Preventing and Controlling Infectious Diseases, COVID-19 Edition

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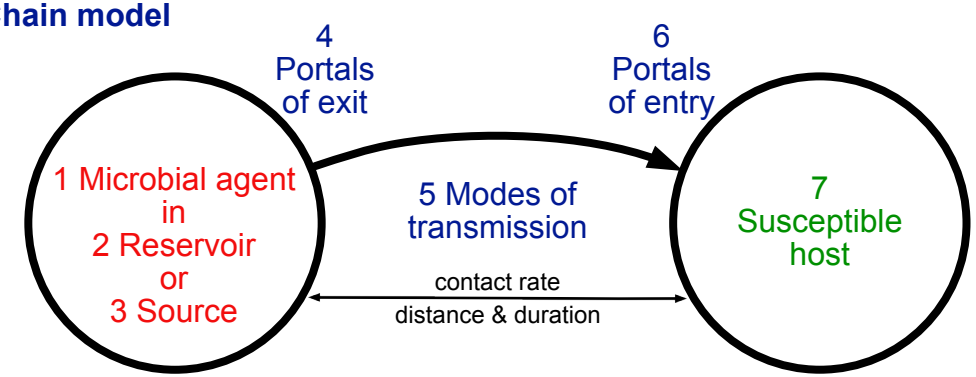
Chain model



Reservoir / Source
1 air
2 water
3 food
4 people
5 animals and vectors
6 vehicles
7 soil and debris

Modes of transmission
1 contact - direct
2 contact - indirect (fomites, fecal)
3 droplet
4 airborne
5 vehicle-borne
6 vector-borne
7 vertical (mother to fetus or newborn)

The 7 Habits of Uninfected People
1 physical distancing (especially if susceptible or most vulnerable)
2 frequent hand washing; avoid touching eyes, nose, and mouth
3 face covering or mask, respiratory hygiene, and cough etiquette
4 staying home when sick: don't go to school, work, social events
5 keeping vaccinations up-to-date (e.g., flu, hep A)
6 safe consuming of water, food, products (includes harm reduction)
7 understanding infection prevention/control (study this document)

Transmission containment strategies
1 reduce reservoir and / or source (mitigate hazard, disinfection)
2 reduce contact (decrease rate and duration, increase distance)
3 reduce fraction of population that is infectious
4 reduce biological infectiousness (e.g., ART in HIV)
5 reduce biological susceptibility (e.g., PrEP, vaccine)
6 interrupt transmission (infection control, N95s, face masks, etc.)
7 reduce fraction of population that is susceptible

Transmission equations

EQ 1: $R(t) = R_0\, x(t) \approx c\, p\, d\, [1 - h\, f - r(t)]$

EQ 2: $I(t) = c\, p\, P(t)$

R(t) = effective reproductive number
R_0 = basic reproductive number
x = fraction of population susceptible
c = contact rate between infectious sources and susceptibles
p = transmission probability
d = duration of infectiousness
h = vaccine effectiveness
f = fraction of population vaccinated
r(t) = fraction removed (recovered immune)
I(t) = infection rate among susceptibles
P(t) = probability source is infectious
(t) = at time t

Special transmission drivers
1 asymptomatic infectiousness
2 pre-symptomatic infectiousness
2 short serial (generation) time
3 airborne transmission
4 fomite transmission
5 fecal-oral transmission

Infectious disease control measures / tools
- behavior change of reservoir/source and/or susceptibles
- testing (diagnostic, and targeted and/or mass screening)
- case definition (epidemiological, clinical, and laboratory criteria)
- case finding for isolation, treatment, surveillance
- isolation (separation of infectious person ["case"])
- case management (transport, house, feed, isolate, treat, clear)
- contact tracing for quarantine, PEP, surveillance
- quarantine (separation of exposed individuals)
- social distancing (for individuals or groups)
  * keeping 6 or more feet from others
  * school closures, cancellation of classes
  * cancellation of mass gatherings
  * travel restrictions
- shelter at home ("shelter in place") (avoiding potential exposures)
- vaccination (targeted and/or mass)
- pre- or post-exposure prophylaxis (PrEP, PEP, vaccine, IgG, drug)
- treatment (infectious cases or co-risk factor)
- infection prevention (aka infection control)
- environmental measures, including disinfection
- cordon sanitaire (preventing *exit* from affected region)
- protective sequestration (preventing *entry* into unaffected region)

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Details here: https://escholarship.org/uc/item/7687z08g
Also visit population health blog: https://taragonmd.github.io/