COORDINATION RESPONSE BETWEEN PUBLIC HEALTH AND MEDICAL LABORATORY TOWARD ENDEMICS

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Abstract:
Within the context of the healthcare system, clinical laboratories are of critical importance. Clinical laboratories provide objective medical data that supports about sixty to seventy percent of clinical choices. However, the evidence that supports this claim is poorly documented, and laboratories continue to lack visibility, despite the undeniable impact that they have on patient care and public health. We place a strong emphasis on the necessity of establishing a harmonized and coordinated national public health laboratory system, particularly for the purpose of conducting an outbreak investigation. This system should incorporate various categories of public health laboratories within a country and should be closely connected to the national public health delivery system as well as regional and international high-end laboratories.

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Introduction:

Since the beginning of recorded history, infectious diseases have been a problem for human beings of all sorts. In spite of the recent rapid discoveries and advancements in modern medicine, science, and biotechnology, infectious diseases continue to be the second biggest cause of death around the globe. Of the estimated 57 million deaths that take place around the world each year, infectious diseases are directly responsible for more than 15 million deaths, which is more than 25 percent of the total. Because of the indirect impacts of infections, millions of additional fatalities have occurred. Additionally, infectious diseases are responsible for an increase in morbidity and a loss of job productivity as a consequence of compromised health and disability. Indeed, infectious diseases are responsible for nearly thirty percent of all disability-adjusted life years worldwide [1]. The world has experienced an increasing incidence and transboundary transmission of developing infectious illnesses during the past four decades as a result of population growth, urbanization, and globalization. This has added to the burden of infectious diseases that already existed. Although viruses make up the majority of newly emerging and re-emerging pathogens, viruses only account for a small fraction of the approximately 1400 pathogen species that have been identified as being capable of infecting humans. The majority of the viruses that are reported to infect humans are likely to be RNA viruses [2,3]. On average, however, more than two new species of viruses that infect humans are reported every year around the globe. Lab medicine is the single most important medical activity that takes place in the healthcare industry all around the world [3]. Clinical laboratories are essential to the delivery of patient care because they are responsible for providing and assuring the quality of medical laboratory testing that is used to support clinical decision-making within the healthcare system. In point of fact, clinical laboratories provide medical practitioners with the objective data that is required to provide care that is of a high quality, safe, effective, and suitable for the prevention, diagnosis, treatment, and management of diseases [4]. During the past two decades, it is anticipated that the number of laboratory tests that are available to doctors has increased by a factor of two, reaching a minimum of 3,500 assays. In addition, the global market for in vitro diagnostics (IVD) was estimated to be worth $87 billion USD in 2021, and it is anticipated that it would reach $135 billion USD in the next ten years, expanding at a pace of 4.6% yearly [5]. It is obvious that healthcare systems are unable to function properly in the absence of the information that is provided by clinical laboratories in both hospital and community settings. It is believed that clinical laboratories are responsible for providing roughly 90 percent of the objective data that is contained in medical records and that they have an influence on 60–70 percent of clinical decisions [6]. However, the evidence that supports these statements is not clearly documented. In a recent paper, Rohr et al. conducted an interview survey with forty oncologists and forty-nine cardiologists. The purpose of the survey was to determine the number of cases in which the oncologists and cardiologists ordered intravenous (IVD) testing, as well as the number of cases in which IVD was used for initial diagnosis, therapy monitoring, or post-treatment follow-up. In total, intravenous drug testing was utilized in 88, 77, and 72 percent of patients for the purposes of initial diagnosis, treatment monitoring, and follow-up, respectively, indicating the undeniable significance of IVD in the process of patient evaluation [7].

Review:

It is possible that the coronavirus disease 2019 (COVID-19) is the illustration that best illustrates the vital role that laboratory medicine plays in public health and patient care. Laboratory professionals swiftly mobilized in the aftermath of the first worldwide wave of the SARS-CoV-2 pandemic, which occurred in the early 2020. Their goal was to separate the genetic information of SARS-CoV-2 and develop molecular tests to diagnose current infections and support public health protocols. In the beginning, regulatory agencies permitted the development of nucleic acid amplification tests (NAATs), which included reverse transcription-polymerase chain reaction (RT-PCR), in order to diagnose SARS-CoV-2 infection, even at low virus loads. In order to enable community testing, as well as rapid isolation and return to work techniques, additional efforts were committed to the development of rapid tests. These tests included antigen tests (such as lateral flow assays) and point-of-care loop-mediated isothermal amplification (LAMP) assays. As of September 2022, it is predicted that a total of 682 RNA-based tests and 985 antigen-based assays have been developed all over the world in order to identify SARS-CoV-2 [8]. In the process of transitioning into a "endemic," laboratory medicine continues to make a significant contribution by creating bivalent assays for the detection of various influenza and coronaviruses. Additionally, laboratory medicine remains committed to ensuring that assays continue to be accurate even as new variations appear. Laboratory experts have been crucial in advising suitable test

