Chapter 14
Machine Learning Framework for Prediction of Early Childhood Obesity: A Case of Zimbabwe

Panashe Chiurunge
Graduate Business School, Chinhoyi University of Technology, Zimbabwe

Agripah Kandiero
Africa University, Zimbabwe

ABSTRACT

One of the challenges being faced in the 21st century is child obesity, which is a serious health concern in Zimbabwe and the world. If obesity is not controlled, it has detrimental consequences when a child risks suffering from health challenges such as cancer, type 2 diabetes, heart disease, and osteoarthritis in adulthood. Therefore, it is paramount to have an early prediction of child obesity using the BMI scale. Technology has the unrealized potential to identify people at risk for behavioural health conditions and inform prevention and intervention strategies. In this study, a prediction model was proposed to investigate how technology can be used to predict child obesity. Using a prediction model, this study sought to understand technology's potential value in child obesity. Three different machine learning methods were used to establish accuracy in the prediction model. The findings of this study indicate that it is feasible to use a prediction tool to identify individuals at risk of being diagnosed with obesity, which can facilitate early intervention and improved outcomes.

BACKGROUND TO STUDY

Childhood obesity is a global health problem with short- and long-term health consequences. This systematic review presents a summary of the experiences on different family-, school-, and clinic-based interventions. An electronic search was conducted in MEDLINE, PubMed, ISI Web of Science, and

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Scopus scientific databases. We included those studies conducted among obese individuals aged up to 18 years. Our search yielded 105 relevant papers, 70 of them were conducted as high quality clinical trials. (Kelishadi & Azizi-Soleiman 2014).

Preterm birth is defined as delivery at or before 37 completed weeks of pregnancy, and over 80% of preterm births occurred in Asia and sub-Saharan Africa annually over the past few decades (Chawanpaiboon et al., 2014). In 2014, 7.8% of all preterm births worldwide occurred in China, one of the top 5 nations by estimated preterm birth rates (Chawanpaiboon et al., 2014). Maintaining a healthy metabolic condition for preterm newborns over time has become a popular research interest as preterm infant care quality advances and preterm survival rates rise (UNICEF, WHO, World Bank & UN-DESA, 2018).

Compared to term babies, preterm babies have an increased risk of becoming obese as children (Li et al., 2012). However, it is still unknown what variables contribute to childhood obesity in this particular group of newborns (Wood et al., 2018). Unquestionably, the best study design to answer the question is a prospective birth cohort study with a big sample size and a lengthy follow-up period. However, standard data processing, statistical analysis based on a priori assumption, and result interpretation are challenged by the abundance, complexity, high dimensions, and heterogeneity of health care data (such as biological and lifestyle data). Without having to describe associations in advance or make firm assumptions about the underlying mechanisms, machine learning can assist discover relationships in data (Wood et al., 2018). It can also be used to generate prediction models. Furthermore, it is even more important to comprehend why a predictive model generated a particular prediction or to explain the individual variables that contributed to the prediction therapeutically significant since certain aspects might be changeable.

Body mass index (BMI) in adults is defined as a ratio of body mass in kilograms to the square of an individual's height in metres. In adults, BMIs over 25 kg/m^2 and 30 kg/m^2 are classified as overweight and obese, respectively, due to body mass index, which changes significantly with age. These levels are calculated differently in children and adolescents and vary with their age and gender. Obese children are at increased risk of suffering from health problems such as heart disease, type 2 diabetes, cancer, and osteoarthritis in their childhood. Therefore, early prediction of childhood obesity is essential for fat and overweight babies. Three different machine learning methods have been proposed, including a prediction model for the analysis. SVM, KNN and ANN for estimating accuracy in the prediction model have been done.

Being overweight and Obese is a cause of concern for the contraction of chronic noncommunicable diseases (NCDs) and is, therefore of great public health concern. The issue of Obesity is problematic, especially considering the extensive evidence for medical conditions associated with the disease. These entail health risks with potential effects on an individual and society's social and economic well-being. Poor health conditions resulting from Obesity may be a barrier to developing a good mind and thus pave the way for poor learning behaviour in children and outcomes.

In Zimbabwe, the weight for Height of Children Under-five was recorded at 5.60 per cent. This was an increase from the previous survey's figure of 3.60 per cent. The percentage of children under the age of five whose height is more than two standard deviations above the median for the international reference population of the same age, as determined by the WHO's new child growth standards released in 2006, is known as the WHO's new child growth standards prevalence of overweight children. UNICEF, WHO, and World Bank have collaborated on child malnutrition estimates (JME).

Machine learning has revolutionised many industries, including healthcare. Healthcare professionals can use machine learning algorithms to analyse and interpret vast amounts of data to predict, diagnose,