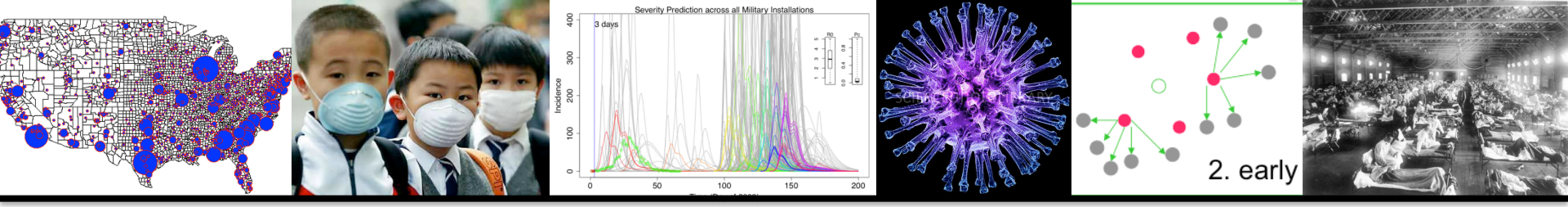


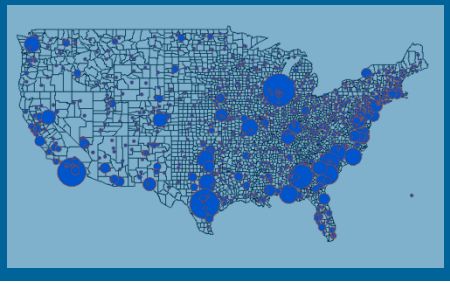
Rapid assessment of pandemic impact using clinical episode data from spatially distinct military populations

January, 2013

Steven Riley
Pete Riley
Predictive Science Inc.

