Chapter 6
Early Detection Prediction and Prevention of Noncommunicable Diseases in People at High Risks of Communicable Diseases

ABSTRACT

The traditional screening for disease consists of medically testing individuals to detect diseases at an early stage. However, a screening or disease diagnosis is based on a patient-physician interview where patients answer the questions the physician asks him. It can be a direct (face-to-face) interview or an indirect communication by using a medium (video conference, phone, online web application, etc.). The traditional screening for NDCs presents certain limitations. Convergence of non-infectious and infectious diseases is not considered. This chapter proposes an innovative system and framework for pervasive/ubiquitous screening for early detection and prevention of NCDs in asymptomatic individuals at (tropical) infectious diseases risks. The proposed screening consists of pervasive sensing for physical, physiological, biochemical vital parameters, and quality of life by measuring the mental health, lifestyle, social, and climatic environmental modalities using the miniaturized wearable internet of things (IoT) systems and m-health application without activity restriction and behavior modification. It further determines the genetic/genomic predisposition and uses it for the prediction processing.

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INTRODUCTION

Multimorbidities such as cardiovascular/heart diseases (CVD) associated with severe malaria; or other (tropical) infectious diseases associated with diabetics and/or CVD, HIV/Aids associated with tuberculosis, etc. are frequent in several patients. Some parasitic infections can be associated with significant morbidity and mortality in regions of high endemicity(Hidron et al., 2010). The concept of multimorbidity, developed and published in 1976 in Germany at the first time, is an extension of the concept of comorbidity, which is defined as the interaction between any disease or risk factors with one main disease with the effect of making it worse. According to World Health Organization (WHO), multimorbidity is defined as suffering of or affecting by two or more chronic health conditions (Le Reste et al., 2015).

Recently two cases of tropical infections have been reported causing cardiovascular diseases. A case of a fatal complication of myocardial infarction in individuals (patient) with delayed diagnosis of Plasmodium falciparum infection is reported in (Chandra & Chandra, 2011). Another case of a complication of acute coronary after an experimental test/case of Plasmodium falciparum infection is reported in (Nieman et al., 2009). The coronary syndrome was diagnosed after the successful treatment of the malaria infection. Considering these two reported cases above, a convergence of tropical infectious diseases such as malaria and CVD and/or other non-communicable diseases seems to exist. The convergence presents new challenges and new opportunities to enact responsive changes in policy and research (Remais, Zeng, Li, Tian, & Engelgau, 2013). The association of the infectious disease with the non-communicable disease will, therefore, be investigated in the scope of the present project.

Data Analytics, including machine learning and predictive analytics and modeling, leads to understand and mitigate the behavioral, genetic and environmental causes of disease and treatment's failure. Machine learning methods are being used for large datasets to set up different patient groups, healthy, asymptomatic or sick, as well as to perform early symptoms analyses for early detection of acute NCDs and infection. The data sets could consist of genetic material and information and/or biophysical and mental conditions information collected from the patient. The convergence of tropical infectious diseases, such as malaria, and non-communicable diseases is neither trivial nor transient; but represents a phase in the epidemiological transition (Remais et al., 2013), therefore, an improved early detection in asymptomatic or

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