POLICY MAKING IN CASE OF IODINE DEFICIENCY DISORDER BASED ON AGENT INTERACTION IN WEST JAVA PROVINCE

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Abstract

Iodine Deficiency Disorder (IDD) is a syndrome that emerges as result of a continuously low Iodine content in human body during a period of time. The year 1998's National Mapping IDD Survey throughout areas of Indonesia shows that 33% of sub district in the country are classified as endemic, 21% as low endemic, 5% as medium endemic and 7% as severe endemic areas. IDD has become a serious issue because its impacts, directly and indirectly, to the human being and to the quality of human resources. Due to serious impacts of IDD, the government of Indonesia has tried to prevent IDD problems by focusing on distribution of iodized oil capsule for productive women (15 - 49 years old) in severe and medium endemic areas (as the short term effort), and salt iodination or iodized salt consumption (as the long-term effort). But the program is not yet optimal, because some producers are still producing non-iodized salt or producing iodized salt with less than 30 ppm iodine content, some distributors are still distributing non-iodized salt or distributing iodized salt with less than 30 ppm iodine content and majority of consumers is not critical and less concerned toward the consumption salt product. To overcome the problem, then, it needs a policy for pressuring and supporting through the regulator function. In the previous research, it doesn't involve agent's activities process in order to consume salt. In our research, it will describe people activities process in order to consume iodized salt especially in endemic areas in West Java and including the previous policy by government to take care this problem using social simulation SOARS. The objective of our research is to get new policies which could reduce Iodine Deficiency Disorder problem.

Keywords:Iodine Deficiency Disorder (IDD), social simulation, Activity Model

1. Introduction

Iodine-deficiency disorders (IDD), which affects hundreds of millions of people, primarily in developing countries like Indonesia. GAKY or Iodine Deficiency Disorder (IDD) is a syndrome emerges as result of a continuously low Iodine content in human body during a period of time. Iodine is natural mineral in soil and water. This micro-nutrient is needed by human body to produce thyroxin hormone which is needed for normal growth and intelligence development.

A region is considered as low-iodine area if its soil and water is extremely lack of iodine content, caused by erosion, heavy rains or floods. As result, if they only depend on water resource and foods, people living in that area could suffer from lack of iodine.

The year 1998's National Mapping IDD Survey throughout areas of Indonesia shows that 33% of sub district in the country are classified as endemic, 21% as low endemic, 5% as medium endemic and 7% as severe endemic areas. Based on data, it is predicted that 53.8 million people live in IDD endemic areas, comprising 8.8 million in severe endemic areas, 8.2 million in medium area, and 36.8 million in low endemic areas.

IDD has become a serous issue because its impacts, directly and indirectly, to the human being and to the quality of human resources that cover three aspects namely the intelligence aspect, social

development aspect, and the economic development aspect. Due to serious impacts of IDD, the government of Indonesia has tried to prevent IDD problems by focusing on (1) distribution of iodized oil capsule for productive women (15 - 49 years old) in severe and medium endemic areas (as the short term effort), and (2) salt iodination or iodized salt consumption (as the long-term effort).

In another side, survey on iodized salt consumption conducted by Central Bureau of Statistic (BPS) shows that during the period of 1996 - 2002 number of households who consume standard iodized salt (= 30 ppm) is not too high, namely at only 58.1% in 1996 to 68.53% in year 2002. The condition is caused by some factors, such as some producers are still producing non-iodized salt or producing iodized salt with less than 30 ppm iodine content, some distributors are still distributing non-iodized salt or distributing iodized salt with less than 30 ppm iodine content and majority of consumers is not critical and less concerned toward the consumption salt product. Meanwhile, the regulator that regulates the consumption salt seems not functioning. One of the reasons is because there has been no law applicable for.

In this paper, we would describe about agent's activities process in order to consume iodized salt especially in endemic areas in West Java and including the previous policy by government to take care this problem using social simulation SOARS. The objective of our research is to get new policies which could reduce Iodine Deficiency Disorder problem.

