Prisoner's Dilemma in Strategic Preventing of Covid -19: A Mathematical Exercise

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Abstract: The Prisoner's dilemma is the best-known game of strategy in social science. It helps us understand what governs the balance between cooperation and competition in business, in politics, and in social settings [18]. The Prisoner's Dilemma model is being used for social problems as well as development work, thus this tool of game theory is multidimensional, it is using its important role in the topics of politics, biology, economics and logics etc. In this paper, we will discuss the success of the vaccine on the human being made to diagnose the current Covid-19 epidemic.

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1. INTRODUCTION

In today's perspective, the phase of epidemic Covid-19 has created upheaval in people's lives all over the world. There is a lot of competition between drugs and vaccines in the market, which has caused confusion among the general public, which should be used and which is not? As such, it is preparing to launch its own vaccine in countries. In the current scenario, the third phase of the vaccine has been started in some countries and in some countries the vaccine is likely to come on the market in the next 2-3 months.

But according to the WHO, any vaccine can prevent this epidemic only when this minimum is 70% successful, but it will also have side effects which we will not immediately understand. It is very difficult to say which vaccine would be successful in such a situation and what its side effects would be, as well as the fact that the WHO has given the fact that the success of the vaccine would depend on the human body as well. According to the WHO, the probability of being successful in obese individuals will be low.

2. DILEMMA

In the current perspective, there is an abundance of Immune boosters in the market to increase the immunity to fight Covid-19, many brands are competing in the market with their own qualities. In such a situation, there is confusion about which product to buy by the general public; this situation is called "Dilemma". Along with social problems, the Dilemma model of prisoners is being used in the decision process of development work. This tool of game theory is multi-faceted; it is being made more successful by using it in the fields of politics, biology, economics *etc.*

3. PRISONER'S DILEMMA AND COVID -19

The more eagerly the people of the world wait on the Covid-19 vaccine, the more confused it is whether the problem will be overcome as soon as the vaccine arrives, what are the side effects, is the mask presently enough, What will

be the situation after the arrival of the vaccine, with so many questions, the whole world has been expecting from the companies making the vaccine.

Prisoner's dilemma was originally framed by Merrill Flood and Melvin Dresher while working at RAND in 1950. Albert W. Tucker formalized the game with prison sentence rewards and named it "prisoner's dilemma" [6].

We analyze the facts associated with Covid-19 as the basis of the concept of this original "Prisoner's Dilemma", which is an illusion in the world, whether Covid-19 will be completely removed as soon as the vaccine comes. There are certain confusions and obscurity regarding the social strategy to prevent this pandemic and the strategic options in this regard as thought and practiced by common people in general are listed below.

a. There is no need for a mask and a distance of 2 yards as soon as the vaccine arrives.

b. Apply the mask and keep a distance of 2 yards until the vaccine is 100% successful.

c. No need for vaccines and masks all will be cured with time.

To analyze this, we select a community which we divide into three groups (group 1, group 2 and group 3). And analyzing all the above three points, for this, point 'a' is given 5 marks, point 'b' is given 10 marks and point 'c' is given 0 marks.

Figure 1 shows the Prisoners' Dilemma for Covid-19 between Group 1, Group 2 and Group 3. If the three groups of the community have been vaccinated and do not keep the distance of mask and 2 yard, then the probability of getting Covid-19 will be 50%. Because according to 'WHO' the vaccine will not have the same effect on all people and currently there is no guarantee of 100% success of the vaccine, its results will be reported in time. Thus the community is in a 50% safe zone.

If the two groups of the community have been vaccinated and one group assumes that there is no need for vaccines and masks, all will recover over time. In this case, two groups will be in 50% safe zone but one group will be in 100% Danger zone. Thus the community is in a 30% safe zone.

If one group of the community has been vaccinated and two groups believe that there is no need for vaccines and masks, all will recover over time. In this situation, two groups would be in 100% dangerous zone but one group would be in 50% safe zone. Thus the community is in 15% safe zone.

If the three groups of the community apply the mask and keep a distance of 2 yards until the vaccine is 100% successful, then the probability of getting Covid-19 will be 95%. Thus the community is in a 95% safe zone.