David P. Bacon
Science Applications International Corporation

Acknowledgements



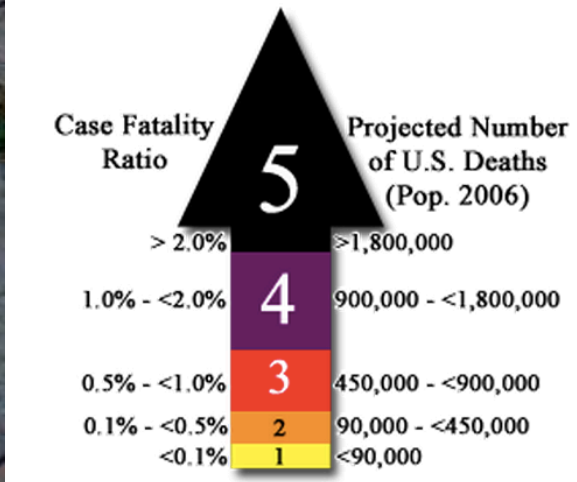
NCMI / DTRA / AFHSC

Funded by NCMI contract W81XWH-10-A-0026/DO001 to SAIC

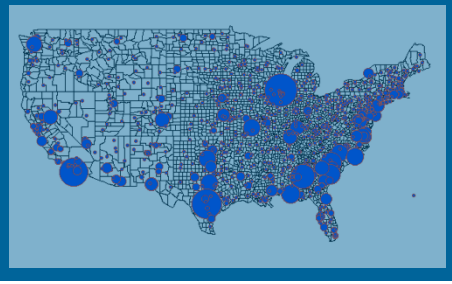
Predictive Science

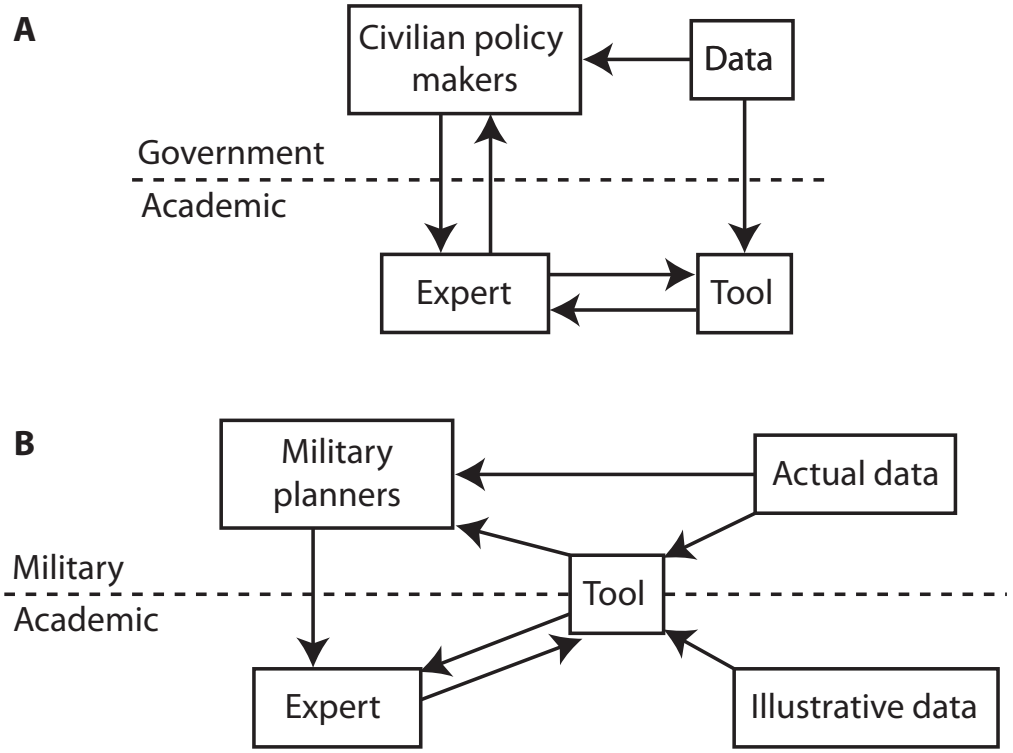
Imperial College London


订餐电话:26050990

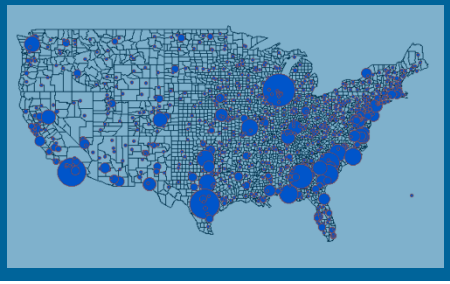

Case Fatality Ratio
Projected Number of U.S. Deaths (Pop. 2006)
5
> 2.0%
>1,800,000
4
1.0% - <2.0%
900,000 - <1,800,000
3
0.5% - <1.0%
450,000 - <900,000
2
0.1% - <0.5%
90,000 - <450,000
1
<0.1%
<90,000
Assumes 30% illness rate and unmitigated pandemic without interventions

Alternate models for interaction of ecological science and health policy





Overview



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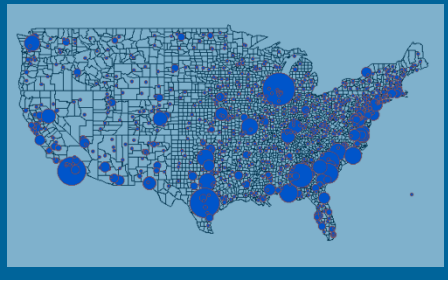
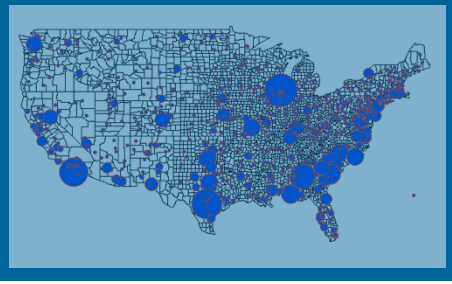
Severity matrix



