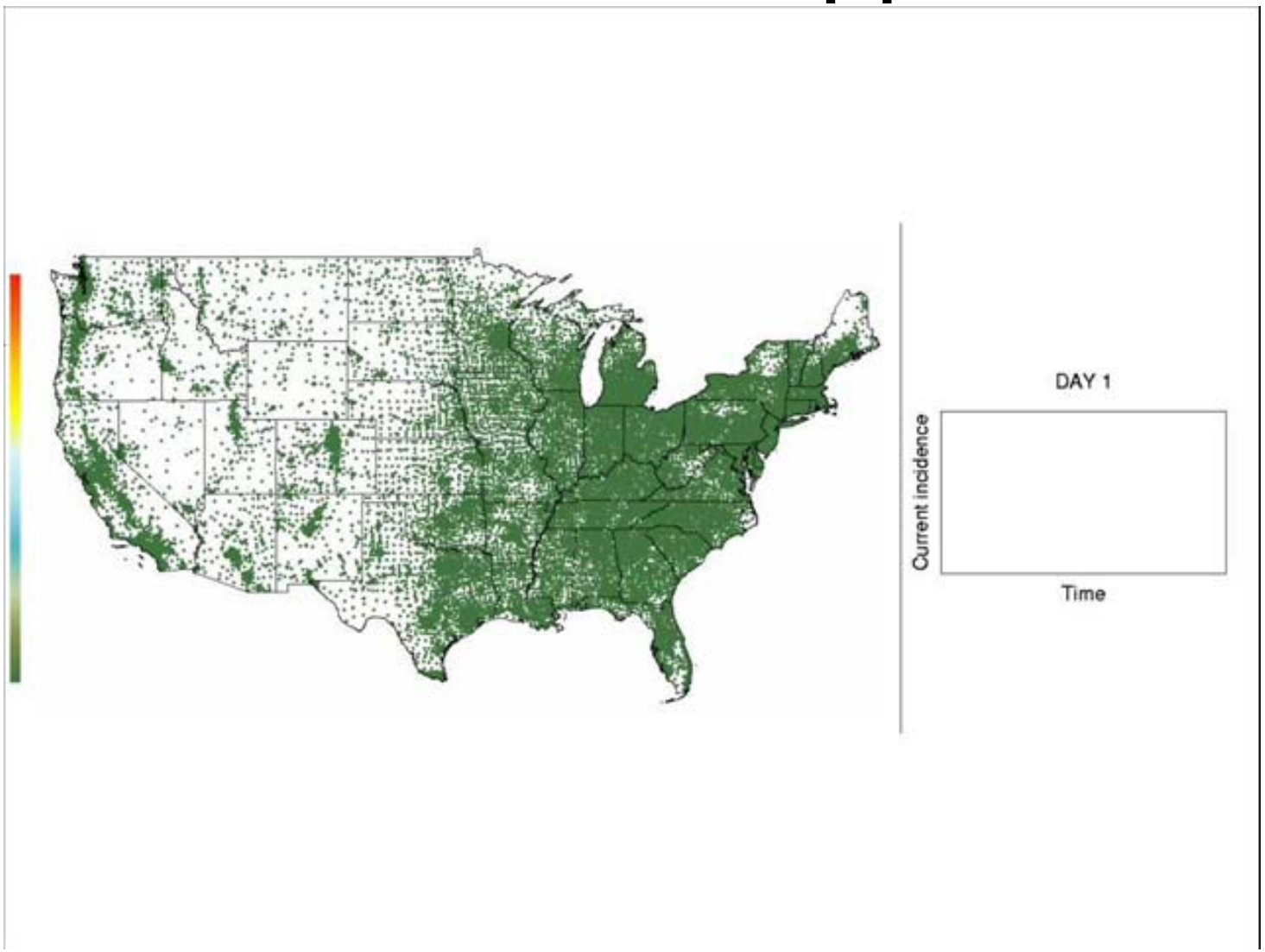
BIOST/STAT 578 A
Statistical Methods in Infectious Diseases
Lecture 9
February 3, 2009

Stochastic epidemic models: Pandemic influenza II

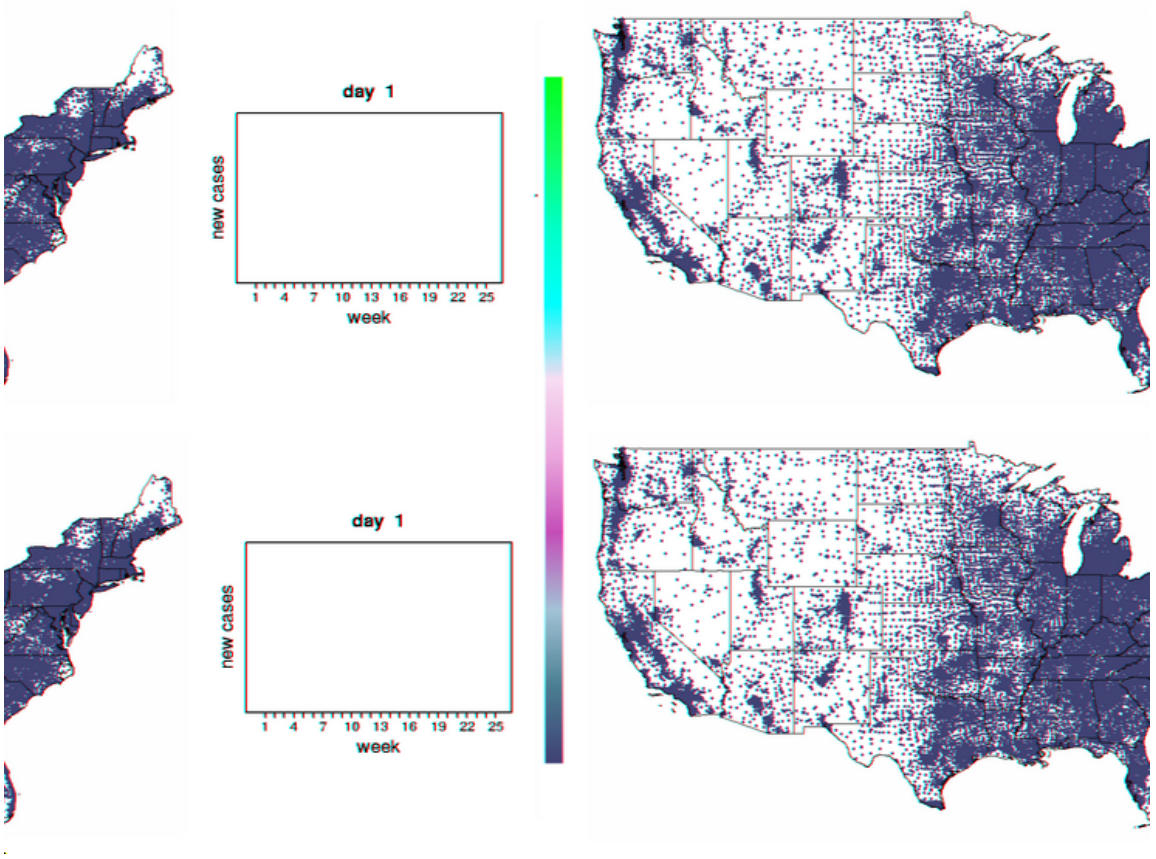
This Could Happen!



