advances in the field of pathology include the need for pathologists to comply with national standards and guidelines. Additionally, the scarcity of pathology services in regions that may have poor healthcare infrastructure needs to be addressed to aid us in anticipating future healthcare requirements(16).

The future of clinical pathology is predicted to be morpho-molecular (2). Will understanding this aid us in better anticipating future health requirements such as management of chronic illnesses in an aging population and pro-active medical care instead of reactive medical treatment? In my opinion, I strongly believe understanding pathology will aid us by providing a basis where we don't await clinical manifestations of a disease but by pathological screening beforehand, we can personalise the patient's care pathway and put mechanisms in place to manage the disease, leading to better prognosis and patient outcomes.

The only way to ensure there is a true understanding of pathology to aid us is by altering medical education and training of our physicians. It would be unethical to allow junior physicians to attempt to treat disease without a basic understanding of the disease process.

The development of new technologies that can be used by pathologists in futuristic prevention based healthcare models are a necessity. These technologies such as immunohistochemistry and gene expression profiling (22), allow an understanding of pathology which will allow us to better anticipate healthcare requirements. Knowing the nature and cause of the disease and how to treat it, equips us for clinical practice. Additionally, knowing the genetic presence of the disease, detecting and treating it early before it manifests phenotypically seems like the direction future healthcare systems want us to go in. And what better field than pathology to lead us in the right direction? Recent developments have allowed pathologists to better identify micro metastases (cancerous growths smaller than 0.2 mm) in lymph node tissue (23). ER status determination is now part of the pathology dataset required for breast cancer. FISH and SISH techniques allow us to visualise genetic material and detect genetic abnormalities (24). Advances such as these help us to anticipate what the needs of healthcare in the future will be and what pathologists can contribute.

Understanding pathology does not just benefit clinical decision making; but it also ensures efficient delivery of pathology services through intelligent commissioning and requesting of diagnostic and screening services. Knowing the right screening tool for physicians to request would save time, which is an especially limited resource in clinical practice.

Pathologists are able to provide insights through their study of diseases at a molecular level, which contributes to better equipping us for when future healthcare requirements arise. The UK biobank project is a large scale biomedical database and research resource, where a large number of participants (five hundred thousand participants) donating bio-specimens has allowed for several scientific discoveries (25). With this open access resource, what better way can an understanding of pathology be used to anticipate future healthcare requirements? As the overarching theme of future healthcare requirements is management of chronic illnesses and prevention based medicine, improvements in our understanding of pathology will aid in facilitating pathology to be at the forefront of providing resources to meet these anticipated future healthcare requirements.

Conclusion

Pathology as a field will always lay the foundation for clinical medicine. Pathology provides a link between all aspects of medicine, from immunology, parasitology, oncology and haematology. Future healthcare requirements for an increasing age population include the management of chronic illnesses and a prevention based healthcare model. With a thorough understanding of the study of pathology, one hopes that we can better anticipate and prepare for the ever-increasing healthcare requirements that will be placed on the healthcare system. Pathologists have gone from behind the curtains to the stage and re-established their importance position in the patient care pathway.

With our current knowledge of what future healthcare requirements will be, our understanding of pathology will aid us by providing us with a high-level of knowledge of the mechanisms of disease and the management and treatment of these diseases.

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