2. Iodine Deficiency Disorder in West Java

The strategic geographic position of West Java province has many advantages for this regional prominently from transportation and communication side. Apart from that, West Java has fertile area which comes from volcanic deposit and possesses many rivers running across so that the most of land are suitable for agriculture. At this time, West Java provinces divided by 20 regencies and 6 municipalities, 543 districts, 521 special villages and 6701 villages. Many people in villages of West Java had a poor awareness to consume an iodized salt.

Iodized salt was exist before Indonesia independent with regulation which released at Dutch colonial in 1927, however the regulation didn't run well in 1945 with riffed of salt monopolies. The effort to reduce the problem of GAKY was started in 1976 with various limitations, i.e., GAKY prevalence is not available, governmental responsibility unclear because no obligatory regulation and no coordination between related sectors.

Monitoring of iodized Salt had been done by UNICEF and BPS in all of area in Indonesia with checking iodized salt at household. The research in Indonesia had been done in elementary school in 1980-1982 at 26 provinces. The result is TGR (goiter prevalence) more than 10%, 68, 3% from 966 sub district, and some countryside more than 80%. Assessment of salt consumption in household was conducted by differentiating iodine content in salt. The result was show percentage of household which consume salt with iodine content is enough (> 30 ppm), less (< 30 ppm), and none.

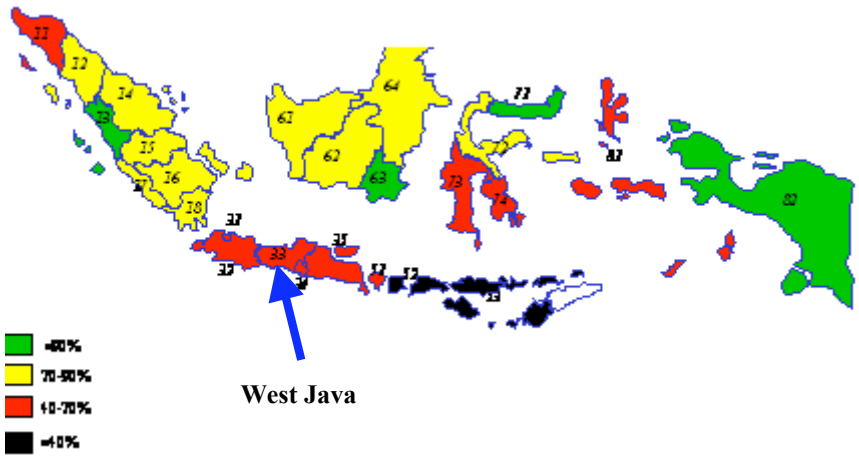

Figure 1. Consumption of Iodized Salt in Household

There are 37 ' red area' because of less iodine". From 300 more sub-province / town existed in entire of Indonesia, there are 37 sub-provinces which expressed town as ' red area' because iodized

salt consumption of its society is very small. West Java provinces are included in red area. The following is TGR prevalence in area of West Java.