Mitigation of Pandemic Influenza in the US

- Slowing spread until a well-matched vaccine becomes available
- What is true in the US, probably holds for most developed countries

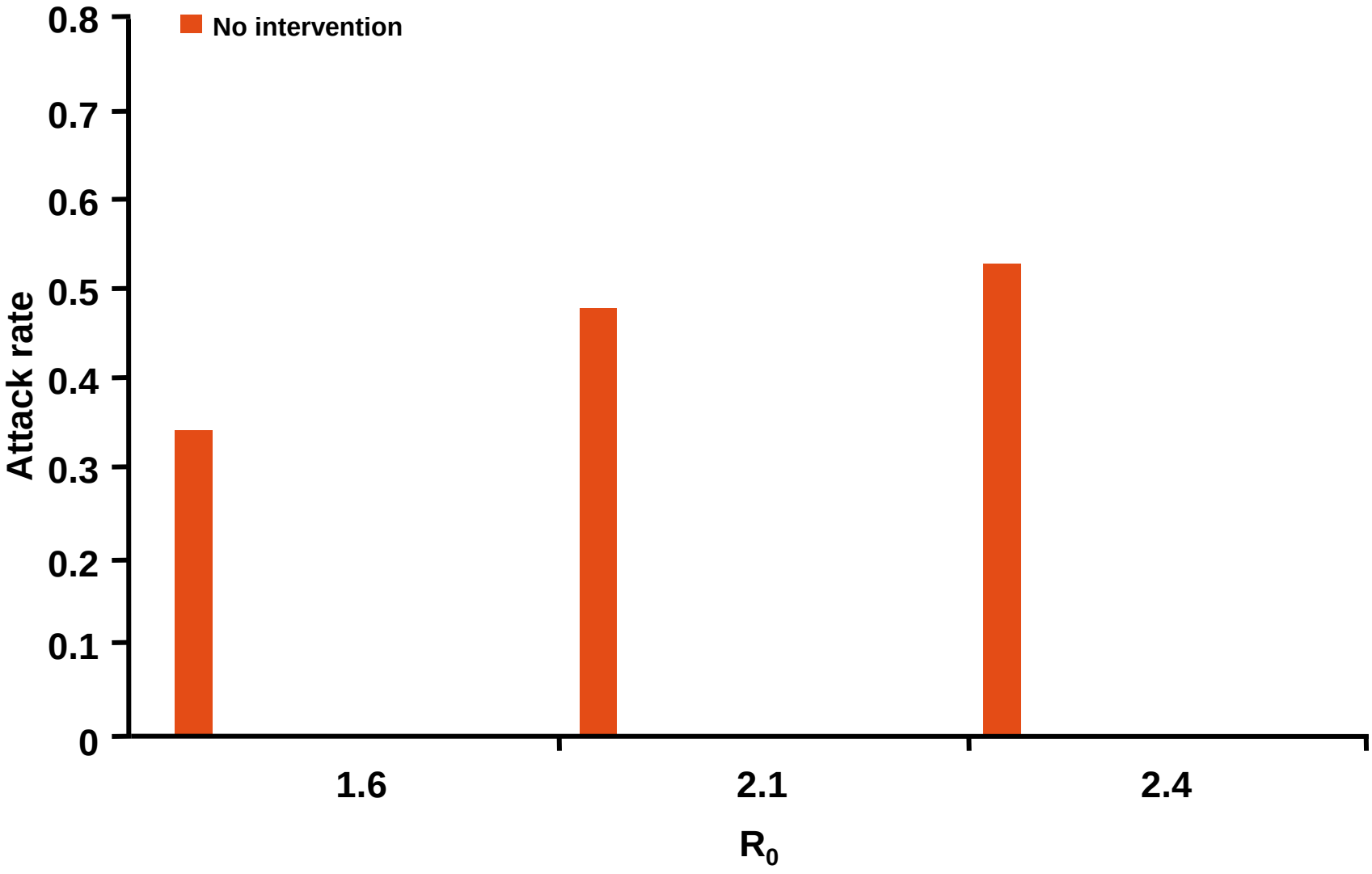
Vaccination 70% pre-prime, post boost, 10 million doses per week, R_0 = 2.1



