UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

MATHEMATICAL MODELLING ON THE CONTROL OF MEASLES BY VACCINATION IN MALAYSIA

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IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

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ABSTRACT

The SEIR model for measles disease transmission is discussed here. The host (human) population is divided into four compartments: susceptible, exposed, infected, and recovered. The interest here is to deduce SEIR model to predict the transmission of measles in Malaysia. SEIR model is used to investigate the transmission of measles against vaccination used and to find the effective reproductive number in presence of vaccination, R_p and basic reproductive number, R_0. Based on the parameter values in Table 3.4 and Table 3.5, the epidemic conditions or also known as basic reproductive number, R_0 (97) was calculated where the value is R_0=2.4180 which is greater than unity, 1. The value obtained implies that there is will be an epidemic for the measles virus in the population. Then, the data and parameter values were substituted into R_p (82) where the value obtained is $R_p = 0.6080$. The value of R_p shows that it is smaller than 1 which means the epidemic for the measles virus can be eliminated by increasing the mass vaccination among the individuals in the population. The data is obtained for the year 2015. The SEIR model is solved by using command from maple software. From the observations, the higher the dosage of vaccination used, the higher the number of recovered population. Other than that, in order to increase number of recovered individuals, the dosage of vaccination should be increase year by year.

1 INTRODUCTION

1.1 Research Backgroud

Measles cases were first found in 7th century ("History of Measles", 2014). Nonetheless, the vaccine for measles was first developed by the researchers in 1963 in order to avoid measles virus. Nearly all children got measles before the vaccine became available because it is so easily expand. It is approximately 3-4 million cases of measles in the United State and an estimated 400-500 people died each year ("History of Measles", 2014).

The measles virus is a paramyxovirus, genus Morbillivirus. Measles is a very contagious virus that can spread through contact with infected mucus and saliva. During childhood, it is first and worst eruptive fever occurred. A widespread skin rash is a classic symbol of measles. This rash can last up to seven days and generally presents within the first three to five days of exposure to the virus.

Humans are the only natural hosts of measles virus. The measles virus can live on surfaces for a few hours. As the infected molecules enter the air and settle on surfaces, anyone within close proximity can become infected. Direct contact with infected nasal or throat secretions or transmission through coughing and sneezing of infected person can also transmit measles.

There exists the basic reproductive ratio,R_0 which is the quantity use to study of how disease spreads and can be controlled. The number of secondary cases, R_0 is from a single infectious individual in the whole susceptible population. The current usage of R_0 was initiated by Ross in 1909 by Hethcote (2000). If $R_0 < 1$, the modeled disease will no longer exists and if $R_0 > 1$, the disease spreads out through the population. R_0 turned out to be significant influence in deciding the targets for vaccination coverage (Fred et al., 2014).

Measles is a disease that cannot be cured but it is a vaccine-preventable diseases. Measles can lead to life-threatening complications such as pneumonia and encephalitis, so it is important to receive a measles vaccine. But in rare cases, it is important to note that vaccine also can cause