CHAPTER

4

BAYESIAN LOGISTIC REGRESSION ANALYSIS OF ADHD CHILDREN'S DIAGNOSIS

Oon Seok Khim and Haliza Abd. Rahman

4.1   INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is a mental disorder that usually starts in early childhood. This disorder can persist into adulthood if it is left untreated. The symptoms of ADHD can be characterised as inattention, hyperactivity, and impulsivity (Smidts & Oosterlaan, 2007). ADHD affects a child's social interaction and academic performance. Children with ADHD often find it difficult to sit quietly and make excessive noise. They have a problem controlling their behaviour and it is difficult to sustain attention (Evans et al., 2010). Characteristic behaviours of ADHD are long-term and impaired daily life.

Some studies suggested that the causes of ADHD involve the interaction between genetics and environmental factors. Prenatal and demographic factors also contribute to ADHD in children (Asherson, 2012). Trauma to the brain is also believed to be associated with ADHD. The symptoms are difficult to determine as there is no standard level of inattention, hyperactivity, and impulsivity. Moreover, the symptoms in a

child are sometimes treated as age-related behaviours and consequently delay the treatment.

Clinical diagnosis of ADHD is usually under-diagnosis where the symptoms had been ignored or overlooked by guardians. According to a report on a survey in Britain it took 18 months for a child from their first visit to receiving their formal diagnosis and third of children waited two or more years to be diagnosis with ADHD. The delay hindered early treatment and intervention thus causes the symptoms to persist or become worse as children reach adolescent or adulthood. An alternative to ADHD diagnosis is the machine learning method using a mathematical model. Logistic regression is used to analyse expected symptoms that contribute to the existence of ADHD in children.

The unknown parameter is estimated by the Bayesian approach. Logistics regression is used when the variable of interest is binary or dichotomous. Besides, this statistical method best describes the relationship between an outcome variable and a set of independent variables. The Bayesian approach provides credible interval that contains the true parameters value with approximately 95% certainty. The Bayesian method also improves the precision of the estimates because the prior provides incorporate information and posterior estimate is based on the combination sources of information from prior and likelihood.

4.2   ATTENTION-DEFICIT HYPERACTIVITY DISORDER

When it's time to sit quietly in class, does your child have trouble staying focused, behaving appropriately in public, or sitting quietly at home? If it happens at different ages and on a random basis, not being able to sit still or remain within bounds is normal childhood behaviour. However, if this behaviour occurs regularly and negatively impacts your child's everyday life, they may have ADHD.

Attention-deficit hyperactivity disorder (ADHD) is a frequently diagnosed neurodevelopmental condition that develops in childhood and is characterised by excessive levels of hyperactivity, impulsivity,

and inattention. Worldwide, ADHD affects approximately 5% of school-aged children, and 65% of those instances persist into adulthood (Chen et al., 2016).

When symptoms of ADHD begin in childhood, almost half of all cases persist into adulthood. Adults with ADHD frequently struggle to follow directions, recall information, focus on, or arrange tasks. ADHD can result in behavioural, emotional, intellectual, vocational, and social difficulties that impair one's quality of life if these behaviours are not recognised and managed appropriately.

Furthermore, by definition, ADHD is a neurodevelopmental issue rather than a "mental ailment." The phrase "mental illness" encompasses a wide variety of conditions that impair one's mood, behaviour, or thinking. ADHD is more accurately described as a pattern of behaviour, as something unique about the way a person accomplishes things, rather than as something "wrong" with people. ADHD appears to relate to neuronal circuits in the brain's functioning (the default mode and the task positive mode). At some ages (developmental stages), this functioning results in undesirable behavioural characteristics, consequently, the term neurodevelopmental disorder is a more comprehensive category name for the problem of ADHD.

4.2.1 Bayesian Logistic Regression in Attention-deficit Hyperactivity Disorder

Attention-deficit hyperactivity disorder (ADHD) is one of the most frequent childhood neuroscience diseases. It is frequently diagnosed first in infancy and often lasts till maturity. Children with ADHD may have difficulty paying attention, restraining emotional dysregulation (may act unintentionally), or becoming extremely energetic. The relationship between the causes of diseases consequently needs to be found. For example, the connection of second-hand smoke (SHS) symptoms and subtypes of the ADHD exposure window (prenatal, early postnatal, and current time) was explored in children using the generalised linear model (GLM), this problem solves (Lin et al., 2021).