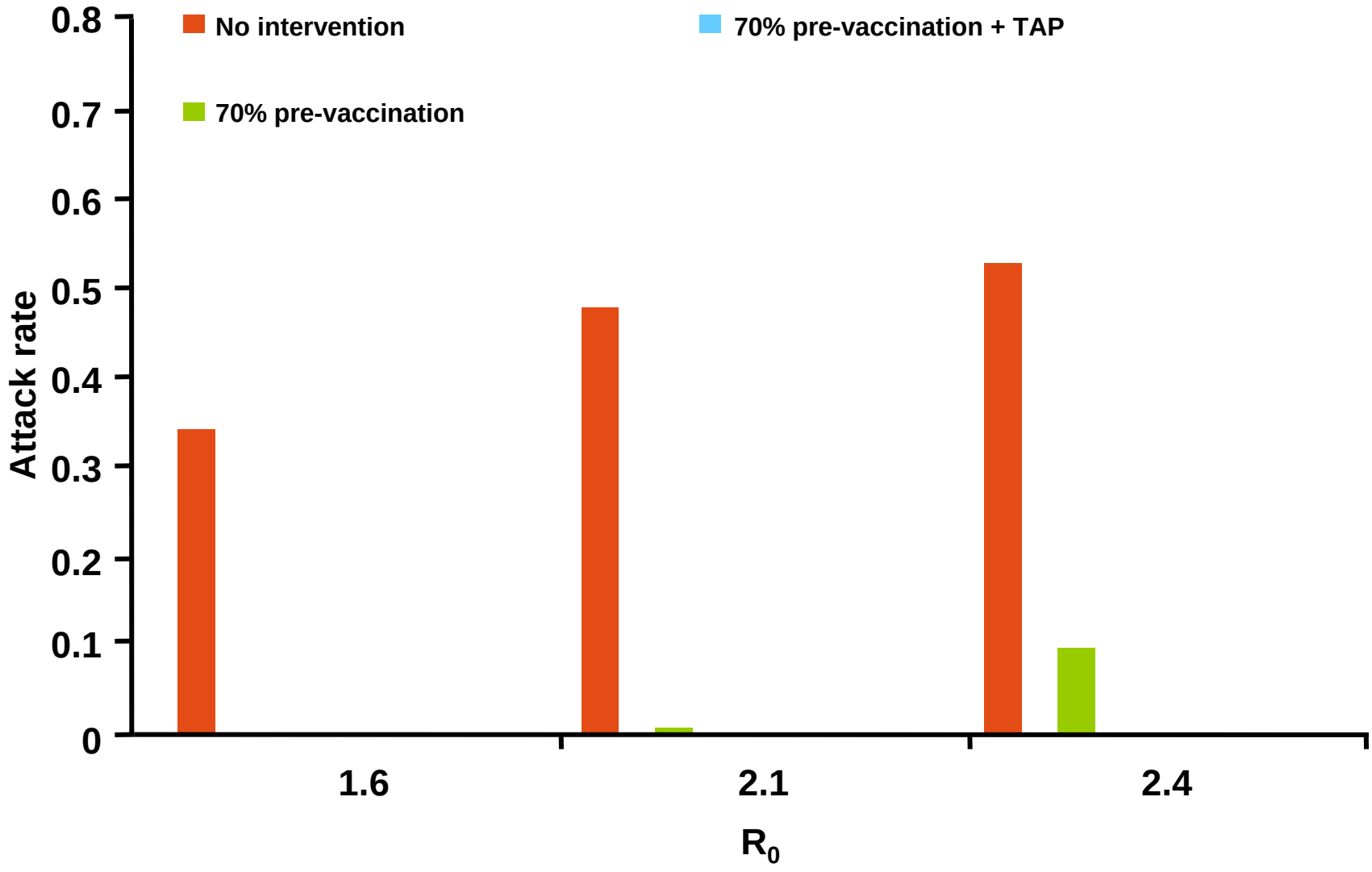
US priming with vaccine

R_0	**1.6**	**2.1**	**2.4**	**3.0**
Baseline illness AR	34	48	53	59
Ring vaccination boost (by census tract)	< 1	23	30	38
Ring vaccination boost (by county)	< 1	21	29	38
Mass vaccination boost	< 1	15	24	32