implementation, utilization, and quality standards. In addition to the development of molecular and antigen tests, they have also been instrumental in the development of these tests. Guidelines on molecular and fast antigen SARS-CoV-2 testing were produced and published by the International Federation of Cancer Centers (IFCC) Task Force on COVID-19. These guidelines included suggestions on clinical indications and target population, assay selection, verification of assay performance, as well as test interpretation and limits [9]. Laboratory research and public health initiatives all around the world have benefited tremendously from the utilization of these resources. Additionally, laboratory medicine has contributed to the pandemic by creating serological assays for the identification of antibodies against SARS-CoV-2. These assays are in addition to the detection of SARS-CoV-2 infection using molecular and antigen testing. These tests have been essential in determining whether or not a vaccine is effective and in determining whether or not monoclonal antibody therapy are effective in immunocompromised people. Guidelines on the utility of serological antibody tests against SARS-CoV-2 were also released by the International Federation of Cancer Control (IFCC) Task Force on COVID-19 [10]. These guidelines also addressed the utilization of routine biochemical and hematological testing for the purpose of patient monitoring and management in community and critical care settings.

When taken as a whole, laboratory medicine has been involved in the management of patients infected with SARS-CoV-2, beginning with the detection of the virus and continuing through the management of severe cases. This worldwide public health disaster would have been unmanageable and would have most likely resulted in significantly greater morbidity and fatality rates [10]. Without the objective patient-level data that laboratories provided during the pandemic, the crisis would have been prevented from occurring.

Emerging novel viruses are a major public health concern with the potential of causing high health and socioeconomic impacts, as has occurred with progressive pandemic infectious diseases such as human immunodeficiency viruses (HIV), the recent pandemic caused by the novel quadruple re-assortment strain of influenza A virus (H1N1), and more transient events such as the outbreaks of Nipah virus in 1998/1999 and severe acute respiratory syndrome (SARS) coronavirus in 2003 [11]. The highly pathogenic avian influenza H5N1, the henipavirus, the Ebola virus, the expanded multidrug-resistant Mycobacterium tuberculosis, and antimicrobial resistant microorganisms are some of the other emerging infections that are of regional or global interest. Additionally, acute hemorrhagic diseases caused by hantaviruses, arenaviruses, and dengue viruses are also noteworthy. Major obstacles need to be conquered in the national and international capacity for early detection, rapid and accurate etiological identification (especially for those caused by novel pathogens), rapid response, and effective control in order to reduce the negative effects of emerging epidemic infectious diseases on both public health and the economy. When it comes to determining the etiological agent that is responsible for an outbreak, the diagnostic laboratory plays a crucial role. It also gives information that is both timely and accurate, which is necessary for guiding control actions. This is demonstrated by the epidemic of the Nipah virus that occurred in Malaysia in 1998/1999. It took more than six months to effectively control the epidemic as a result of the inaccurate diagnosis of the etiologic agent and the subsequent application of incorrect control methods [12]. However, there are situations in which control measures need to be based on the epidemiological characteristics of the outbreak and the pattern of disease transmission. This is because not all infections are easily recognized in the early stage of the outbreak. In order to reduce the severity of the effects of future epidemics of infectious diseases that are still in the process of developing, it is essential to establish laboratory and epidemiological capacity at both the national and regional levels. It is necessary for all of the countries in the region to demonstrate a commitment in order to effectively develop such public health capabilities. On the other hand, in order to develop and establish such an effective national public health capacity, particularly the laboratory component to support infectious disease surveillance, outbreak investigation, and early response, it is highly recommended to have a good understanding of the concepts of emerging infectious diseases as well as an integrated country and regional public health laboratory system that is in accordance with the nature and type of emerging pathogens, particularly novel ones [12].

Conclusion:

In spite of the significant contribution they make to medical treatment, clinical laboratories frequently function within a limited space. To advocate for increased awareness of laboratory sciences, it is therefore of the utmost importance to conduct outcome studies that demonstrate the value of laboratory medicine outside of clinical laboratories. To optimize the contribution of

laboratory medicine to patient care and to improve health, economic, and operational outcomes on a worldwide scale, this can, in turn, lead to improvements that can be implemented and collaborations between different healthcare sectors. Without the information that clinical laboratories offer, healthcare systems just cannot function. This would result in a significant number of crucial clinical decisions being made with only a little amount of objective evidence. This article provides several examples that highlight the direct influence that clinical laboratory testing has on patient care and public health. These examples include cardiac biomarkers, antimicrobial stewardship, traumatic brain injury (TBI), and COVID-19 diagnostics at the system level. Because laboratory experts are sometimes hidden from the public eye, there is an immediate need for new prospective and retrospective research that try to directly illustrate this obvious worth in different settings. A greater level of visibility will, in the long run, result in a more suitable allocation of resources and allow laboratories to maximize the influence they have.

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