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PERSONAL VIEW

An urgent need to teach complexity science to health science students

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I. INTRODUCTION

Healthcare systems and medicines operate in a complex landscape and constantly interact with individuals, the environment, and society. In such a complex healthcare delivery system, nonlinearity always exists, and treatments, different healthcare services, and medicines cannot be delivered without factoring in the uncertainty brought about by human, behavioural, system, and societal factors.

A medical doctor prescribes medication/s to treat diseases or healthcare problems following certain treatment protocols and guidelines. However, in the community, several factors affect the adherence and outcomes, such as adverse effects, lifestyle factors, socioeconomic aspects, attitudes, and belief systems, so it is difficult to entirely predict the success of a regimen. These factors that can influence the outcomes of therapy have not received adequate attention. Furthermore, the complexity of healthcare delivery is starker in the treatment of ageing populations or those with chronic diseases.

Our world is becoming increasingly complex. Many uncertainties affect the delivery of healthcare services today. There are inherent challenges within the healthcare system such as lack of adequate funding, ageing population, rising burden of chronic diseases, and overstretched health workforce. In addition, newer challenges such as the impact of climate change on health delivery, the use of digital health technologies, the emergence of new epidemics, and questions regarding sustainability make healthcare delivery complex and uncertain. Healthcare systems operate through a network of subsystems such as hospitals and health systems, clinics, primary healthcare networks, rehabilitation centres, pharmacies, hospices, care homes, families, and patients. They interact with each other in a complex way sometimes producing unintended consequences such as adverse reactions, medication errors, unintended hospitalisations, and hospital-acquired infections. Thus, if we view the health system as a complex entity we can appreciate its dynamic behaviour helping us in delivering health services in a self-organized way (Lipsitz, 2012).

There is an urgent need to teach complexity science to undergraduate and postgraduate health sciences students as it better prepares them to deliver healthcare services and medicines to a dynamic and complex society. The healthcare systems we work for and the communities and societies we deliver healthcare services and medicines are complex. Healthcare delivery is disrupted by access to funding and resources, information and communication technology (ICT) applications, healthcare professionals who keep moving in and out of the system, and the increasing burden of chronic diseases and elderly populations needing several healthcare services and medicines. It is difficult to predict the outcome of the healthcare services and medicines that are delivered via both primary and secondary healthcare systems. Furthermore, it is difficult to predict the impact of healthcare services and medicines on patients. A patient may develop an adverse drug reaction to a

medication, patient may have different genetic polymorphisms affecting the metabolism of medication or factors such as socioeconomic conditions, education level, support system might affect the way they receive and use healthcare services and medicines. There has been a growing recognition of such complex needs and the biological, psychological, social, and cultural aspects of medicine in the healthcare sciences curriculum (Quintero, 2014). There is also a greater appreciation for the collaborative care and practice model that brings together medical doctors, pharmacists, nurses, and other healthcare professionals together for patient care (Blount et al., 2006). The collaborative care model attempts to implement change in small and manageable cycles, appreciating the complexity involved. We must introduce complexity in medicine and pharmacy teaching and learning by introducing concepts, terminology, and lexicons regarding complexity and uncertainty. Students' engagement and appreciation of the complexity of healthcare systems and delivery can be assessed through reflective practice, clinical reasoning, and evidence-based practice.

Complexity recognises that relationships may be nonlinear and emphasises the relations and interconnections between different components. Flow, interdependence and the emergence of structures and patterns are emphasised. An acceptance of the non-linear cause and effect relationship is stressed. Evidence-based medicine is based on statistics derived from large populations. Applying the results to an individual patient requires caution. Diagnosis and treatment outcomes are probabilistically determined. With the advent of large data sets the probabilistic nature of medicine is becoming apparent. A particular set of signs and symptoms provides a set of differential diagnosis in either increasing or decreasing order of probability. A variety of social, emotional, and political factors can influence treatment decisions, access to care, and treatment outcomes.

Universities have begun to realise the importance of teaching complexity science to medicine and health sciences students. A study by Jorm et al. (2016) had shown how complexity theory can be used to guide interprofessional learning. It showed how complexity theory can be used to design cases, formats, and assessments and how it enabled students to achieve complex interprofessional learning outcomes (Jorm et al., 2016). Another study by Jorm and Roberts (2018) reported the use of complexity theory to design evaluations with a new focus on developing medical students as future change agents for the transformation of the health system and patients' lives (Jorm & Roberts, 2018). Several institutions like the Santa Fe Institute (New Mexico, United States) have already begun training programs on complexity in medicine and health care systems. Such programs and training need to be developed and evaluated globally so that medicine and pharmacy students can better tackle the complexity of health systems and the uncertainty around delivering medicines and healthcare in a complex environment. Training students for complexity today can ensure they are better prepared for both current and future challenges.

Notes on Contributors

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Declaration of Interest

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