If the two groups of the community apply the mask and keep a distance of 2 yards until the vaccine is 100% successful and one group assumes that there is no need for vaccines and masks, all will recover over time. In this case, two groups will be in 95% safe zone but one group will be in 100% Danger zone. Thus the community is in a 70% safe zone.

If one group of the community apply the mask and keep a distance of 2 yards until the vaccine is 100% successful and two groups believe that there is no need for vaccines and masks, all will recover over time. In this situation, two groups would be in 100% dangerous zone but one group would be in 95% safe zone. Thus the community is in 40% safe zone.

If the two groups of the community apply the mask and keep a distance of 2 yards until the vaccine is 100% successful and one group assumes no need for a mask and a distance of 2 yards as soon as the vaccine arrives. In this case, two groups will be in 95% safe zone but one group will be in 50% Danger zone. Thus the community is in 80% safe zone.

If one group of the community applies the mask and keep a distance of 2 yards until the vaccine is 100% successful and two groups assumes no need for a mask and a distance of 2 yards as soon as the vaccine arrives. In this case, one group will be in 95% safe zone but two groups will be in 50% Danger zone. Thus the community is in 60% safe zone.

If one group of the community apply the mask and keep a distance of 2 yards until the vaccine is 100% successful, one group assumes no need for a mask and a distance of 2 yards as soon as the vaccine arrives and one group

assumes that there is no need for vaccines and masks, all will recover over time. Thus the community is in 45% safe zone.

If the all three groups of the community neither apply the vaccine nor wear the mask and believe that it will heal over time. In such a situation, 100% of the community would be in the danger zone of Covid-19. Then from Covid-19, the same people will be able to fight better, whose immunity is very good and there is no other disease. But this will make the community disorganized and the economy will go down.

Table 1 Prisoners Dilemma between Group1,Group2 and Group3

		Group 2								
Group 1		a	b	c	a	b	c	a	b	c
	a	(5,5,5)	(5,10,10)	(5,0,0)	(5,5,0)	(5,10,5)	(5,0,10)	(5,5,10)	(5,10,0)	(5,0,5)
	b	(10,5,5)	(10,10,10)	(10,0,0)	(10,5,0)	(10,10,5)	(10,0,10)	(10,5,10)	(10,10,5)	(10,0,5)
	c	(0,5,5)	(0,10,10)	(0,0,0)	(0,5,0)	(0,10,5)	(0,0,10)	(0,5,10)	(0,10,0)	(0,0,5)
		a	b	c	c	a	b	b	c	a
		Group 3								

We can show crisp matrix form of Table 1

Table 2 Matrix between Danger zone and Safe zone

pair of thoughts	Danger zone (in %)	Safe zone (in %)
Three ‘a’	50	50
Two ‘a’ and one ‘c’	70	30
Two ‘c’ and one ‘a’	85	15
Three ‘b’	5	95
Two ‘b’ and one ‘c’	30	70
Two ‘c’ and one ‘b’	60	40
Two ‘b’ and one ‘a’	20	80
Two ‘a’ and one ‘b’	40	60
one ‘a’, one ‘b’ and one ‘c’	55	45
Three ‘c’	100	00

Ranking fuzzy numbers is important in decision making. Since very often the alternatives are evaluated by fuzzy numbers in a vague environment, a comparison between these fuzzy numbers is indeed a comparison between alternatives [13]. We can rank by Fuzzy logic of Table 2.

Table 3 Ranking according to safe zone

pair of thoughts	Three ‘a’	Two ‘a’ and one ‘c’	Two ‘c’ and one ‘a’	Three ‘b’	Two ‘b’ and one ‘c’	Two ‘c’ and one ‘b’	Two ‘b’ and one ‘a’	Two ‘a’ and one ‘b’	one ‘a’, one ‘b’ and one ‘c’	Three ‘c’
Ranking	0. 5	0.3	0.2	0.9	0.7	0.4	0.8	0.6	0.4	0.0

We see in Table 3 best decision is (b,b,b), because highest safe zone rank is 0.9 .

4. CONCLUSION

Thus we conclude that what is best for one group will be the best for mankind of the whole world. In this way, with the help of the prisoners' dilemma, it turns out that currently ‘the three groups of the community apply the mask and keep a distance of 2 yards until the vaccine is 100% successful’ would be the best decision.

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