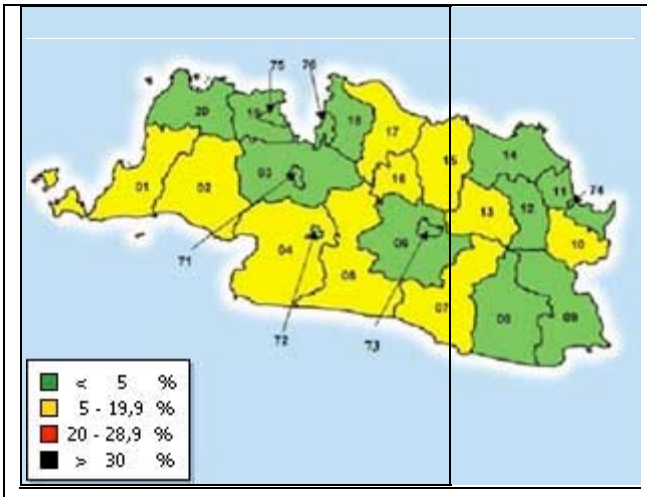

Figure 2. TGR Prevalence in West Java

Table 1. TGR Prevalence in West Java

CBS	Areas	TGR
01	Pandeglang	6,2 %
02	Lebak	6,3 %
03	Bogor	2,1 %
04	Sukabumi	7,8 %
05	Cianjur	7,2 %
06	Bandung	4,3 %
07	Garut	6,6 %
08	Tasikmalaya	3,3 %
09	Ciamis	2,8 %
10	Kuningan	7,1 %
11	Cirebon	4,9 %
12	Majalengka	4,8 %
13	Sumedang	5,8 %
14	Indramayu	0,6 %
15	Sumedang	5,8 %
16	Purwakarta	10,1 %
17	Karawang	5,8 %
18	Bekasi	2,4 %
19	Tangerang	3,1 %
20	Serang	4,8 %
71	Bogor	0,0 %
72	Sukabumi	0,2 %
73	Bandung	1,2 %
74	Cirebon	0,0 %
75	Tangerang	0,3 %
76	Bekasi	0,3 %

Total Goiter Rate (TGR) is prevalence of Goiter which calculated based all stage of enlargement of thyroid gland, both palpable and visible. TGR indicate the level of endemically of IDD problem in certain area.

1. National Mapping Survey of TGR among Elementary School Children resulted:
   · TGR 1980 : 37.7%
   · TGR 1990 : 27.7%
   · TGR 1998 : 09.8%
2. IDD Endemic area wherein its population are having enlargement of thyroid dland, classified:
   · Severe : TGR = 30%
   · Moderate : TGR 20 – 29.9%
   · Mild : TGR 05 – 19.9%
   · Non : TGR < 05%

The IDD survey in 1998 revealed that around 33% of sub-districts in Indonesia categorized as Endemic IDD:

· 272 sub districts as severe endemic area
· 197 sub districts as moderate endemic area
· 831 sub districts as mild endemic area

Based on data collecting from BPS 2000, percentage of household to consume iodized salt with enough content in West Java is only 40 – 70% especially in village's area. In the city, people usually understand to consume iodine salt. According to the observation, generally, salt industries exist at Java, South Sulawesi, and Madura. Salt farmer has a lot of number in Indonesia, and only produce salt with help from sunrise and they use low technology to produce salt, so the result was not very good

that is have high water content. Salt farmer usually sold their product to people who will sell a salt to

No	Province	Cities	Villages	Cities + Villages
1	North Sumatra	85.19	71.89	77.67
2	West Sumatra	91.81	75.86	80.65
3	Riau	91.06	86.58	88.9
4	Jambi	90.38	80.93	83.58
5	South Sumatra	89.11	75.81	80.35
6	Bengkulu	93.31	84.07	86.77
7	Lampung	85.72	77.51	79.29
8	Bangka Belitung	85.99	65.26	74.28
9	DKI Jakarta	88.49		88.49
10	**West Java**	**81.09**	**59.89**	**70.72**
11	Central Java	69.13	53.49	60.08
12	Yogyakarta	82.81	60.55	74.66
13	East Java	79.98	57.66	67.12
14	Banten	88.57	53.68	73.56
15	Bali	84.54	71.83	78.73
16	West Nusa Tenggara	67.12	55.12	56.4
17	East Nusa Tenggara	86.99	62.51	66.4
18	West Kalimantan	79.61	77.07	77.72
19	Central Kalimantan	93.01	93.67	93.48
20	South Kalimantan	92.71	79.3	84.38
21	East Kalimantan	89.08	85.97	87.74
22	North Sulawesi	85.56	80.75	82.66
23	Central Sulawesi	83.75	67.2	70.34
24	South Sulawesi	83.1	55.62	63.88
25	South East Sulawesi	82.93	61.61	66.14
26	Gorontalo	90.92	82.65	84.86
	Indonesia	**81.66**	**63.49**	**71.62**

producer who will produce iodized salt.

