Staff testing scenarios

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4/20/2021

Simulation framework

- All staff assigned a work schedule that determines time frames when they are working. $\mathbf{I}(w_{it})$ is an indicator function for whether staff member i is working at the facility at time t. Work schedules can be simulated or drawn directly from CDCR data.

- Testing frequency can be assigned on an individual or staff-wide basis. Again, can be simulated or drawn directly from CDCR data.

- New infections among staff can come from the community or from the facility either from other staff or from residents.

- All staff are subject to force of infection, Λ, that is partitioned between the community and the workplace by parameter α, such that $\lambda_w = \Lambda\alpha$ and $\lambda_c = \Lambda(1-\alpha)$. Λ is further modified according to the staff location such that they are only subject to λ_w while working, thus: $\Lambda_{it} = \lambda_w \mathbf{I}(w_{it}) + \lambda_c(1 - \mathbf{I}(w_{it}))$

- New cases among staff at each time step are then generated by subjecting all susceptible staff to a Bernoulli trial where $p = \Lambda_{it}$

- Whenever new staff infection generated, draw from distributions to determine:
  - asymptomatic or symptomatic case
  - latent period (t_{latent})
  - incubation period ($t_{incubation}$)
  - total infectious period ($t_{infectious}$)
    to generate an infectiousness profile (β_{it}). Assuming constant $\mathcal{R}$ across all individuals, $r_{it} = \mathcal{R}\beta_{it}$

- Testing schedule determines when staff is tested

- For now assume that isolation only occurs after testing. Future sims can incorporate asymptomatic rates and probability of self-isolating given symptom onset/duration of symptoms

- Main outcome is expected number of cases transmitted by staff over the simulation timeframe: $\mathbf{E}[cases] = \sum_{t=1}^{t_{sim}} \sum_{i=1}^{n} \mathbf{I}(w_{it}) r_{it}$

Scenarios

- "Observation" scenario with observed community prevalence, number of staff at each facility, observed staff testing frequency and characteristics (PCR/TAT, antigen). Could see how well matches observed resident importations and staff cases detected as model validation, but I wouldn't expect a real close match

- Simulations across community prevalence and testing frequency (continuous scales, could have heat map of expected resident cases)

- More discrete scenarios with e.g. high, medium, low community prevalence and high, medium, low testing frequency

- Would like to make space for an adaptive scenario of some sort in which staff testing frequency is a function of community prevalence (i.e. more tests when community transmission is high, fewer when community transmission is low)