

Viral Spread in Absence of Symptoms in the COVID-19 Pandemic: A Need for Revised Transmission Prevention Strategies

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ABSTRACT

Given how quickly the virus spread across the globe within a matter of months, it became clear that there was something unique and extreme about the transmission properties of SARS-CoV-2, the virus driving the COVID-19 pandemic. Public health strategies that emphasize rapid transmission prevention are key to reducing the future impact of this virus on lives and economies across the globe until an effective treatment and vaccine are developed.

Keywords: COVID-19; SARS-CoV-2; Public health; Asymptomatic; Transmission

ABOUT THE STUDY

Two basic public health strategies utilized when aiming to control spread of an infectious disease include isolation of symptomatic individuals and tracing and quarantining contacts of the symptomatic case [1]. The success of these strategies at curbing viral transmission, however, depends on the timing of peak infectivity relative to symptom onset. In the case of SARS-CoV-2, it quickly became evident that individuals could be infected yet have absence of symptoms and more importantly, could transmit the virus to others all while asymptomatic [2].

Various studies involving universally tested populations have demonstrated that a proportion of SARS-CoV-2 PCR positive cases were asymptomatic at time of positive test. On the Diamond Princess cruise ship of 3,063 passengers on board tested, 634 were positive for SARS-CoV-2 and 17.9% of these positive passengers lacked symptoms at time of test [3]. In New York City, all patients admitted to the labor and delivery unit were tested regardless of symptoms and of those that tested positive, 87.9% were asymptomatic at the time of the test [4].

Evidence of asymptomatic transmission was demonstrated in the transmission of a female Chinese business woman to two German business men in the absence of symptoms [5]. In a contact tracing study out of Wuhan from January prior to community spread, infectivity of the virus was traced in a 22 years old man who asymptotically transmitted the virus to his cousin and 6 out of 15 classmates he encountered two days after returning from Wuhan where he was infected [6].

Given that presence of symptoms can no longer be used as a marker of infection in order to cue testing, mask use and quarantine, other strategies must be utilized. As community spread of the virus became rampant, it became harder to identify those at highest risk of having and transmitting the virus. As a result, universal mask use, continued social distancing and more frequent testing regardless of symptoms should be a major public health focus.

As access to testing continues to be a limitation in the current pandemic, allocation of testing resources to universal testing of at risk populations as well as populations with high exposure frequency and high transmissibility potential should be prioritized. This population includes residents and staff of long term care facilities, health care workers, and first responders.

Implementation of universal serial testing of residents and staff of a Pennsylvania nursing home regardless of symptoms allowed for early isolation of infected individuals, preventing further transmission during an outbreak. A health care worker at the facility tested positive for SARS-CoV-2 after working with a resident prior to symptom onset. This index resident was asymptomatic but tested positive. Universal testing was instituted and over the next 2 weeks of serial testing every 3-5 days, 27 residents were positive, 14 of which were asymptomatic at time of test [7]. Another skilled nursing facility in Los Angeles that instituted universal and serial PCR testing found that 14 out of 19 positive residents were asymptomatic at the time of testing and 4 out of 8 staff members positive were asymptomatic [8]. In San Francisco, universal testing in long term care facilities found

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asymptomatic infection in residents to be as high as 75% and 41% in health care workers [9]. These studies demonstrate the potential for widespread transmission prior to symptom onset and the importance of widespread testing, especially in at risk populations.

Success of infectious disease prevention strategies depends on the transmission properties of the virus in question. Not every virus is the same and therefore not every epidemic can be approached the same way. Understanding the temporal dynamics of transmission of a novel virus in the early stages is of utmost importance in order to devise effective public health strategies. Determination of time course of peak infectivity in relation to symptom onset and exposure informs the ease at which infected individuals can be identified and isolated prior to viral propagation.

In the case of the SARS-CoV epidemic of 2003, it was determined that transmission occurred several days after symptom onset [10]. Public health strategies involved isolation of symptomatic individuals so as to prevent further transmission and close observation of asymptomatic contacts of confirmed infected individuals so as to isolate them as soon as they become symptomatic [11].

In a virus like SARS-CoV where symptom onset occurs prior to infectiousness, a system in which symptomatic patients are singled out to be tested and then isolated is quite effective. In other viruses such as Influenza where the virus can be spread silently in absence of symptoms, transmission prevention strategies that rely on symptom presentation are of little value. In the current epidemic, SARS-CoV-2 has transmission potential in absence of symptoms. Temporal patterns of viral shedding in 94 confirmed SARS-CoV-2 infected individuals found the highest viral load in throat swabs at the time of symptom onset suggesting infectiousness peaked on or before symptom onset. Additionally, in 77 transmission pairs, it was inferred based on the incubation period and serial intervals that infectiousness started about 2.3 days prior to symptom onset and peaked the day of symptom onset [12]. Thus, strategies that employ infection identification by symptom onset will be insufficient in controlling viral spread. Infection identification in order to prevent asymptomatic spread must depend on RT PCR testing of asymptomatic individuals with exposure risk. Transmission prevention in absence of knowledge of who is infected should rely on universal mask usage and social distancing when possible.

Three proposed public health tenants of transmission prevention in epidemics perpetuated by asymptomatic transmission include: Serial universal testing of asymptomatic high risk populations, universal mask usage and maintenance of social distancing. For best transmission control, all three would be utilized. In the absence of all, there is very little chance of preventing further global spread. Priority needs to be placed on

instituting policies that are customized to the unique temporal dynamics of transmission of the SARS-CoV-2 virus and therefore resources must be allocated in a way that prioritizes access to testing, universal masks and societal accommodation to social distancing practices. The impact of SARS-CoV-2 has rippled across the globe and we must all do our small part to follow best public health practices to prevent further viral transmission and pandemic propagation.

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