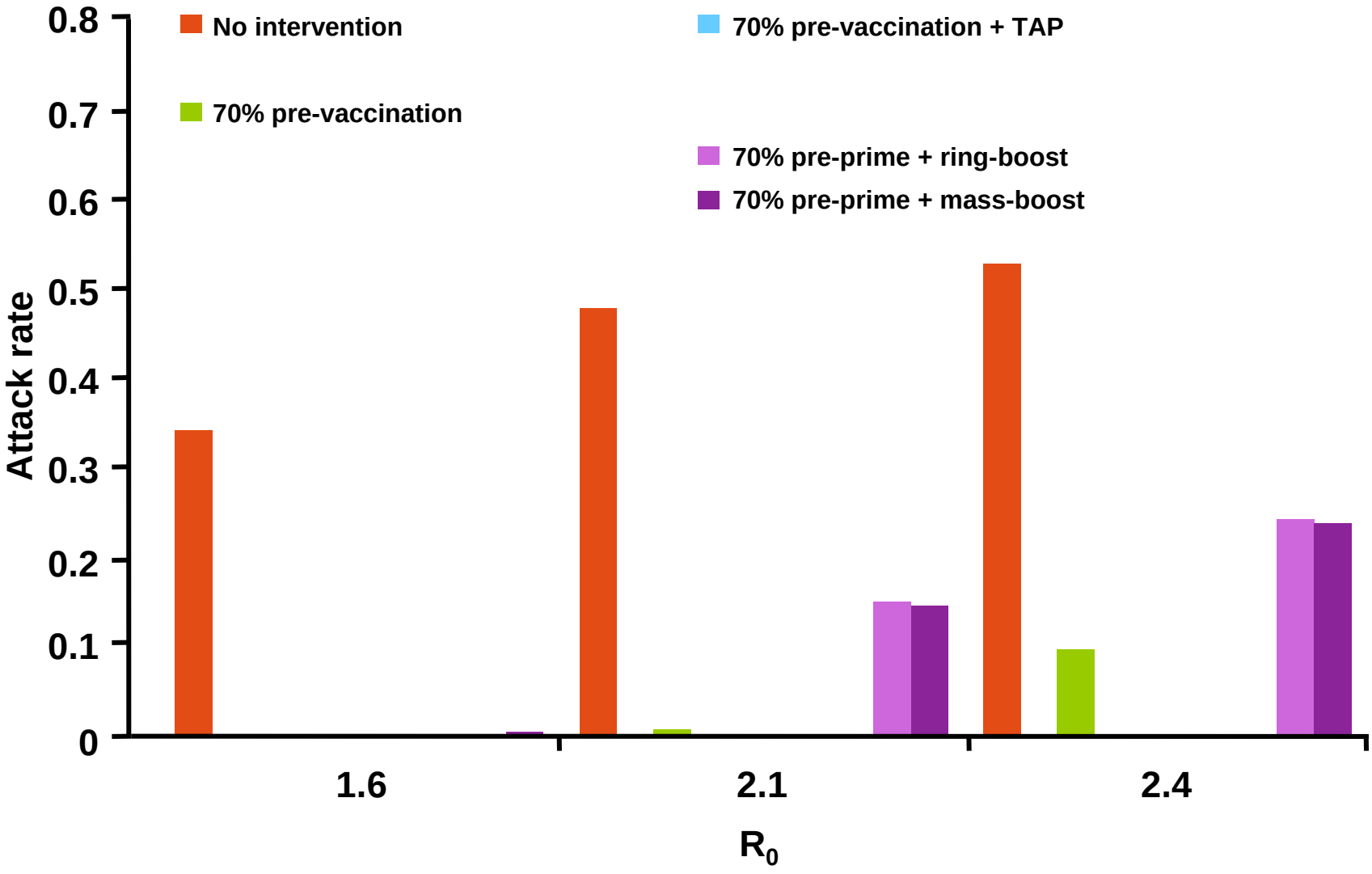
Mitigation scenarios



Mitigation scenarios



Mitigation scenarios



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