

**Covid 19 and Herd Immunity?
The War between the Human and the Virus**

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On March 16th, 53 days after Covid 19 has landed in Europe, two European countries, the UK and the Netherlands, announced their policy to deal with Covid 19: Herd immunization is their mantra.

According to the definition of clinical infectious diseases, herd immunity is a form of indirect protection from such disease that occurs when a large percentage of a population has become immune to an infection, whether through infection or vaccination, thereby eventually providing a measure of protection for individuals who are not immune.

To the majority of the scientific world, this strategy on how to deal with Covid 19 came as a big surprise. With a basic reproduction number of Covid 19 of 3 (meaning that one infected person on average can infect another three persons), and a generation interval of 4 days (meaning the interval between the onset of person A to the onset of his/her infected person B is four days, evaluated with the assumption of an average of eight days of incubation period of Covid 19), this coronavirus has been genetically qualified as an epidemic from day one of its appearance.

To figure out how this virus can affect the whole population of Europe, let's do some simple math:

The whole population of Europe is 741 million. With Covid 19's basic reproduction number of 3 and generation interval of 4 days, we can generate the below formula

$$1 + 3 + 3^2 + 3^3 + \dots + 3^n = 741,000,000$$

N is the generation of the virus has spread.

Therefore, $n = 19.2$. This means Covid 19 will take 19.2 generations to infect all Europeans. In terms of days, it is $19.2 * 4 = 76.8$ days, equals to 77 days.

This means that if no measures are taken to intervene against the spread of the virus, such as wearing masks, isolating infected people, reducing/eliminating social interaction, etc., the whole European population will get the infection by April 10th, 2020 (counted from the day of the first case of Covid 19 in Europe on January 24th, 2020)

Now the UK and NL announced to "immunize their herd". Will this be effective? Theoretically and practically, it cannot be effective.

Theoretically,

Let's assume what British and Dutch authority proposed is correct, namely that herd immunity could curb this coronavirus and people who are not immune could therefore be protected, with the basic reproduction number of 3. We can propose the formula below

$$R_0(1 - P) < 1$$

Where R_0 is the basic reproduction number, P is the proportion of the population that is immune from Covid 19, so $1-P$ means the portion of the people that will be infected by Covid 19.

This formula means that with $R_0 = 3$ to infect the non-immune population, the result must be smaller than 1, so that the virus can be overcome in the end. So, guess what the result is? **$P = 66.7\%$** , which means **66.7 percent of the population will necessarily need to be infected to achieve herd immunity from Covid 19.**

In the case of the UK, with a total population of 67.5 million people, this means 45 million British people will be infected. If the death rate is an optimistic number of 1 percent (which seems impossible according to the European data coming out of Italy), the UK will at least have 45,000 people die. This is the same death toll that Britain had to endure in World War II.

In the case of the Netherlands, with a total population of 17.18 million people, $p=66.7\%$ means 11.4 millions of Dutch people who will need to be infected in order to achieve herd immunity. If the death rate is the same optimistic number of 1 percent (which seems impossible according to the European data coming out of Italy), the Netherlands will have at least 11,400 people die, somewhat less than the number of the military casualties of the Netherlands in World War II (17,000).

On top, the surviving infected herd will end up suffering from the consequences of pulmonary fibrosis. Their damaged and scarred lung tissue will make it difficult for them to breathe for the rest of their lives.

In comparison, the battle to achieve herd immunity as a measure against Covid 19, is worse than the nightmare of World War II. And on top, it might allow Covid20 to be generated along the way if we do not deal with it properly.

How to deal with it? What measures should be applied, at long last, now in Europe?

Practically,

Let's see the experience of humans in the past dealing with measles.

Measles has a basic reproduction number of 12 to 18, which is much higher than the reproduction number of 3 applicable to Covid 19. On the other hand, measles has a much lower death rate of only 0.3 percent, compared to the optimistic assumption of 1.0 applied to Covid 19.

By 1980 when the first vaccination of Measles came into the market, humanity, for nine centuries, with more than 90 percent of the population infected and immune (meeting the criteria of Herd immunity), never succeeded to achieve full herd immunity protecting those who were not immunized from getting infected. So, in practice, herd immunity was not achieved which will likely be the case for the herds in the UK and the Netherlands mass exposed to Covid 19.

The most effective ways to protect the uninfected, unimmune population before the emergence of a Covid 19 vaccination, are actually **the basic ones**:

In terms of community, putting strict measure on reducing and/or eliminating social interaction and applying aggressive testing and case tracking as much as possible and as early as possible. Examples of China, HK, Taiwan, Korea, and Singapore taking the most strict measures in the past two months should be seriously studied. It is very disappointing to see how Europe moved too late and too slow, even with the lessons which have been clear to see in China and Italy. Optimistically, if Europe can apply the most effective and strict measures, the infection rate might flatten out in Europe in two months. To do so, locking down and converting as many activities as possible online are essential.

In terms of medical treatment of Covid 19, it would seem essential to go into a fully transparent medical experience exchange with other countries, particularly China, Taiwan, HK, Korea, and Singapore. They seem to have found a success formula that they could share. Inspiring our medical institutions in Europe with practical lessons from those countries and regions will help Europe to reduce the death toll that unnecessary experiments will cause. Also, learn to use alternative treatment methods such as Chinese medicine to help infected people to recover quickly with fewer side effects and prevent unimmune people from getting infected. Meanwhile, the investment and effort to explore new vaccination with other countries have to be continued and accelerated.

The current crisis laid bare considerable flaws of the "modern societies" of the West. Democracies seem ill equipped to deal with a crisis that needs quick and determined action. To opt for herd immunity as a measure to tackle Covid 19 could be translated into: "we do not know what to do, so doing nothing looks like the best

option". The influence of the industrial/business complex in such crisis will also need to be discussed and reflected carefully. In essence this crisis could be seen as an opportunity to upgrade the current model of business and its view of a globalized order, so that business and industries may continue to be globally connected but have more roots that keep them locally sustained.