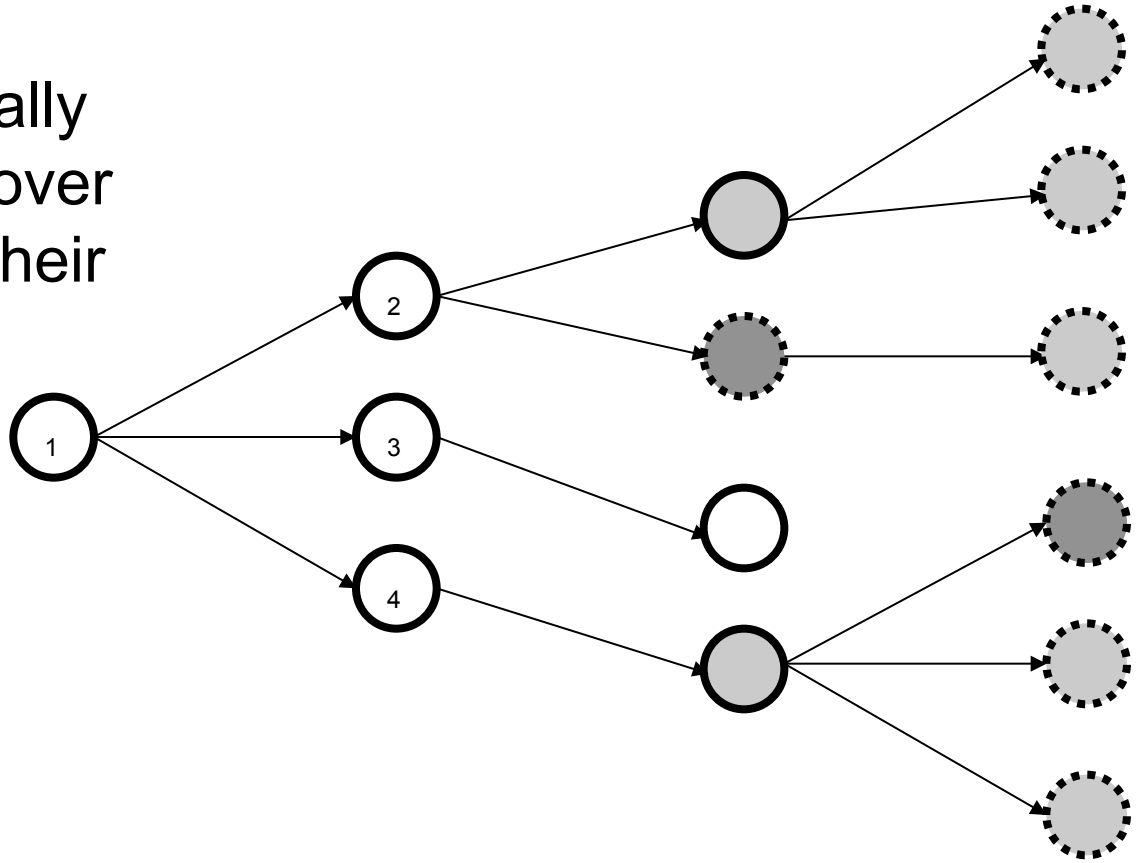
R0 \ IFR	Low	High
High	Explicit interventions unlikely to be justified either for containment or mitigation	Implement most stringent interventions and watch carefully for the population response to the new infection: apparently high Ro may drop rapidly when high CFR fully appreciated
Low	Consider carefully the cost of non-containment then the costs and benefits of mitigation	Most stringent Intervention, for containment or effective mitigation