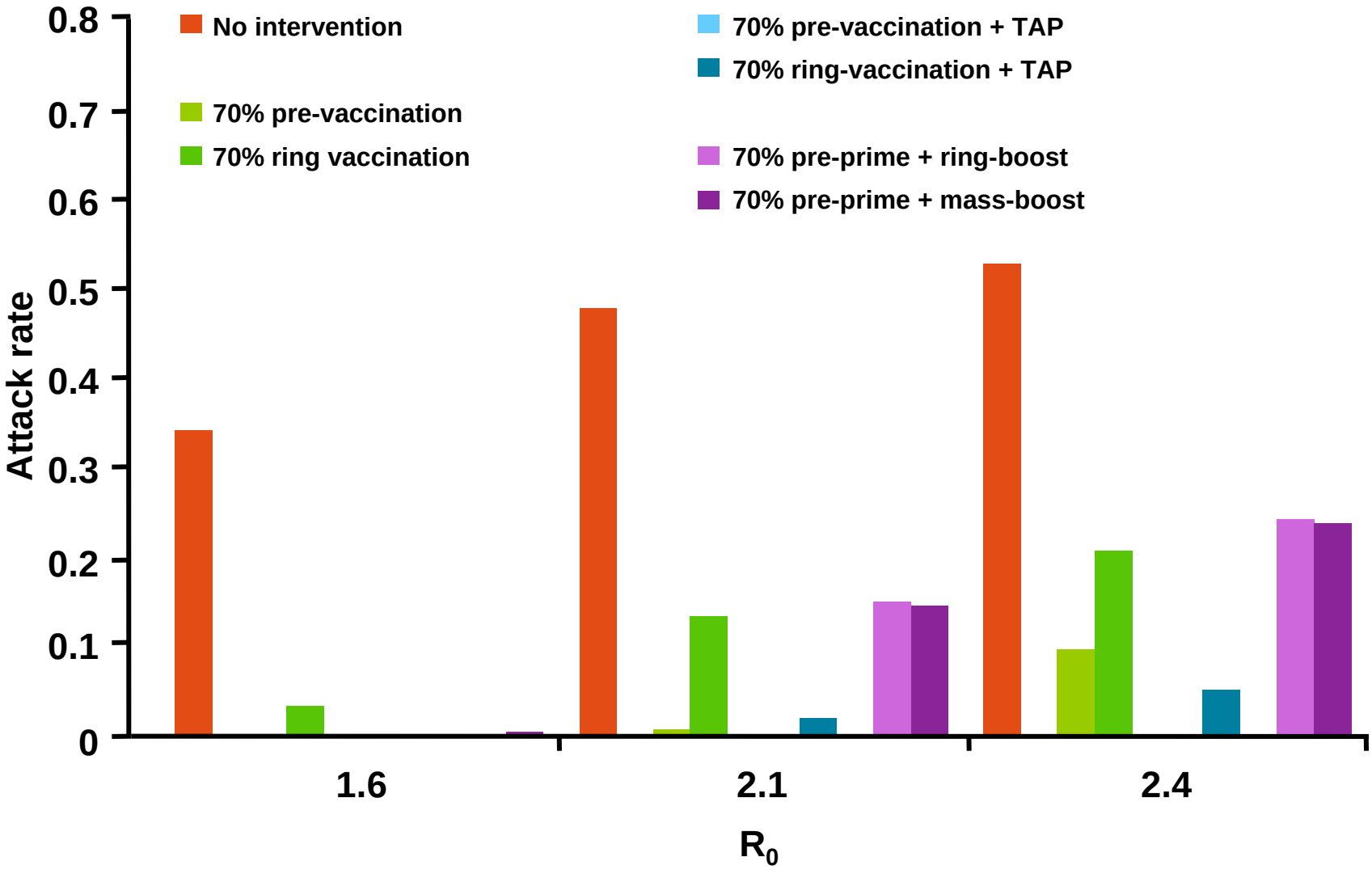
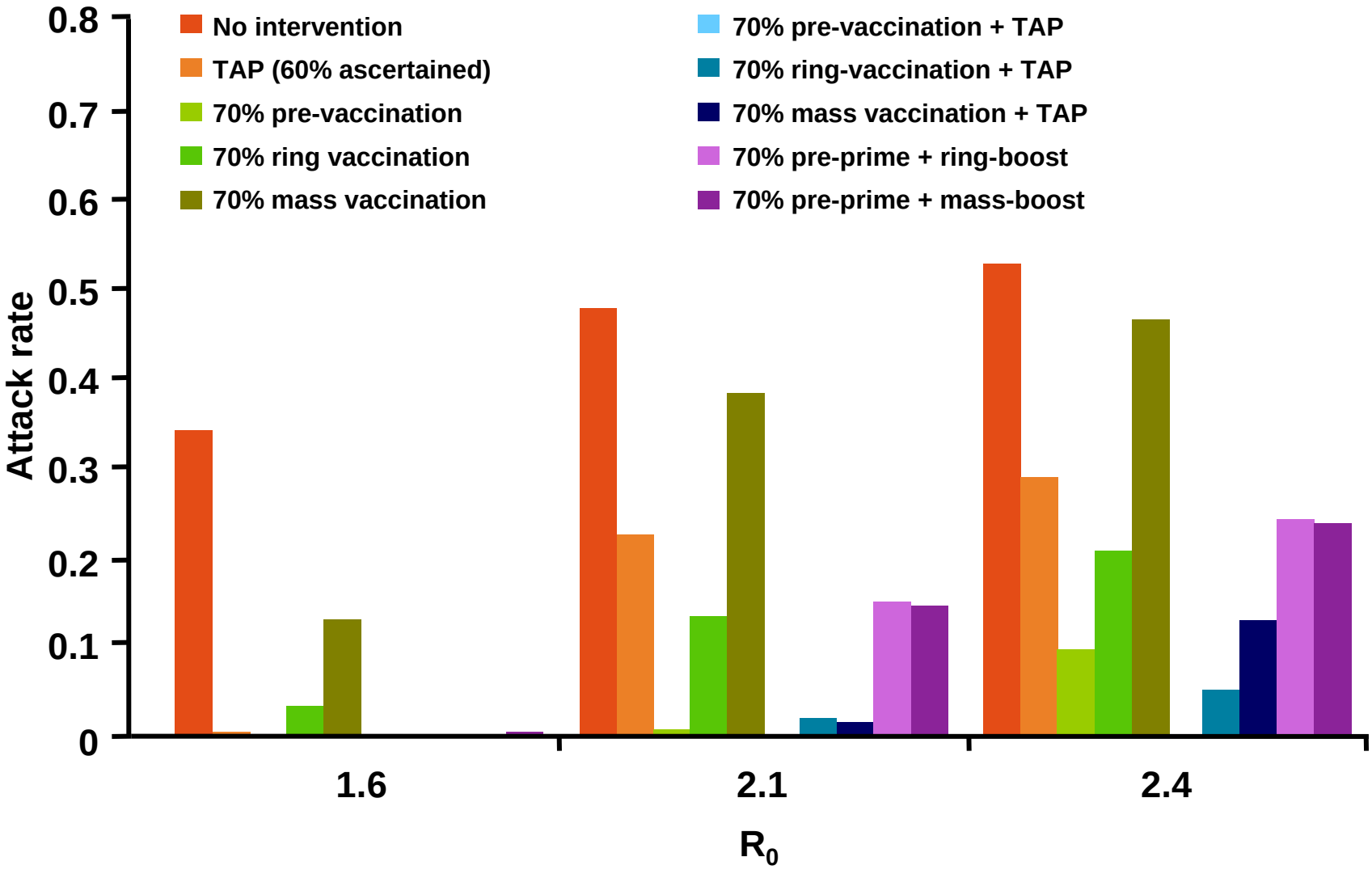
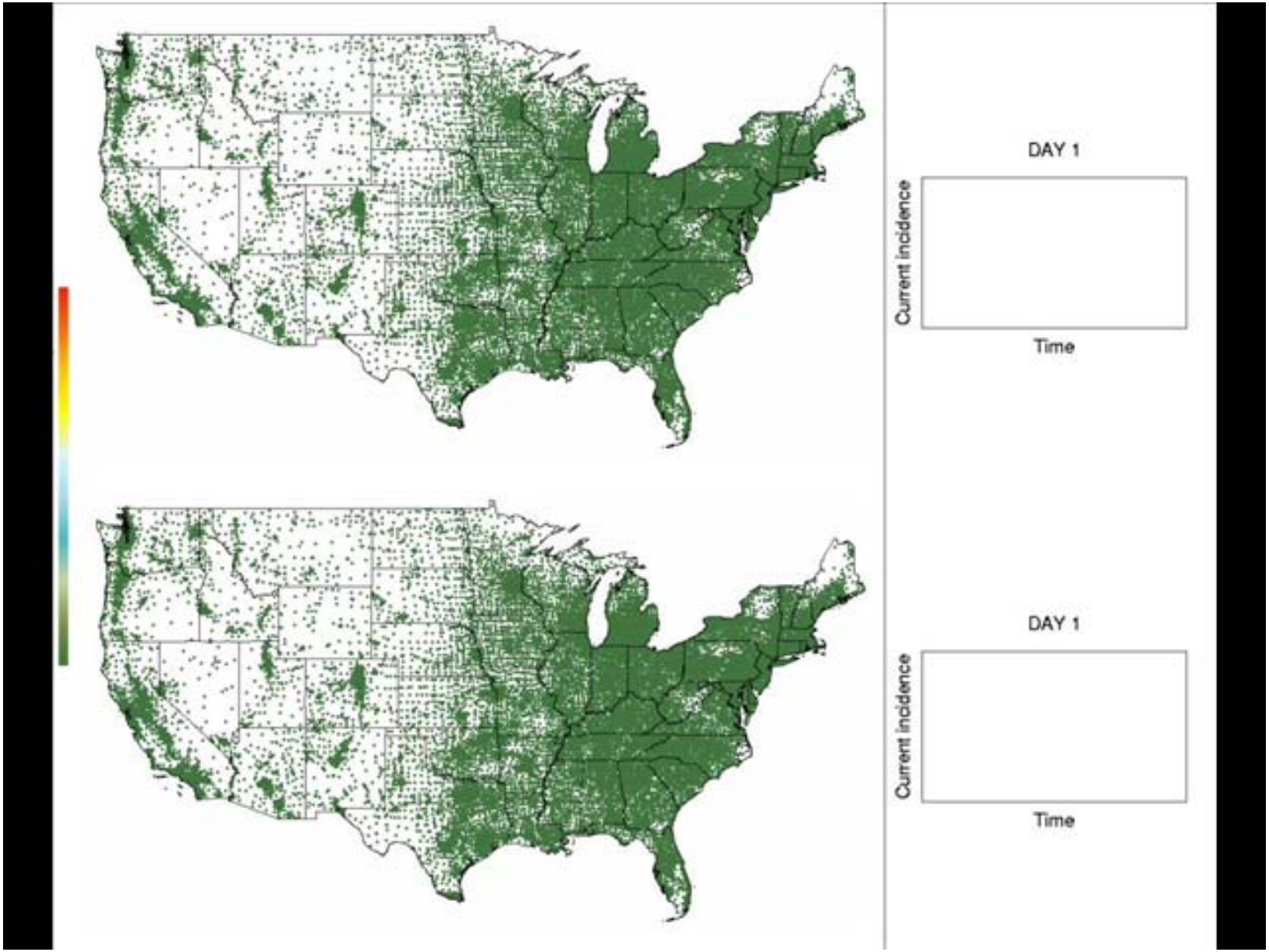