Table 2. Percentage of Household who knows Iodized Salt in 2002

Iodized salt production in Java had limitation to produce salt that could be distributed to another province. Based on prediction, the salt company is only produce 20 % from the whole salt in Indonesia, and the other was produced by 300 middle companies and from 25000 salt farmers. Many big companies which bought a salt from abroad if the quality of people's salt were low. The problem in Iodized salt process was happened at level salt producer with have small scale, because they had not a lot of asset and technology.

There are some cases in West Java which deal with producer who produce salt with low iodine content. Even though, there is regulation from government about iodized salt but many producers who make opportunist action. The condition caused by some factors, such as:

1. Some producers are still producing non-iodized salt or producing iodized salt with less than 30 ppm iodine content
2. Some distributors are still distributing non-iodized salt or distributing iodized salt with less than 30ppm iodine content
3. Majority of consumers is not critical and less concerned toward the consumption salt product

Meanwhile, the regulator that regulates the consumption salt seems not functioning. One of the reasons is because there is no enforcement law.

Table 2. Spectrum of Iodine deficiency disorder

Groups	Effects
Pregnant Mother	• Abortus
Child and Young	• Goiter • Impaired mental function & Retarded physical development • Juvenile hypothyroidism
Adult	• Goiter with its complication • Hypothyroidism • Impaired mental function • Iodine Induced Hyperthyroidism (IIH)

3. Agent Based Simulation in Iodine Deficiency Disorder

There are important agents in Iodine Deficiency Disorder problem namely, consumer (people), consumption salt business actor (producer, collector/agent and retailer), community mover element (NGO), and regulator (executive, legislative and law enforcement officer).

In this paper, we will describe virtual activity human model in Villages of West Java in order to consume iodized salt. We choose a village, because people in village had a little knowledge about why must consume iodized salt and why this is important to their live.

There are several types of spots in human activities in villages such as house, hospital, warung (in village we call warung as a mini shop), distributor, salt company, market, salt producer and farmer salt. We assume a simple activity of agents. A young and old go to warung to buy salt and then come back to house. Adult goes to warung, but sometime goes to the market if stock was empty, and goes back to house. A pregnant woman goes to hospital (clinic) to check up her fetus and goes back to house. A baby goes to the hospital, if they were sick and goes back to the house.

The other model in activities model is distribution model to distribute salt. Retailer distributes a salt to the market, so the market can sell a salt for people in villages. Salt producer produce a salt from collector/agent, so it will related with another. If a stock is none, then a product couldn't sell to consumer. Collector gets a salt from salt farmer. They were related with the availability of salt. They can sell a salt to the market with iodine content is enough (> 30 ppm), less (< 30 ppm), and none. There is some agent to check a production of salt whether iodized or non iodized, that is NGO.

In this model, we assume that there are some household which consist of family structure especially structure in West Java. The member of family who act to buy a slat to the "warung" or market is agent young, adult, old and it will be consumed by a whole member of family.

In salt distribution model, we assume that market or "warung" got the salt from produces agent, then it will be sold to consumer. The role of NGO in this model is to observe a producer in

Iodine content and give the socialization to the society about how important to consume iodine salt. The hospital act to handle the agent who suffers iodine deficiency disorder. This activity model will move the agents who involve in order consuming salt and the handling to observe salt distribution.

The following is coding which had been done at each agent who involves in activity model:

a. Householder Consumer

We assume that young, adult, and old agents have an attribute of awareness. Because of this agent act to buy a salt to "warung" or market, then the attribute of awareness related with degree of knowledge of this agent about the importance to consume an Iodized salt. The higher of degree of knowledge, the higher of actor's awareness to not consumed a non-iodized salt.