Adapted: WER 2009

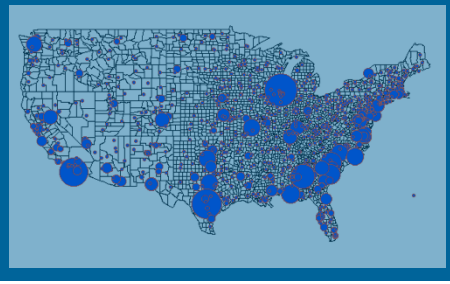
The basic reproductive number

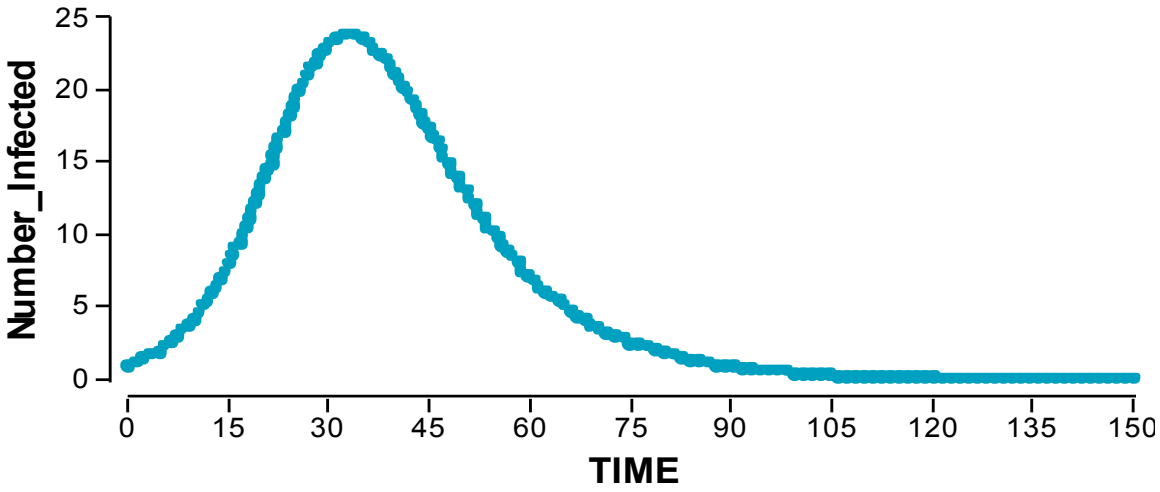


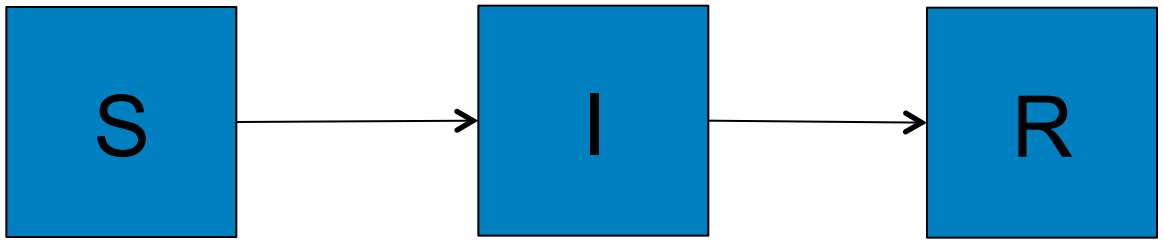
"The average number of secondary cases generated by a typically infectious individual over the entire course of their infection"



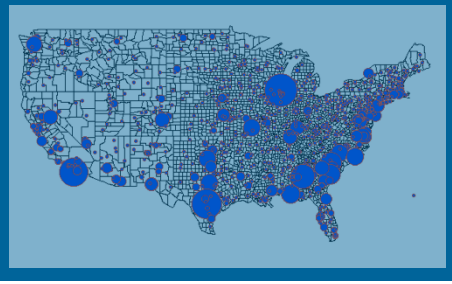
Simple epidemic models explain the trajectory of incidence