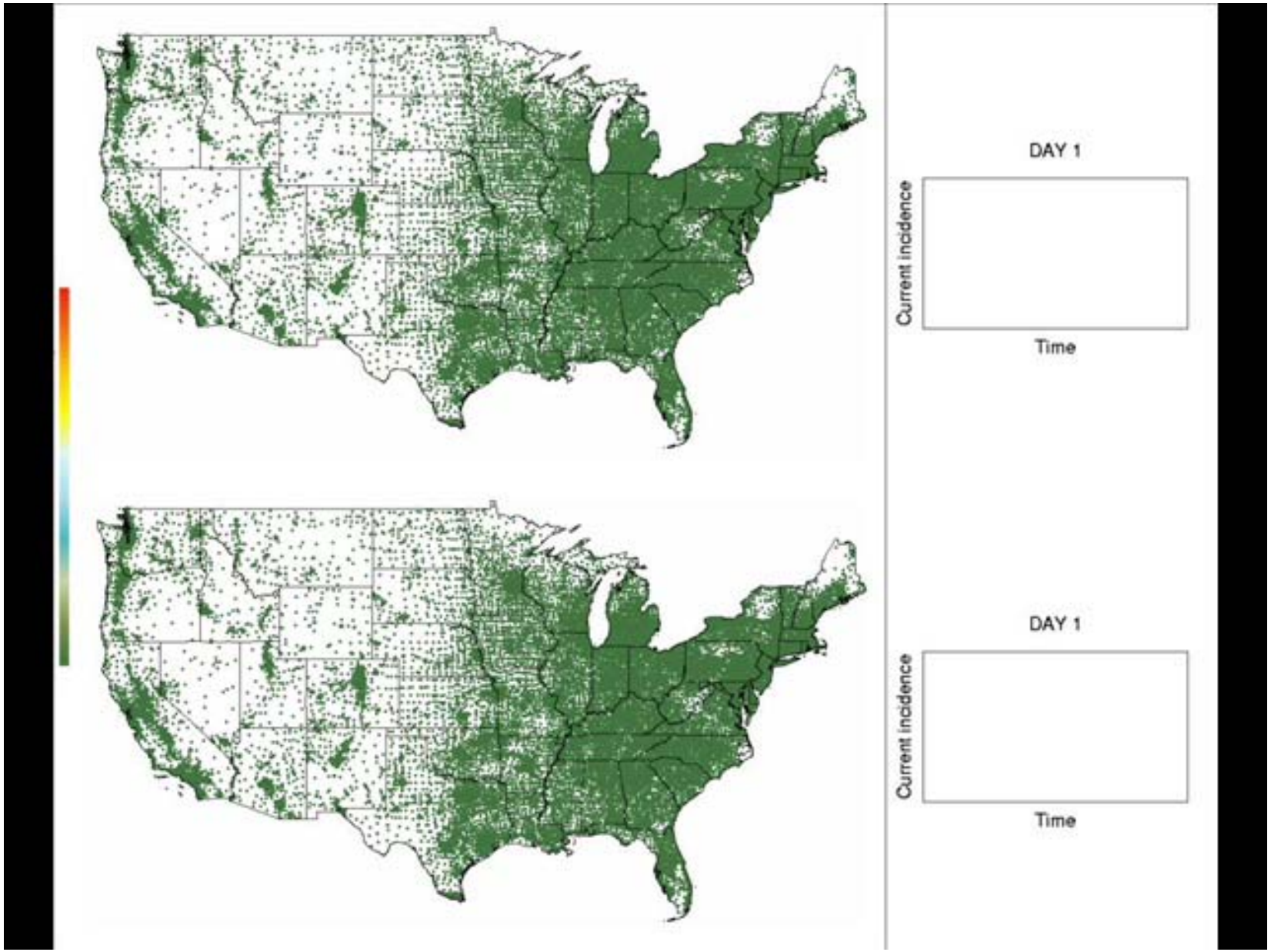
Mitigation scenarios



Long-range travel restriction, 10% normal, $R_0 = 1.9$



60% TAP 7 days post-alert; 20 million course stockpile, R_0 = 1.9



Social Distancing in the 1918 Pandemic

INFLUENZA

FREQUENTLY COMPLICATED WITH

PNEUMONIA

IS PREVALENT AT THIS TIME THROUGHOUT AMERICA.
THIS THEATRE IS CO-OPERATING WITH THE DEPARTMENT OF HEALTH

YOU MUST DO THE SAME

IF YOU HAVE A COLD AND ARE COUGHING AND SNEEZING. DO NOT ENTER THIS THEATRE

GO HOME AND GO TO BED UNTIL YOU ARE WELL

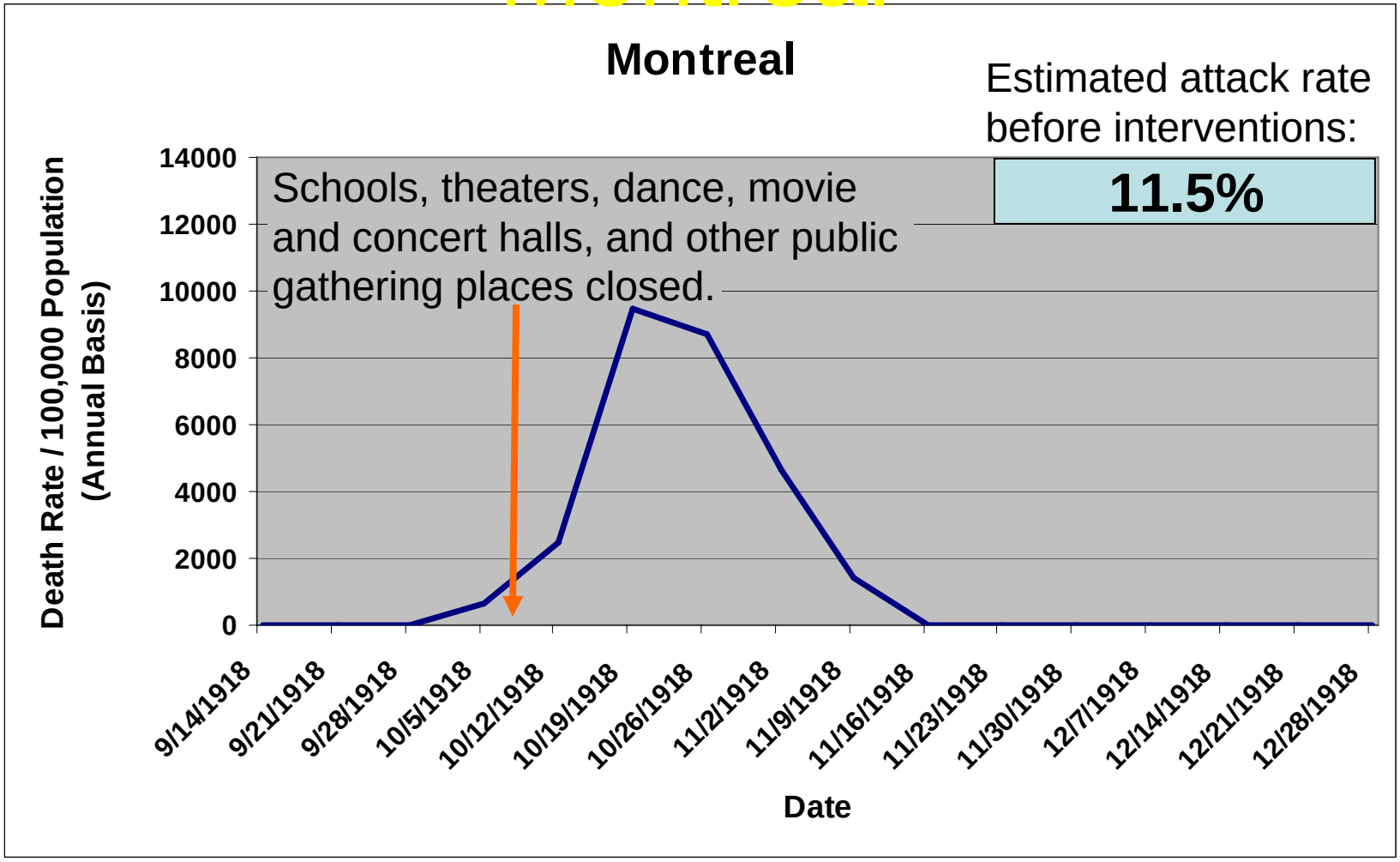
Coughing, Sneezing or Spitting Will Not Be Permitted In The Theatre. In case you must cough or Sneeze do so in your own handkerchief, and if the Coughing or Sneezing Persists Leave The Theatre At Once.

This Theatre has agreed to cooperate with the Department Of Health in disseminating the truth about Influenza, and thus serve a great educational purpose.

