SIR Model with Testing and Isolation Mechanisms

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1 Method

(Arino and Portet, 2020) developed a SLIAR compartmental model to study the spread of an epidemic, specifically COVID-19, in a population. The model incorporates an Erlang distribution of times of sojourn inincubating, symptomatically and asymptomatically infectious compartments. Basic reproduction number is derived. Also, sensitivity analysis with respect to the underlying parameters for the following two outputs was carried out; (i) the number of observable cases during the course of the epidemic and at the peak, and (ii) the timing of the peak of the outbreak. Sensitivity analysis is performed using the R package multisensi.

2 Literature Review

Bergstrom et al. (2020) (1) Model, assumptions: They developed a function, namely expected expoisour $E(C, \tau)$, to approximate trade-offs between the frequency of testing, n, the sensitivity of testing, q, and the delay between testing and results, d. This function is explicitly derived and was connected the effective reproduction number $R = R_0 S$, where S is the proportion of population susciptable. assumption that transmission rates are a step function: individuals who have COVID go from non-infectious to fully infectious instantaneously, and remain fully infectious until they are no longer able to transmit disease. Test sensitivity takes the same form over the course of infection. More sophisticated models could allow varying infectiousness and varying sensitivity over time, as in (Larremore et al., 2020).

References

Arino, J. and Portet, S. (2020). A simple model for covid-19. *Infectious Disease Modelling*.

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Larremore, D. B., Wilder, B., Lester, E., Shehata, S., Burke, J. M., Hay, J. A., Tambe, M., Mina, M. J., and Parker, R. (2020). Test sensitivity is secondary to frequency and turnaround time for covid-19 surveillance. *MedRxiv*.