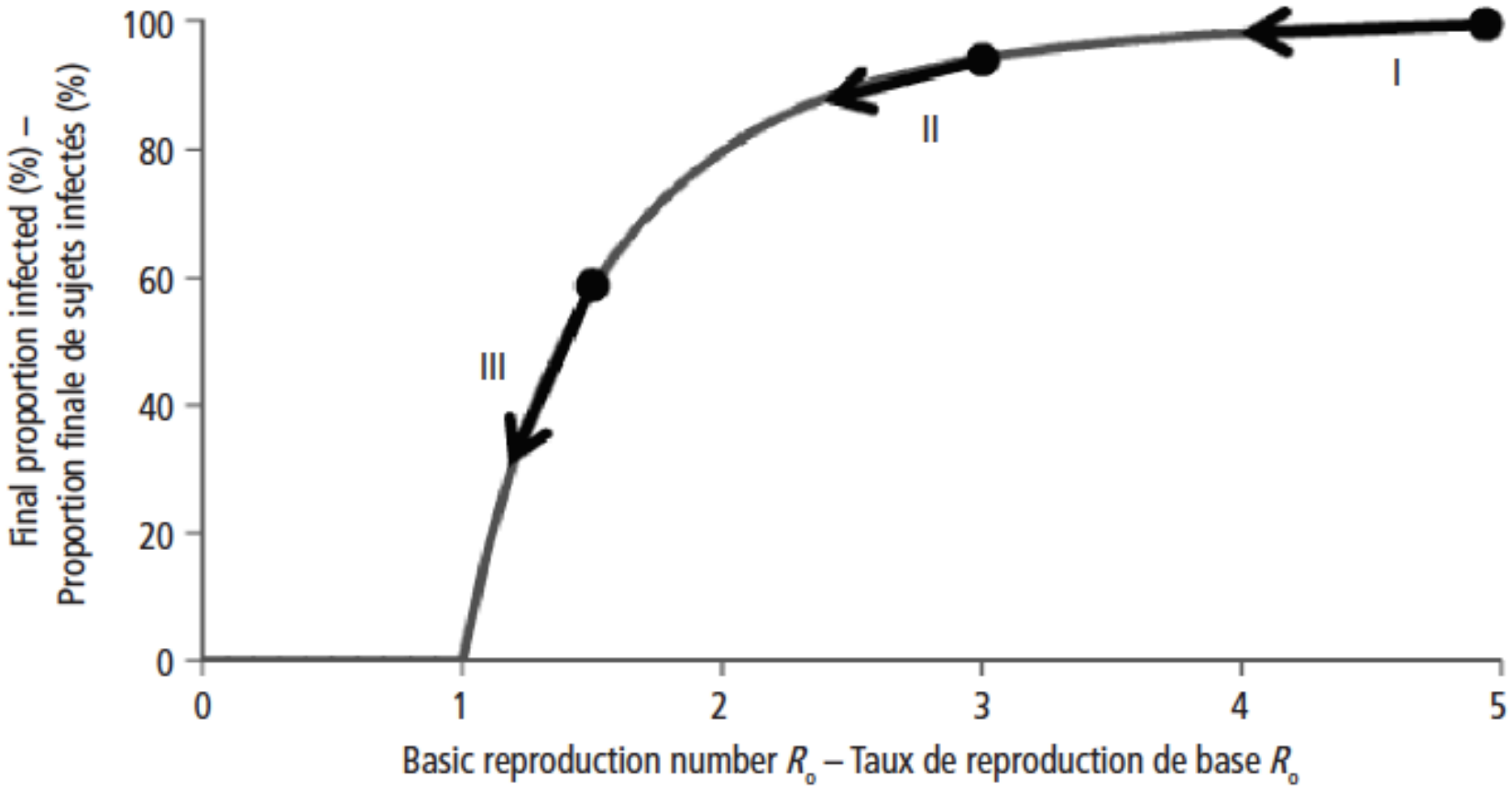






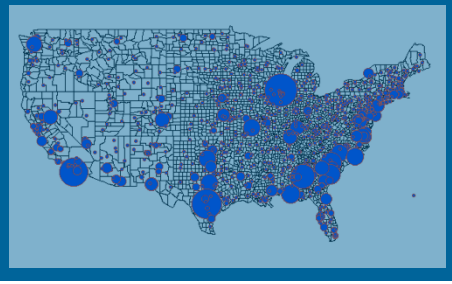
R_0 and the cumulative attack rate

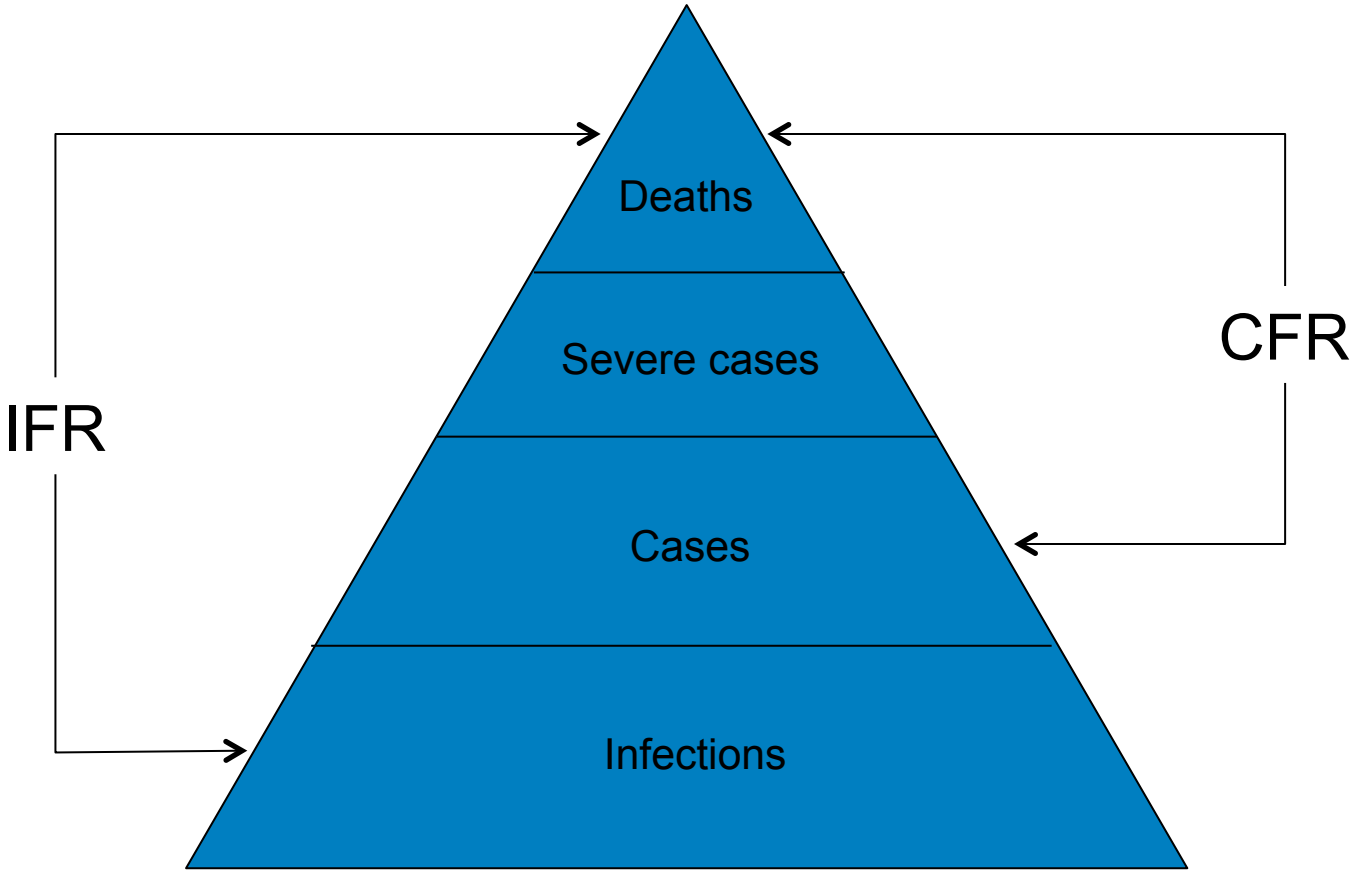




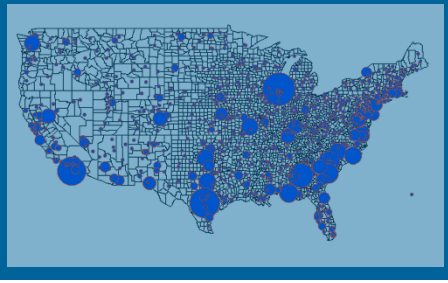
Source: WER 2009

Severity pyramid





Severity matrix



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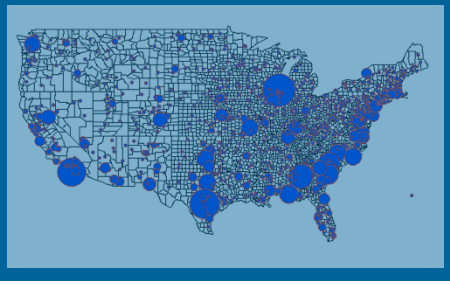