Baby, child, pregnant women, young, adult, and old agents has an attribute health, related to degree of Iodized salt consumption. The higher value of the health, indicated that the agent always consume an iodized salt. The awareness attribute have a range value between 0 and 255, *i.e.*, integers number and it coded by 8 binary bits, as follows:

0	0	1	0	1	0	1	0

From the above coding, the actor has degree of awareness 40/255. The health have a range value between 0 – 100, *i.e.*, integers number. The initialization for awareness degree will generate randomly and the health will be initialized 100 for a whole actors.

b. Producer

We assume that agent in "warung" and market has attributes boldness. Boldness shows the willingness of actor to do dishonest action, *i.e.*, sells a non-iodized salt. The higher level of boldness, it means, the actor do dishonest action frequently, i.*e.*, sells a non-iodized salt. The boldness attribute have a range value between 0 and 255, *i.e.*, integers number and it coded by 8 binary bit, as follows:

0	0	1	0	1	0	1	1

From the above coding, the actor has degree of boldness 41/255. The initialization for boldness degree will generate randomly.

c. Regulator

We assume that government has an attribute care ness. Care ness shows the responsibility level to make the policies in order to handle the health of society and regulation for salt producer. The higher level of care, it means, the agent give a big attention to this problem. This value will become a parameter in model simulation..

d. Moving Element

We assume that NGO has two attributes that is ability and social pressure. Ability shows the agent's degree of knowledge to give direction and information to society in order to increase their awareness. The higher value of ability, the higher of actor understands to give information to society. The ability has a range value between 0 -100, *i.e.*, integers number. This value will determine the existence of actor in his/her population (selection process). Social pressure is a level of pressure that would be made by NGO so the government can improve the attention and the responsibility for this problem. Level of social pressure will become a parameter in this simulation.

4. Simulation Phase

In this simulation model, we will use data population in West Java which had scaled and the human activities based on the life pattern in West Java. Because of the reason that salt is a primary requirement in West Java society, then we use a probability for each agent to buy a salt with value 0.8. This simulation will run in two phase. In the first phase, we build a simulation as follows:

