Why We Do Not Have a Malaria Vaccine

by

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Malaria affects hundreds of millions and kills several million people every year. It has been around for a long time. Two Nobel prizes have been awarded a century ago for identifying the cause and the transmission mechanism of malaria. Yet, till today, we do not have a vaccine for malaria.

Imagine there are 100 people in the world. There are 90 people (type L) who have a small chance of 10% of contracting malaria. There are another 10 people (type H) who would develop malaria with 100% chance. Let us suppose that the harm from malaria is $100 for each person. Let us also assume that for $1 decrease in harm, a consumer is willing to pay $1 (technically, each consumer is risk neutral). Suppose the drug is perfectly effective, has no side effects, and is costless to produce.

How much revenue will a pharmaceutical company generate in each of the following scenarios? (1) It develops a drug D that cures malaria (forever). (2) It develops a vaccine V that prevents malaria from developing.

We show that under the assumption that the pharmaceutical company cannot distinguish between type H and type L, it is more profitable for the drug companies to produce the drug rather than the vaccine.

If the pharmaceutical develops the drug D, it will be able to sell it to all the people who get malaria. By assumption, all the type H will develop malaria. Thus, there will be 10 people from type H who will get malaria. In addition, 9 people of type L will also develop malaria. In total, there will be 19 people with malaria including both types. By assumption, each person contracting malaria will be willing to pay $100 to reduce the effects of malaria by 100%. Therefore, the pharmaceutical company will be able to $1,900 in revenue from the entire population. Given our assumption of zero cost of production, $1,900 will also be the profits of the pharmaceutical company.

Vaccine has to be sold *before* malaria strikes. For type L, there is a 10% chance of malaria. Thus, they will be willing to pay the average loss of 100x(1/10) = $10 for the vaccine. If the pharmaceutical cannot distinguish between type L and type H, it can only charge *$10 to all.* In that case, it will generate $10x100 = $1,000 profits by selling the vaccine to all the 100 people. The other possibility is the following. The company sets a price of $100 for the vaccine. In that case, no person of type L will buy the vaccine ex-ante (as their expected benefits before malaria strikes is $10 but the cost is $100). The only people who will buy the vaccine will be of type H. Since there are 10 of type H, the profits will be $100x10 = $1,000. Thus, in either price strategy, the profits of the company will be $1,000.

Therefore, the profits of the company are bigger in the case of the development of drug D instead of the vaccine V. This argument is extremely general as long as the probability of the type L does not get close to the probability of type H getting the disease and the company cannot distinguish between the types.

(Note: The general argument was developed by Michael Kremer and Christopher M. Snyder).