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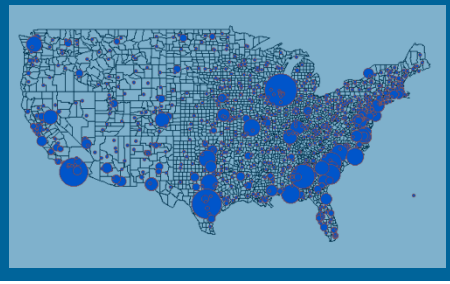
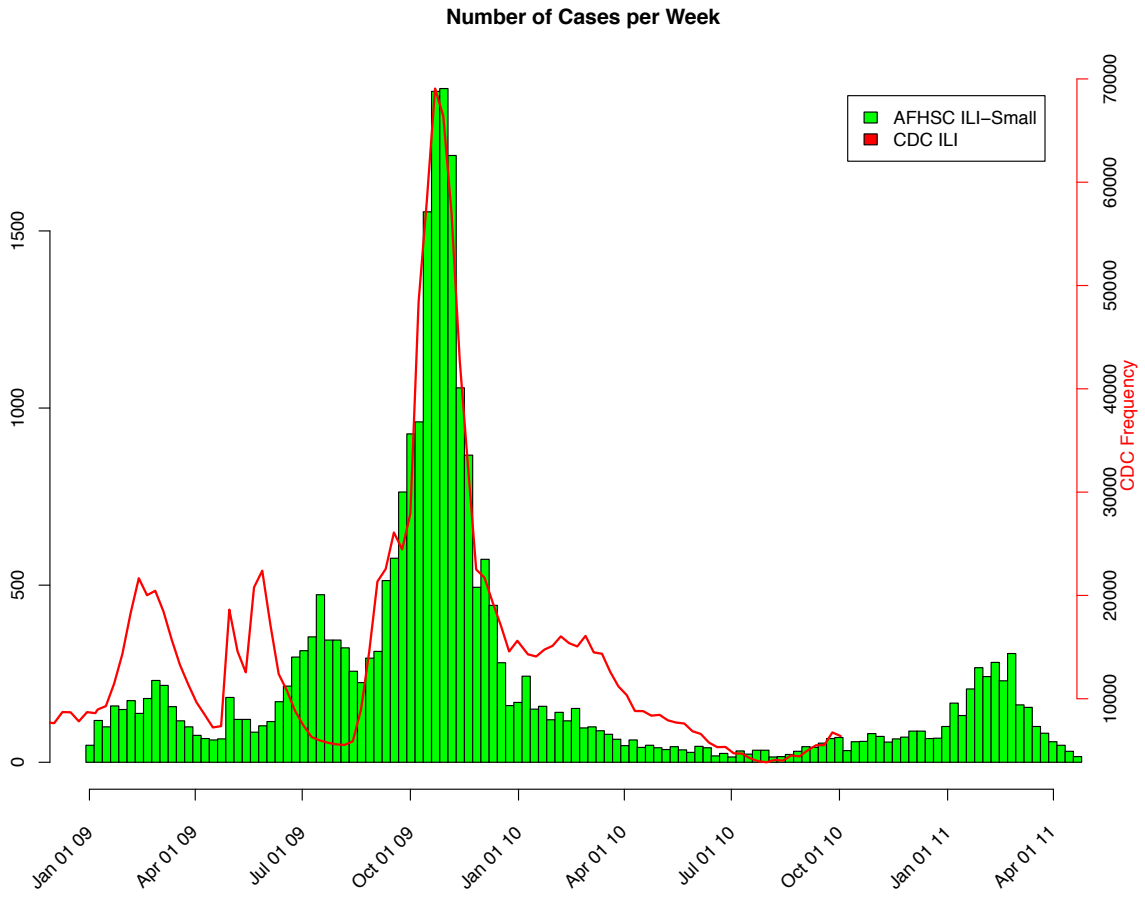
The Marsden-Haug "ILI-small" criteria consistent with CDC ILI cases.

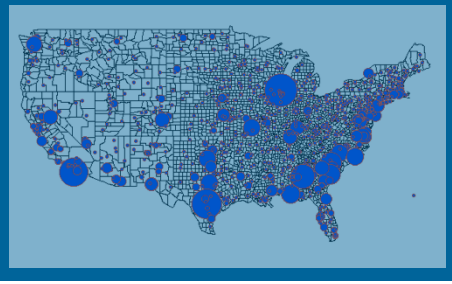


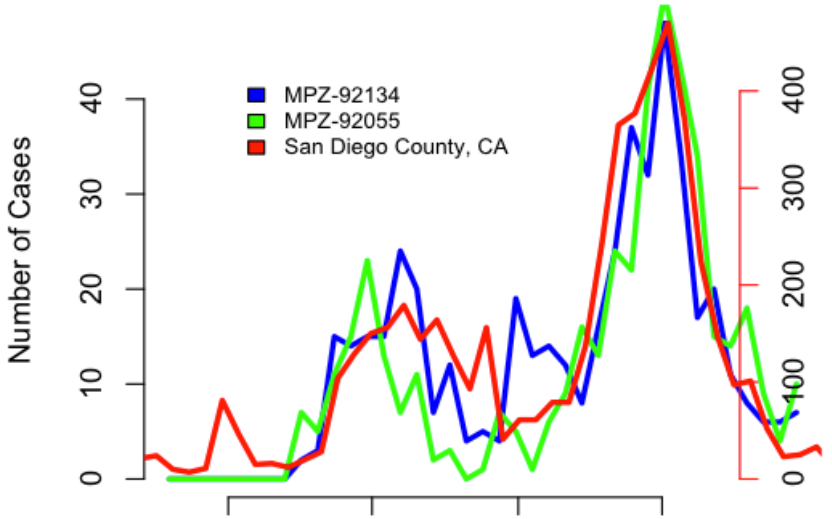
Number of cases matching ICD-9 codes in the AFHSC dataset.