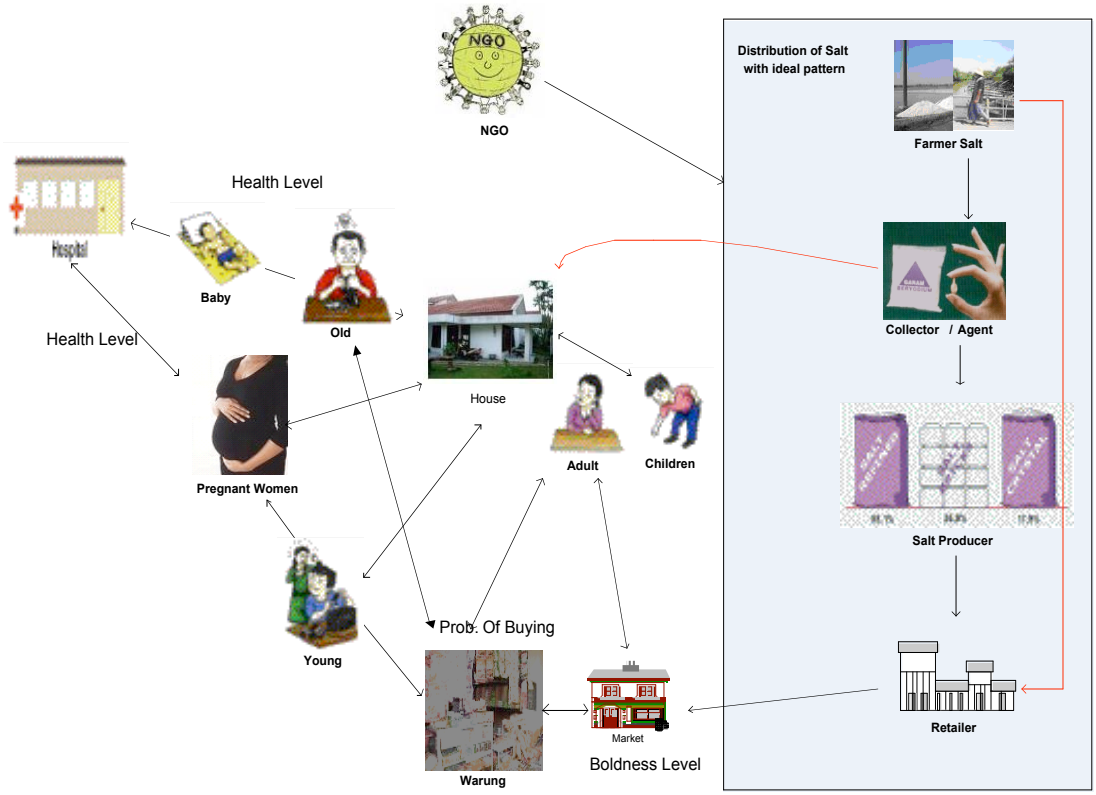

Figure 3. Virtual Human Activity Model in villages in order to consume Salt

Adult, young and old agents will go to "warung or market to buy a salt which determined from probability of buying. Agent will go to the hospital, if the level of health is under 40. The spot "warung", market and salt producer will sell a salt which depend on boldness level that is brave to sold a non iodine salt to the consumer. Consumer could buy non iodine salt depend on care ness level. If an agent go to the hospital then the health will improve and this improvement will depend on the availability of medicines and the service from the hospital. We use two parameters, *i.e., level of care* for government, and degree of social pressure for NGO.

In the second phase, we apply two policies program in order to handle this problem, as follows:

1. Do the socialization by moving element (NGO).
2. Do the social pressure to government to improve the responsibility to this problem by moving element (NGO)

The implementation of socialization by moving element based on the ability of agent. If the agent could give good information about the important to consume an iodine salt, then the ability of this agent will increase and decrease if this agent couldn't improve the awareness of people. In this simulation, we set a parameter of social pressure which useful for pressures a government in order to provide medicines at the hospital and regulate a salt producer. We define the whole parameters as a real value between 0 and 1.

4.1 Simulation

In this simulation, we will analyze the effect of government and NGO role in order to solve the problem. Level of care from government and level of social pressure from NGO will become our focus in this research. The following is parameter that would be used in this simulation.

	Level of Care	Level of Social Pressure
Experiment 1	0.5	1
Experiment 2	1	0.5
Experiment 3	0.01	0.01
Experiment 4	1	1
Experiment 5	0	1
Experiment 6	1	0

Experiment 1

In the first experiment, government give the responsibility to this problem with value only a half and NGO give a full pressure to the government.

