

Problem Chosen

**A**

**2020  
MCM/ICM  
Summary Sheet**

Team Control Number

**Hello**

---

**Novel Coronavirus Pneumonia: Aloha and to Say  
Aloha**

**Summary**

Begin Abstract...

**Keywords:** Begin Keywords...

# Novel Coronavirus Pneumonia: Aloha and to Say Aloha

February 14, 2020

## Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
1.1	Problem Background . . . . .	3
1.2	Our Work . . . . .	3
<b>2</b>	<b>Assumptions and Justifications</b>	<b>3</b>
<b>3</b>	<b>Notations and Definitions</b>	<b>4</b>
<b>4</b>	<b>Modified SEIR Model Based on Differential Equation</b>	<b>5</b>
4.1	Introduce our SEIR Model . . . . .	5
4.2	Determination of Unknown Parameters . . . . .	5
<b>5</b>	<b>title</b>	<b>5</b>
5.1	Background Illustration . . . . .	5
5.2	subsection1 . . . . .	5
5.3	subsection2 . . . . .	5
<b>6</b>	<b>S6</b>	<b>5</b>
6.1	Simulation Results . . . . .	5
<b>7</b>	<b>Model Analysis</b>	<b>5</b>
7.1	Sensitivity Analysis . . . . .	5
7.2	Strengths and Weaknesses . . . . .	5
7.2.1	Strengths . . . . .	5
7.2.2	Weaknesses . . . . .	5
<b>8</b>	<b>Conclusion</b>	<b>5</b>

<b>Appendices</b>	<b>7</b>
<b>Appendix A Solve and Plot Ordinary Differential Equation Systems</b>	<b>7</b>

# 1 Introduction

## 1.1 Problem Background

The ocean is covering approximately 1.3 billion cubic kilometers, which is the equivalent of 97 percent of total water on Earth. While human beings are influencing the environment, climate changes are posing a threat to our oceans. Playing a vital role on oxygen producing, carbon sequestering and food providing for billions of people, the ocean's abilities are being eroded by plenty of stressors. Temp

## 1.2 Our Work

The major logic flow is depicted as follows, in Figure 1:

Figure 1: Major Logic Flow of our Model - ALOHA

# 2 Assumptions and Justifications

We make some general assumptions to simplify our model. We will list all of the assumptions together with corresponding justification below:

- 1) **All of human beings are susceptible to NCP.** NCP was recently discovered and has gene specificity, which make it difficult to be immunized by the body. Thus, we can infer that human beings are susceptible to this virus without previous contact.
- 2) **People will not get susceptible to secondary infection of NCP.** Depending on the nature of the body's immune system, after recovery most people will have better immune reaction to virus. We ignore the possibility of secondary infection to simplify our model.
- 3) **Assume that incubation period to different individuals are the same.** Since incubation period of different host individual is different and also hard to predict, we assume that incubation periods are the same.
- 4) **NCP will only complete the process of human-to-human transmission via close contact such as talking face-to-face.** We simplify our model here since people suffer a rather low level of risk if they do not have close contact with the infected when it comes to NCP.
- 5) **The number of infected people around the world is almost the number of infected people in China.** Although countries except China accounts for 71.57% of the world population (till August 28th, 2019, by United Nations [?]), only less than 0.77% of confirmed cases occurred outside China (till February 3rd, 2020, by various organizations [?][?][?][?]; with detailed information listed in Appendix). Meanwhile, after NCP was discovered in China, all the other countries took immediate action against the spread. Therefore, what deserves our attention is more the circumstances in China.

### 3 Notations and Definitions

For convenience, we define a series of notations for mathematical usage, which are listed in Table 1 to describe our model.

Table 1: Notations mentioned in this paper

Symbol	Definition
$S(t)$	Number of susceptible person at time $t$
$E(t)$	Number of enfective person at time $t$
$I(t)$	Number of infectious person at time $t$
$R(t)$	Number of removed person at time $t$
$t$	Time
$N$	Gross population in this model
$\alpha$	Morbidity of NCP
$\beta$	Infection rate
$\gamma$	Removal rate
$d$	Mortality of NCP
$h$	Recovery rate of NCP
$k$	Average number of people exposed to infections every day
$b$	Probability of infection by contact
$R_0$	Basic reproduction number
$m_i$	Affecting parameters of $i$ th measure by government
$ND$	Number of death
$NR$	Number of recovery
$NSP$	Number of suspected people
$NDP$	Number of diagnosed people

## **4 Modified SEIR Model Based on Differential Equation**

### **4.1 Introduce our SEIR Model**

### **4.2 Determination of Unknown Parameters**

## **5 title**

### **5.1 Background Illustration**

### **5.2 subsection1**

### **5.3 subsection2**

## **6 S6**

### **6.1 Simulation Results**

## **7 Model Analysis**

### **7.1 Sensitivity Analysis**

### **7.2 Strengths and Weaknesses**

#### **7.2.1 Strengths**

- Our model achieves a good simulation in fitting the current infections.
- Our model takes into account the effects of the change of pedestrian flow during the Spring Festival travel rush as well as virus mutations
- The model is a well-organized epidemic model which can be widely applied to other virus disease.

#### **7.2.2 Weaknesses**

- The prediction simulation result can't be verified due to the unknown data in future.
- A large number of assumptions reduce the accuracy of the models simulation results.

## **8 Conclusion**

## **References**

## **Brief Assessment Report**

# Appendices

## Appendix A   Solve and Plot Ordinary Differential Equation Systems