Asymptomatic Transmission of COVID-19

ID Grand Rounds
3/26/20

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1827 publications since 1/18/20

532 publications in last one week

CORONAVIRUS RESEARCH
Hundreds of studies about the virus have been published since the outbreak began.

Journal articles  Preprints

Cumulative studies

January 2020  February  March

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Estimates suggest the COVID-19 coronavirus is less deadly than the related illnesses SARS or MERS, but more infectious ($R_0$) than seasonal influenza.
Outline

• Recent papers on asymptomatic transmission, background (Melisa Shah)
• Discussion of case fatality rate estimations and shortcomings (Eran Bendavid)
• Update on serology for COVID-19 (Scott Boyd)
Asymptomatic Proportion

• What proportion of infected people have mild or no symptoms and might be passing the virus on to others?
  • Informs public health policy, intensity and role of social distancing, true burden of disease

• Can asymptomatic people transmit disease?
  • NEJM study\(^1\) measured SARS-COV-2 viral loads in upper respiratory specimens n=18 from China. 1 patient with asymptomatic infection had similar viral load to symptomatic patients.

Studies examining asymptomatic proportion

- Study assessing asymptomatic infection among people in the Diamond Princess (Mizumoto et al)

- Study using Japanese evacuees from Wuhan n=565 to estimate the asymptomatic proportion (Nishiura et al)

- Related Study: Mathematical modelling study estimating undocumented infections (not only asymptomatic) using pre lock-down data from China and impact on transmission (Ruiyun et al)
RAPID COMMUNICATION

Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 2020

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Diamond Princess Cruise Ship

• On January 20, 2020, the Diamond Princess cruise ship departed Yokohama, Japan, carrying 3,711 passengers and crew.

• On January 25, a symptomatic passenger departed the ship in Hong Kong, where he was evaluated; testing confirmed SARS-CoV-2 infection.

• On February 3, the ship had returned to Japan and quarantine started.
Mizumoto Study

• Tested passengers with PCR, prioritizing high risk and symptomatic cases. 3063 of 3711 received testing.
• Statistical modelling analysis to estimate the proportion of asymptomatic individuals among those tested
• Survival data with right censoring
Results

Of 634 confirmed cases, 306 were symptomatic and 328 were asymptomatic.

Estimated asymptomatic proportion is 17.9% (95%CI: 15.5–20.2%)

Other Studies

• Japanese nationals evacuated from Wuhan\(^1\):
  • 565 people evacuated from Wuhan
  • 5 asymptomatic patients tested positive, and 7 symptomatic patients tested positive (41.6% asymptomatic ratio, 33.3% if one asymptomatic developed symptoms after 14 days)

• Individual level data\(^2\) on 25,961 cases through Feb 18, 2020 using SEIR model
  • “At least 59% of infected cases were unascertained in Wuhan, potentially including asymptomatic and mild-symptomatic cases”

Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV2)

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Methods

• Mathematical model simulating the spatiotemporal dynamics of infections among 375 Chinese cities
  • Uses travel data estimations before and after the Wuhan lock-down
  • January 10-January 23 (period before travel restrictions)
  • Based on an SEIR model including latent period, infection duration, transmission reduction factor for undocumented infections, transmission rate for documented infections, travel multiplicative factors).
  • Found the best fitting model
86% of infections went undocumented from Jan 10-23, and undocumented infections were 55% as contagious ($u=0.55$) as documented infections.
"Overall, our findings indicate that a large proportion of COVID-19 infections were undocumented prior to the implementation of travel restrictions and other heightened control measures in China on 23 January, and that a large proportion of the total force of infection was mediated through these undocumented infections."
Conclusions

• The asymptomatic fraction for COVID is likely significant (18-33%) as indicated from these studies but more data is needed.

• What are the implications of an increased asymptomatic fraction for policy and planning?

• How can we use serology to help better inform these key epidemiological parameters?
Is the Coronavirus as Deadly as They Say?
Current estimates about the Covid-19 fatality rate may be too high by orders of magnitude.

By Eran Bendavid and Jay Bhattacharya
March 24, 2020 6:21 pm ET
Extra Slides
Methods

\[ g(x, p) = \begin{cases} 
  p + (1 - p)(1 - F_D(c - x)) & \text{if they do not have symptoms,} \\
  F_D(c - x) & \text{if they do have symptoms,} 
\end{cases} \]
Figure S1. Heat maps of the density distribution of infection timing by individuals, Symptomatic cases (N= 306)

Vertical axis represents each individual from 1 to N. Cases disembarked after testing positive for the disease. Day 1 corresponds to January 20, 2020, when the first symptomatic case embarked. The vertical line corresponds to February 5, 2020 when the quarantine period started.
Figure S2. Heat maps of the density distribution of infection timing by individuals, Asymptomatic cases (N= 320)

Vertical axis represents each individual from 1 to N. Cases disembarked after testing positive for the disease. Day 1 corresponds to January 20, 2020, when the first symptomatic case embarked. The vertical line corresponds to February 5, 2020 when the quarantine period started.