Supervision 3: Part IIB Paper 8
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Many communicable diseases like tuberculosis and leprosy continue to be stigmatized. This has negative consequences for testing and treatment. Unlike HIV/AIDS, these diseases are not caused by individual behaviors that are perceived to be socially deviant. Our objective is to explain why stigma might, nevertheless, have emerged in the context of these communicable diseases and why it continues to persist.

(1) Begin with the case where there is no cure for a communicable disease. Each community consists of two individuals. Each individual lives for a single time period. In that period, there is an exogenously determined probability, p, that he will contract the communicable disease. These health shocks are uncorrelated across the two individuals. There is an additional probability that each individual will contract the disease through his social interactions with his fellow community-member, and this is where stigma comes in.

Each individual derives utility, U, from the consumption of goods and services when he is healthy. We normalize so that the utility from consumption when he is sick is zero. In addition, he derives utility, V, from his social interactions regardless of whether he is sick or healthy. We assume that if an individual does contract the disease and if he does not restrict his social interactions then he will transmit the infection with probability one. A self-interested individual does not internalize the cost he imposes on his fellow-community member through this transmission mechanism and will continue to interact socially (and receive utility V) even when he is sick. What *enacted* stigma does is to eliminate these social interactions by punishing individuals who are detected with the disease. Denote this punishment by f and denote the gain in social standing for stigmatizers who do the punishing by g. Individuals will respond to the threat of these punishments by stopping their social interactions, in order to hide their condition. We assume that this *internalized* stigma reduces the transmission of the disease within the community to zero.

In this setup, each individual has two choices: (i) Stigmatizing individuals (S) hide their condition if they contract the disease and punish individuals with the disease if detected, and (ii) Non-Stigmatizing individuals (NS) reveal their condition by interacting freely and do not punish individuals with the disease.

(a) Show that the strategy profile (S,S), where the first argument in parentheses refers to individual 1's choice and the second argument refers to individual 2's choice, is the unique equilibrium of this game when f and g are sufficiently large ($f>V$, $g>(2-p)V$).

(b) Show that social welfare in the stigmatizing equilibrium (S,S) is greater than social welfare without stigma (NS,NS) when $U>V/1-p$. Social welfare is defined here as the sum of the two individuals' utilities.

(2) Now consider what happens when a cure is developed. Assume that individuals who are treated are cured with probability one. Once they are treated and cured, they do not transmit the disease to the rest of the community. However, treatment costs an amount c (in terms of time and money) and is observable to the community. Thus, only individuals who choose NS will (also) choose to be treated when they fall ill.

(a) We saw above that the *stigmatizing* equilibrium is welfare maximizing in the absence of a cure when $U >V/1-p$. Once a cure is developed, show that the *non-stigmatizing* equilibrium, in which individuals treat themselves and thereby reduce transmission rates, will instead be welfare maximizing as long as $U+V-c>0$.

(b) It is reasonable to assume that the utility from being healthy $U+V$ exceeds the cost of treatment, c. Nevertheless, some communities will remain in the now inefficient stigmatizing equilibrium. Show that **(i)** (S,S) is the unique equilibrium when $U+V-c<g$; i.e. when the net utility from treatment lies below a threshold value equal to the gain from punishing, g. **(ii)** (NS,NS) is the unique equilibrium when $U+V-c>f$; i.e. when the net utility from treatment exceeds a threshold value equal to the punishment, f, and **(iii)** both (S,S) and (NS,NS) can be supported in equilibrium when $g<U+V-c<f$ (we are implicitly making the reasonable assumption that the punishment, f, is greater than the gain from punishing, g) .

(3) The simple game theoretic model we have developed provides a structural explanation for why stigma could emerge in the presence of an incurable communicable disease. The model can also explain why stigma could persist in some communities but not others, even after a cure has been developed. To test the model we need to construct a measure of $U+V-c$. In general, the utility from consumption is increasing in wealth. Access to health facilities will be increasing in wealth, which implies that the cost of treatment will be decreasing in wealth. It is thus reasonable to assume that $U+V-c$ is increasing in wealth, W.

(a) Use the theoretical results derived above to plot the relationship between community wealth (on the X-axis) and the probability that the community is in a stigmatizing equilibrium (on the Y-axis).

(b) Stigma is associated with delays in testing (to avoid detection). The relationship between community wealth and testing delays should thus be qualitatively the same as what you plotted in the figure above. Can you explain how you could use this relationship to rule out alternative explanations for the relationship between wealth and testing; e.g. wealthier individuals are better educated and so will be more likely to test when they have symptoms?

(c) If you were a policymaker trying to stamp out stigma but had limited resources, which communities would you target and why?