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EDITORIAL

Why Only Test Symptomatic Patients? Consider Random Screening for COVID-19

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The world is at war with the coronavirus disease 2019 (COVID-19) pandemic. With many places still facing a drastic shortage of testing resources, what is the best way to deploy these scarce tests? In the United States (US), the Center for Disease Control and Prevention (CDC) implemented strict criteria that a patient needed to satisfy to qualify for testing, including (1) physical symptoms of COVID-19; (2) recent travel to areas of an outbreak; and (3) direct contact with a person who tested positive for COVID-19 [1]. Additional criteria to narrow allocation included individuals over age 65 years, frontline healthcare workers, and hospitalized patients.

These circumstances are somewhat unique to the US, since other nations have not expressed the same degree of COVID-19 test kit shortages. The United Kingdom (UK) has conducted over 90,000 tests, while still adhering to strict guidelines for testing, including hospital admission and pneumonia; acute respiratory distress syndrome; or influenza like symptoms [2]. By contrast, Canada has conducted over 50,000 tests nationwide under a fairly flexible policy that any patient presenting with coronavirus symptoms is eligible [3].

Wherever the cases may present, testing patients who satisfy some of these criteria is more likely to generate positive test results than testing those who do not exhibit one of these conditions. Yet, the instinct that we should be concentrating testing on patients who exhibit salient markers of the disease may be suboptimal in stunting the transmission rate.

Tactics that the US deployed during World War II provide an important history lesson on how US public health officials should be allocating testing. Back then, the US Army Air Forces brass were concerned with optimally placing armor on bomber planes, with the objective of maximizing the rate at which their pilots survived battle and returned home. Bombers returning from missions often had multitudes of scattered bullet holes. The army's initial instinct was to allocate scarce armor on those areas of the plane that were hit hardest. By focusing on the salient and hardest hit areas of the surviving planes, the army was systematically neglecting areas of the plane that when shot at were most vulnerable to crashing (e.g., the engines and cockpit). Abraham Wald, the Hungarian mathematician who defected to the US at the war's outbreak, recommended an altered strategy to improve aircraft survivability. By studying the distribution of bullet holes throughout multiple aircraft that returned, he deducted that planes needed continued protection of the engines and cockpit to continue returning home, so armor were placed systematically on these areas of all aircraft despite the observable data of bullet holes in the bomber fuselages [4].

In the context of a pandemic during which many people may be infected but asymptomatic, a similar logic suggests that allocating scarce diagnostic resources towards those who do not exhibit warning signs of infection is crucial. If asymptomatic patients are less likely to follow public health guidelines such as social distancing or self-isolation compared to patients who do exhibit symptoms, then providing information to asymptomatic patients that they are infected is a critical step in mitigating disease transmission.

During the brief amount of time that the US has been able to study the COVID-19 outbreak, there has been substantial evidence to support the belief that many of the infected population are asymptomatic. For instance, according to Nishiura and colleagues, the ill-fated *Diamond Princess* cruise ship had an asymptomatic COVID-19 infection prevalence of 30.8% in an adult population [5]. The American Academy of Pediatrics currently reports that about 4% of children are asymptomatic and 51% have only mild symptoms [6].

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These data imply that while symptomatic patients are worth screening to properly manage them, the US should consider randomizing testing in the general population or potentially shifting test resources *away* from symptomatic patients and towards those who are least likely to consider themselves infected. In terms of information theory, one objective of a test is to maximize the "surprise" that a person experiences when receiving a test result [7]. A test result that is not surprising and simply confirms a prior belief has limited value, particularly when tests are scarce. On the other hand, if a person has a strong belief that they are not infected, but then receives a positive test result, they will then likely exhibit a larger change in their behavior compared to a person who simply received confirmatory results. In addition, increasing the proportion of surprising test results will also be valuable to public health officials in painting a more accurate picture of the spread of the disease.

Given these considerations, where do we go from here? US public health officials should make a concerted effort to conserve the supply of COVID-19 test kits [8], but specifically for random sampling in the community. Areas of the US geography that appear to be less impacted by the disease (e.g., West Virginia, Upper Midwest states, Mountain-West states), despite current data, could become problematic epicenters in the days and weeks to come given that these areas are unlikely to experience the same drastic behavioral shifts that locations like California and New York have adopted. Practical concerns will persist with this recommendation, such as distributing test kits to less population-dense areas where disease spread is still common (e.g., suburban areas) and convincing patients presenting with mild or no coronavirus symptoms to volunteer for testing.

One caveat to close with is that this recommendation for random testing depends on the assumption that no treatment is currently available. Without treatment, knowing how to manage population health through primary and preventive care is our strongest weapon. However, if a treatment were to evolve in the coming months, then primarily testing symptomatic patients would become a much more valuable strategy in order to effectively allocate treatment resources to the infected for promoting disease recovery [9].

Compliance with Ethical Standards

Conflict of Interest The author declares that he has no conflict of interest.

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