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Review Article

Concept of Reproductive number & herd immunity in respect to COVID-19

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Abstract: average number of secondary cases arising from an average primary case in a population over the course of its infectious period is reproductive no. if whole population is susceptible (infection is novel like nCOVID-19) then it is called as basic reproductive no. The herd immunity threshold is the proportion of a population that need to be immune in order for an infectious disease to become stable in that community. To eliminate any disease the effective reproductive no. is to be <1.

Keywords: Pharmacokinetic, tissue distribution, sickle cell, home remedy, mixture.

Basic reproductive no (^{R}0)

The average number of secondary cases arising from an average primary case in an entirely susceptible population over the course of its infectious period(Oxford medicine: Infectious disease epidemiology; & principal of epidemiology: CDC). R naught or zero means that it is estimated when there is zero immunity in the population (Gordis Epidemiology). When the disease is novel e.g., novel corona virus disease

Effective reproductive number(R/ Re)

The effective reproductive number (R) is the average number of secondary cases per infectious case in a population made up of both susceptible and non-susceptible hosts. Some contacts will be immune, for example due to prior infection which has conferred life-long immunity, or as a result of previous immunization (Oxford medicine: Infectious disease epidemiology; & principal of epidemiology: CDC).

R=1 (endemic) R>1 (epidemic) R<1(decline in case)

R= R_0x

(Where X= susceptible host)

(https://wwwnc.cdc.gov/eid)

e.g., if R_0 for influenza is 12 in a population where half of the population is immune,

R=12 x 0.5 = 6

- Under these circumstances, a single case of influenza would produce an average of 6 new secondary cases.

Factors determining the R_0

- The infectiousness of the agent.
- Population density.
- Course of infectiousness of the disease (Incubation period, latent periods and period of infectiousness).
- Mode of transmission and contagiousness.

R0 = P × C × D (mathematical formula)(Oxford medicine: Infectious disease epidemiology: & https://wwwnc.cdc.gov/eid)
(P= probability of transmission per contact, C= contact per unit time, D= duration of infectiousness)

R can be reduced through intervention by changing in these factors:

- **Reducing probability of transmission per contact** e.g., Hand Washing vaccination, PPE for corona warriors, special attention to >60yr ages, with comorbidities isolation & proper mask usage infected person etc.
- **Reducing contacts per unit time** e.g., isolation , social distancing , avoid social gathering
- **Reducing duration of infectiousness** e.g., lockdown, fumigation, disinfection of high touch areas (https://wwwnc.cdc.gov/eid)

Herd immunity

- Herd immunity occurs when a significant proportion of the population (or the herd) have been vaccinated (or are immune by infection itself), resulting in protection of susceptible individuals. The larger the number of people who are immune in a population, the lower the likelihood that a susceptible person will come into contact with the infection (https://wwwnc.cdc.gov/eid).
- The herd immunity threshold is the proportion of a population that need to be immune in order for an infectious disease to become stable in that community.
- If the threshold for herd immunity is surpassed, then R<1 and the number of cases of infection decreases.

Herd immunity threshold = 1-1/R0 (Oxford medicine: Infectious disease epidemiology: & https://wwwnc.cdc.gov/eid)

- This is an important measure used in infectious disease control and immunisation and eradication programmes.
- E.g, Covid-19 R0 is 2-3 (Liu, Y. *et al* ., 2020) then HIT is in between 50% to 66%.

Disease elimination & herd immunity

- If the herd effect reduces the risk of infection among the uninfected sufficiently then the infection may no longer be sustainable within the population and the infection may be eliminated.The“effective reproduction number” (R) has to be reduced below 1.

CONCLUSIONS

R0 is an estimate of contagiousness that is a function of human behavior and biological characteristics of pathogens. R0 is not a measure of the severity of an infectious disease or the rapidity of a pathogen’s spread through a population. R0 values are nearly always estimated from mathematical models, and the estimated values are dependent on numerous decisions made in the modeling process. The contagiousness of different historic, emerging, and reemerging infectious agents cannot be fairly compared without recalculating R0 with the same modeling assumptions. Some of the R0 values commonly reported in the literature for past epidemics might not be valid for outbreaks of the same infectious disease today.

REFERENCES

1. Complexity of the Basic Reproduction Number (R0)https://wwwnc.cdc.gov/eid/article/25/1/17-1901_article
2. Gordis Epidemiology
3. Liu, Y., Gayle, A. A., Wilder-Smith, A., &Rocklöv, J. (2020). The reproductive number of COVID-19 is higher compared to SARS coronavirus. *Journal of travel medicine*.
4. Oxford medicine : Infectious disease epidemiology
5. Principal of epidemiology : CDChttps://www.cdc.gov/csels/dsepd/ss1978/index.html