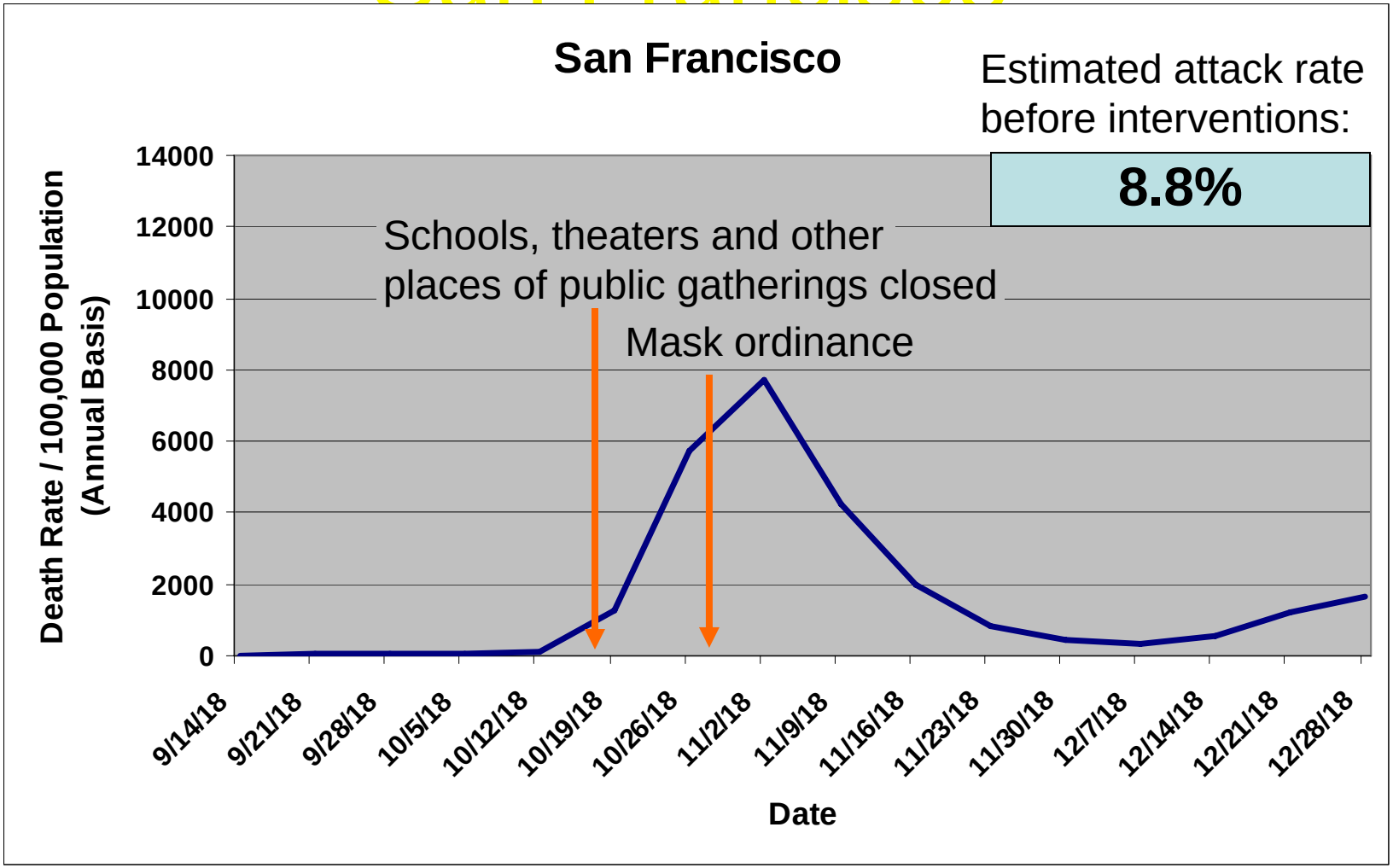
HELP US TO KEEP CHICAGO THE HEALTHIEST CITY IN THE WORLD

JOHN DILL ROBERTSON
COMMISSIONER OF HEALTH

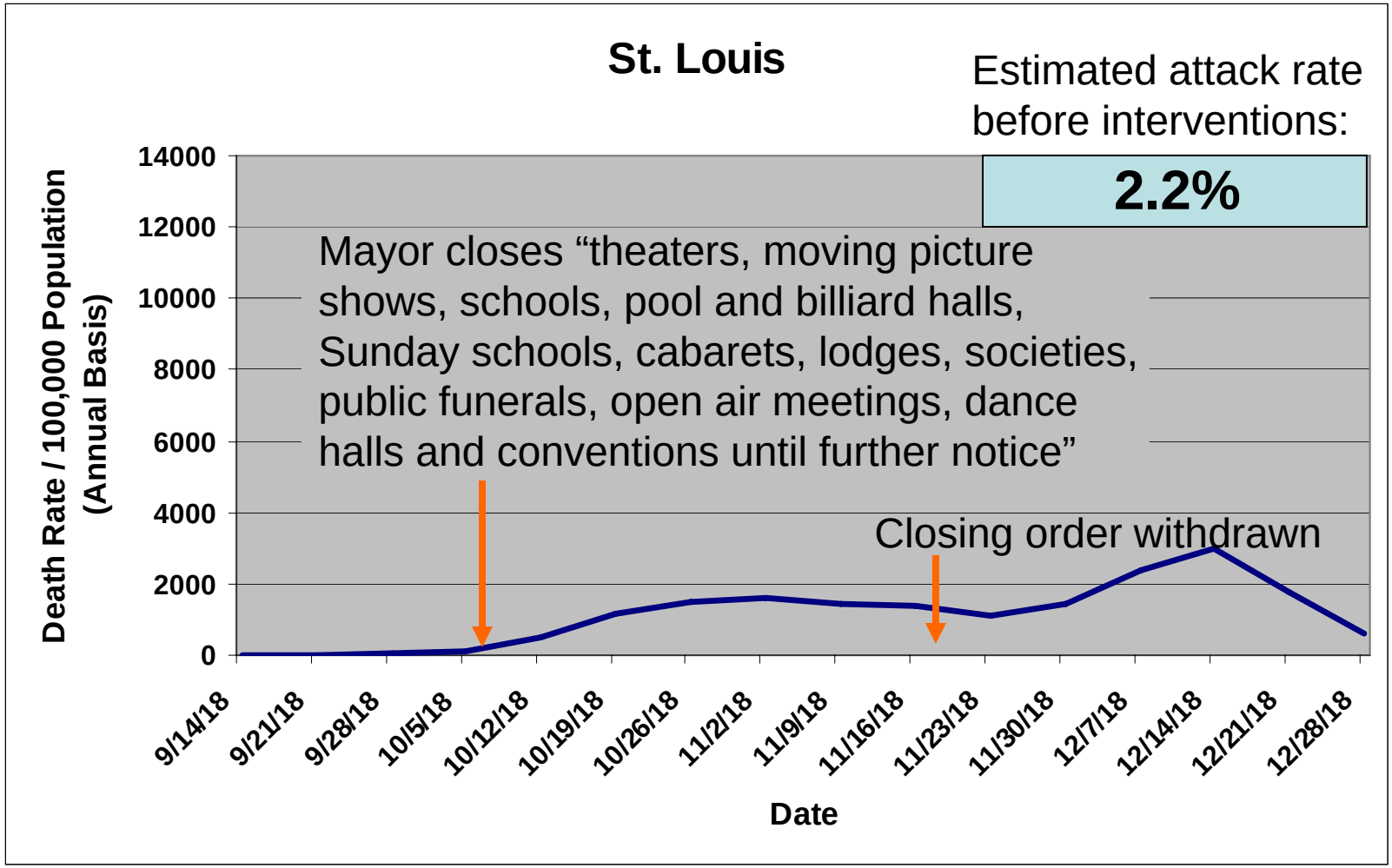
Montreal


Montreal
Estimated attack rate before interventions:
11.5%
Schools, theaters, dance, movie and concert halls, and other public gathering places closed.
Death Rate / 100,000 Population (Annual Basis)
14000
12000
10000
8000
6000
4000
2000
0
9/14/1918
9/21/1918
9/28/1918
10/5/1918
10/12/1918
10/19/1918
10/26/1918
11/2/1918
11/9/1918
11/16/1918
11/23/1918
11/30/1918
12/7/1918
12/14/1918
12/21/1918
12/28/1918
Date

