**Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study – Summary**

**Intro + Aims**

* The authors aim to provide a “now-cast” of the estimated size of the 2019-nCoV epidemic in Wuhan and the number of exported cases to mainland Chinese cities.
* They estimate the effect of various public health measures on controlling the course of the outbreak.

**Methods**

* A meta-population SEIR model was used to describe the transmission of 2019-nCoV within and between Chinese cities and internationally to countries outside of China.
  + This model integrates Chinese flight and human mobility data into the SEIR model structure to provide a description of realistic human movement patterns.
  + For the first 6 days of the outbreak (25th Dec to 1st Jan), the model uses a “zoonotic force of infection” transmission parameter to model human exposure to the seafood market in Wuhan (initial zoonotic event).
* R0 was estimated through Bayesian model fitting using a maximum likelihood equation - fitting the observed number of exported 2019-nCoV cases (outside of China) against the expected number of internationally exported cases (simulated through the model).
  + An uninformative prior (uniform distribution) was used to identify R0.
  + They use SARS-like estimates for the incubation period (6.1 days) and serial interval (8.4 days).
  + Asymptomatic cases NOT assumed to be infective.
* This R0 posterior estimate was next used in the SEIR model to estimate the number of cases in Wuhan, the number of exported cases (from Wuhan) to each Chinese cities and the expected time-course of the outbreak.
  + This R0 value was assumed to remain static for transmission across all Chinese cities.

**Results**

* R0 was estimated at 2.68 (95% CI: 2.47-2.86).
* As of Jan 25th 2020, an estimated 75,815 individuals have been infected in Wuhan (95% CI: 37,304 – 130,330).
* The number of cases exported to other Chinese cities are estimated to be in the hundreds per city – with Chongqing having the greatest number of exported cases (461 cases; 95% CI: 227-805).
* They explored the effect of differing numbers of initial cases caused by zoonotic transmission from the seafood market (50% greater zoonotic FOI, 100% greater zoonotic FOI).
  + As the zoonotic FOI increased (more cases from the seafood market) the estimated number of overall cases decreases (both exported and in Wuhan) and the R0 decreases.
* They estimated the effect of reductions to “transmissibility” and/or human mobility, to assess the effect of these interventions on the estimated time-course of the outbreak.
* With NO interventions, the Wuhan 2019-nCoV epidemic will likely peak April 2020, with a month-long time lag for the other cities to peak in the number of infections.
  + 50% reductions to human mobility had limited effect on epidemic dynamics – due to the number of cases already seeded in multiple Chinese cities before the interventions.
  + Due to the high number of seeded cases, there is likely to be several exponentially growing local outbreaks in Chinese cities.
  + As the “transmissibility” is reduced to 50% the effective reproduction number drops to around 1.3 and the number of cases/infections substantially drops over the course of the outbreak.

**Discussion**

* Multiple Chinese cities are likely to already have self-sustaining local outbreaks.
  + Many of these cities are major international travel hubs – posing a danger of further international spread of 2019-nCoV.
* Large scale public health measures are needed to mitigate further spread and to prevent export to international countries.
* Identifying the zoonotic source is important to prevent new animal-to-human “seeding” events.