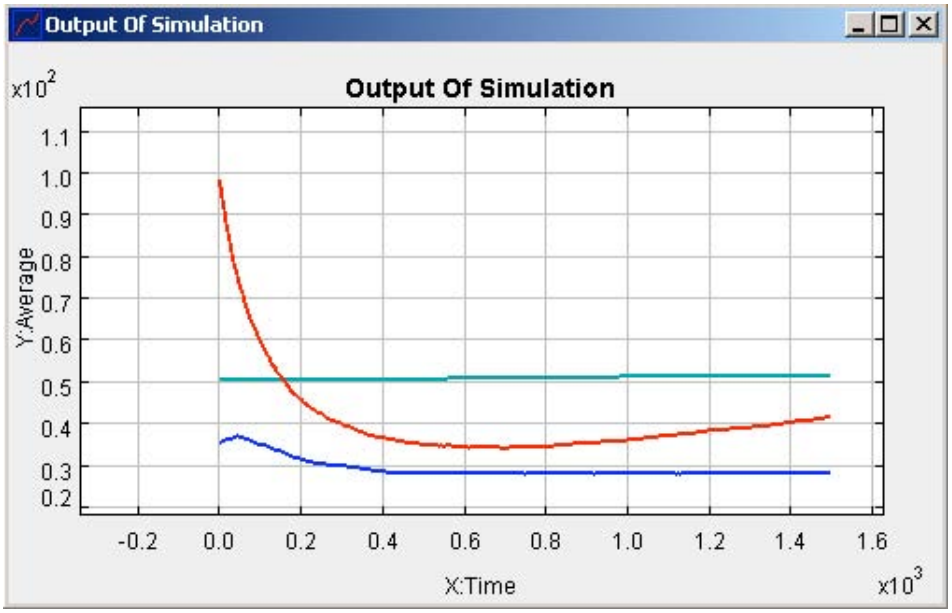

Figure 4. The average of health (red line), awareness (dark green line) and ability (blue line)

From the above figure, we can see that the health of society is decrease which caused by a low ability from NGO in order to give the information about the important thing to consume iodine salt to the society. More over, the government is not full to support regulation for salt producer and to give facility to the hospital.

Experiment 2

In the second experiment, government gives the full responsibility to this problem and NGO give a value only a half to pressure the government.

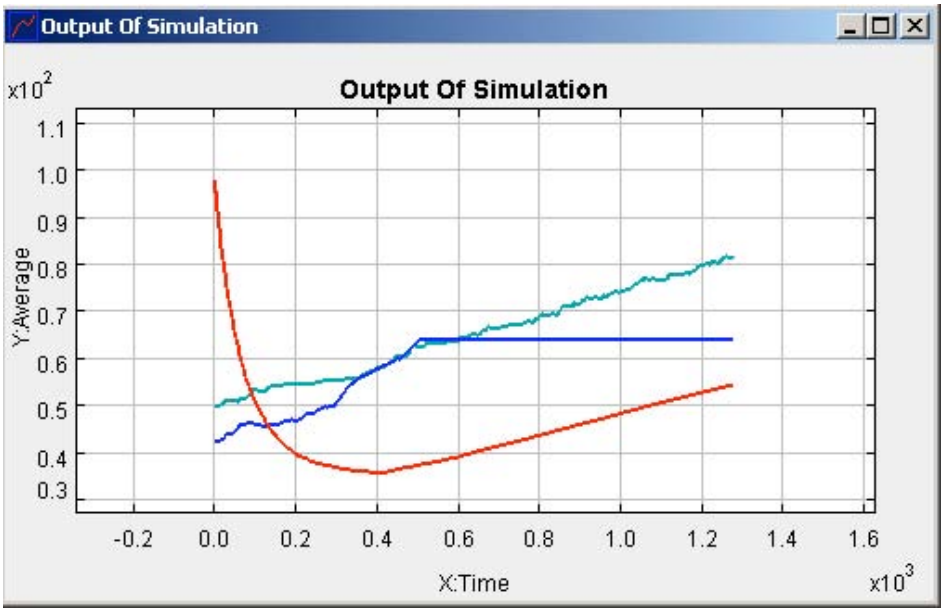

Figure 5. The average of health (red line), awareness (dark green line) and ability (blue line)

From the above figure, we can see that the health of society is decrease at the first and increase slowly. It was caused by the NGO which only give a half effort to give information. The increase of health also was caused by support from government to regulate a salt producer and to give facility to the hospital.

Experiment 3

In the third experiment, both government and NGO didn't give the attention and support for this problem.