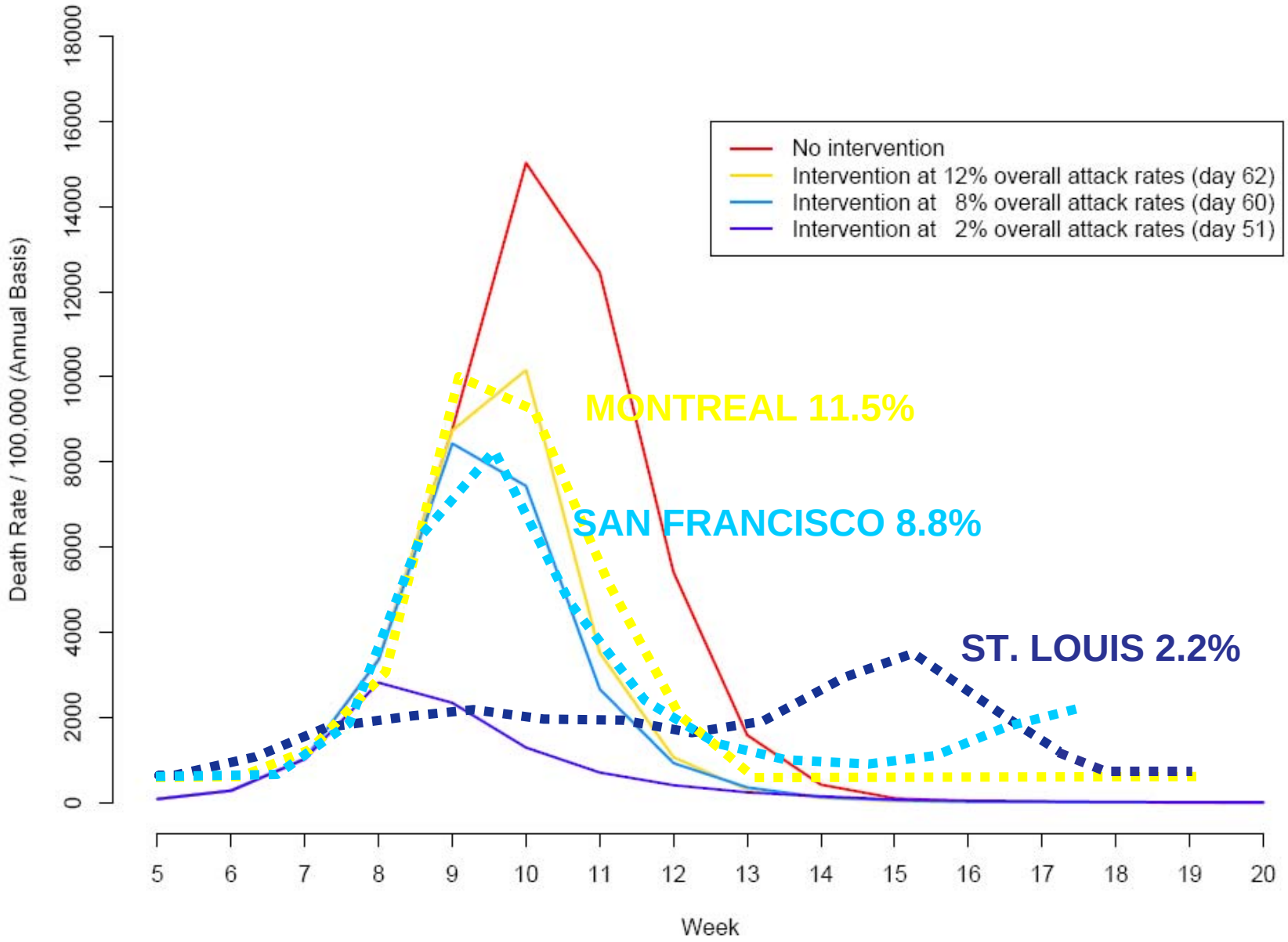
San Francisco



St. Louis


St. Louis
Estimated attack rate before interventions:
2.2%
Mayor closes “theaters, moving picture shows, schools, pool and billiard halls, Sunday schools, cabarets, lodges, societies, public funerals, open air meetings, dance halls and conventions until further notice”
Closing order withdrawn
Death Rate / 100,000 Population (Annual Basis)
14000
12000
10000
8000
6000
4000
2000
0
9/14/18
9/21/18
9/28/18
10/5/18
10/12/18
10/19/18
10/26/18
11/2/18
11/9/18
11/16/18
11/23/18
11/30/18
12/7/18
12/14/18
12/21/18
12/28/18
Date

Model Predictions – 1918 Interventions
Ro = 2.1, 2% case fatality rate



Targeted Layered Containment:

- 60% of symptomatic cases diagnosed
- Treatment of symptomatic cases
- Home isolation of cases
- Prophylaxis of household contacts
- Quarantine of households
- School closure
- Keeping children home
- Community social distancing
- Workplace social distancing
- Liberal leave

compliance

60% compliance

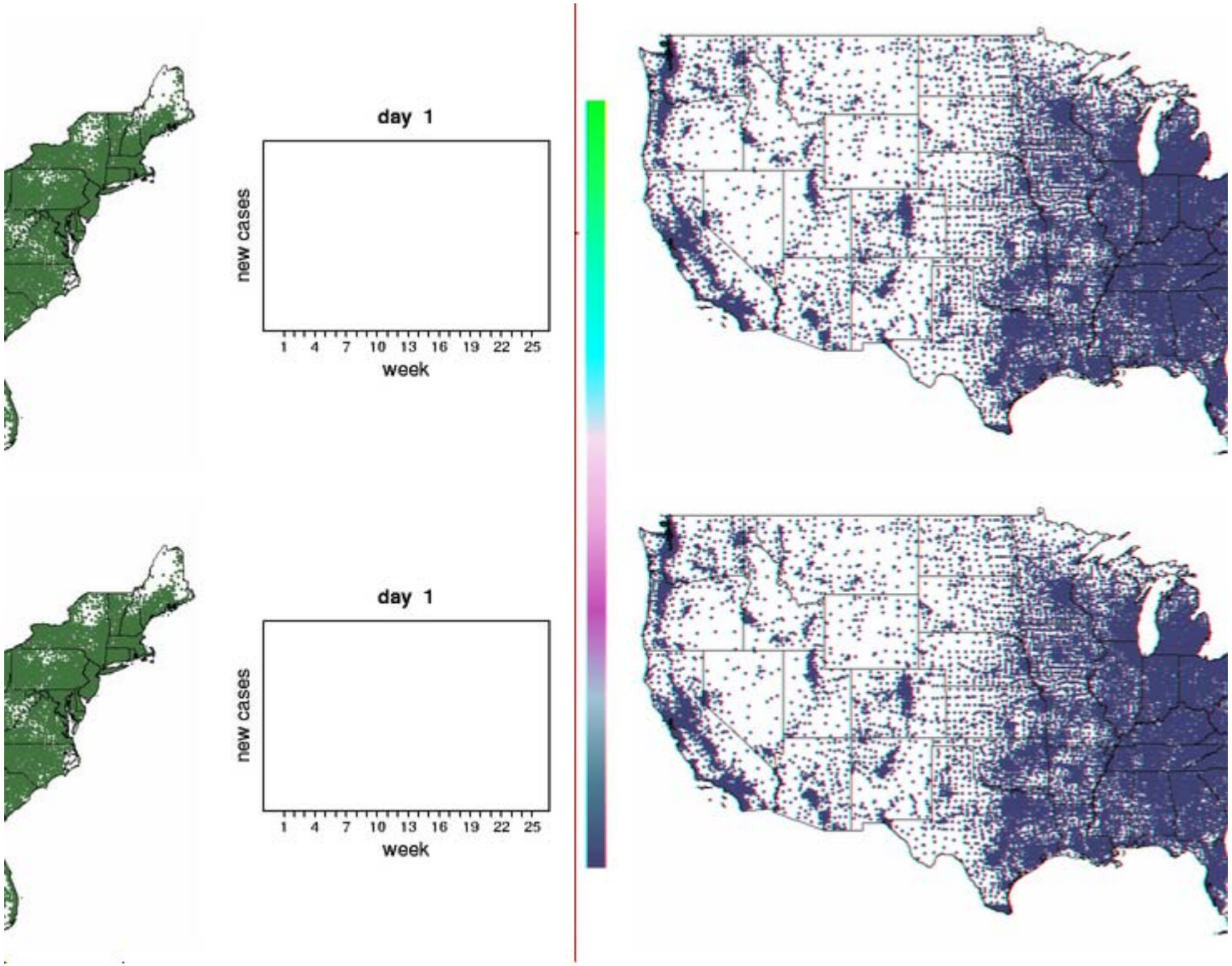
30%

30%

Result

- Well mitigated

Mitigation with strong community response



Conclusions for mitigation in US

- Aggressive use of a stockpiled vaccine is the most effective strategy, 70% coverage
  - Pure reactive vaccination alone could be sufficient
  - The pre-prime, post-boost strategy would be sufficient alone
- School closure is important in reducing spread.
- Travel restrictions are not effective when used alone
- Aggressive social distancing could be partially effective
- For $R_0 \geq 1.9$, need at least 182 million courses of antiviral medication to have significant effect on spread if used alone
- Combinations of household TAP, school closure, vaccines and other social distancing measures could quite effective.

The End