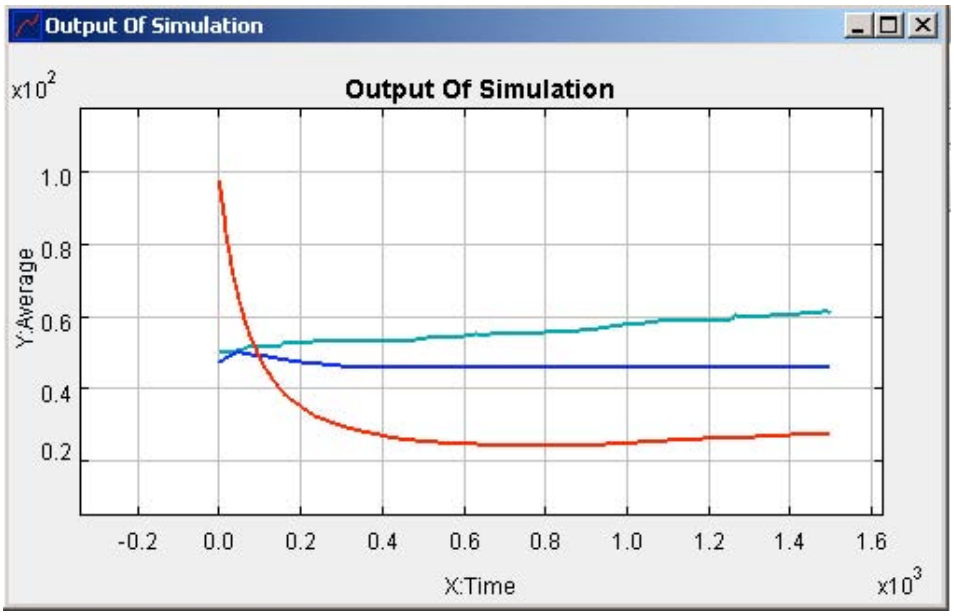

Figure 6. The average of health (red line), awareness (dark green line) and ability (blue line)

From the above figure, we can see that the health of society is always decreased. It was caused by both NGO and government didn't give their responsibility and attention to this problem.

Experiment 4

In the fourth experiment, both government and NGO gives the full responsibility to this problem.

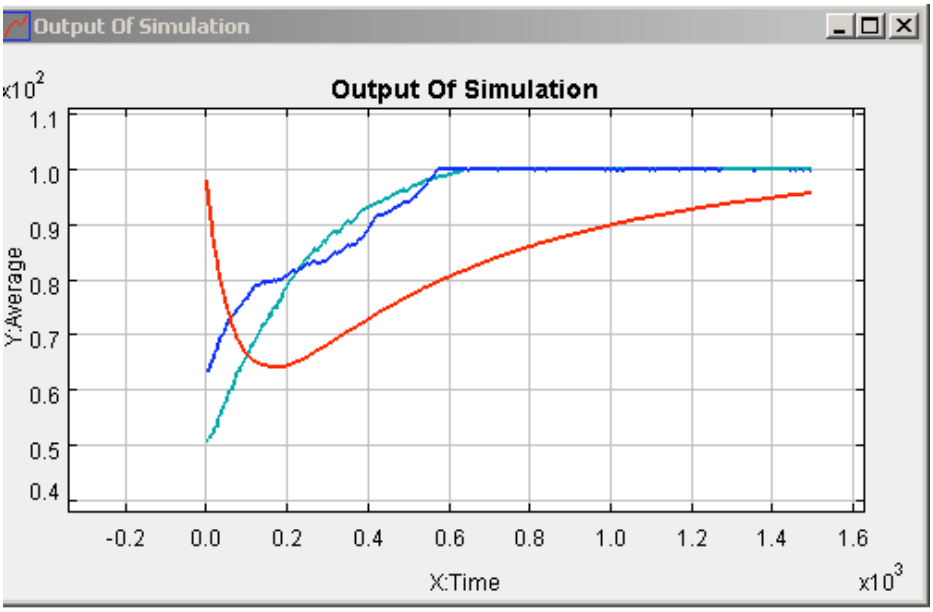

Figure 7. The average of health (red line), awareness (dark green line) and ability (blue line)

From the above figure, we can see that the health of society is always increased. It was caused by both NGO and government gives their responsibility and attention to this problem fully.

5. Conclusion

From the result of simulation, the problem in Iodine Deficiency Disorder (IDD) will work well, if there are support from government and NGO. NGO must act as a moving element to give socialization about the importance of iodine salt and to pressure the government in order to provide the facility to the hospital and regulation to control salt producer, so the salt producer is only sold the iodine salt to the society. The government must give the attention and responsibility to this problem and work together with NGO.

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