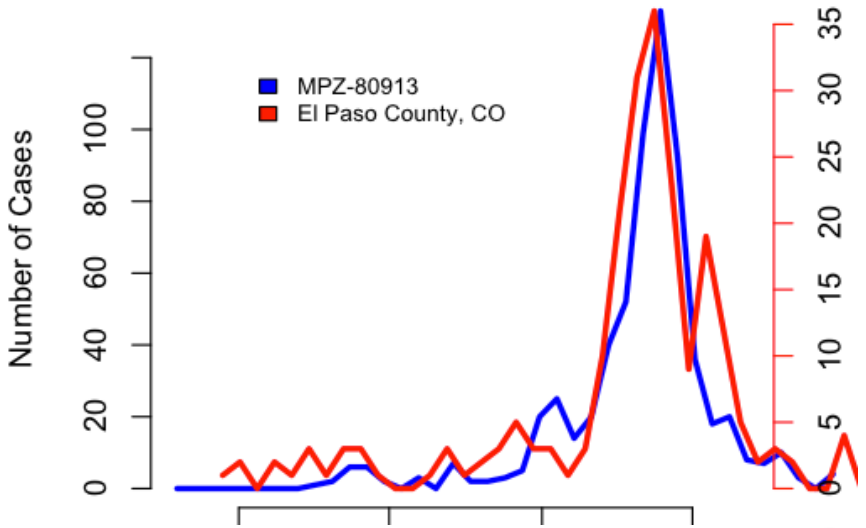
ICD-9	Number of cases	ILI Group
7999	158105	Large
3829	59505	Large
460	165375	Large
4619	60709	Large
4658	897	Small
4659	491810	Large
4660	83450	Large
486	85633	Large
4870	404	Small
4871	25293	Small
4878	1006	Small
490	85526	Large
7806	56	Large
7862	94675	Large

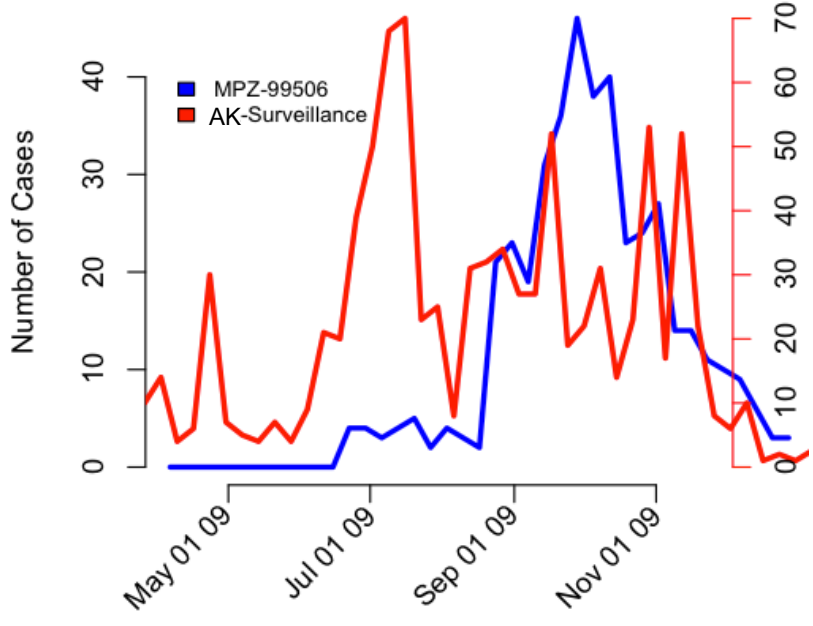


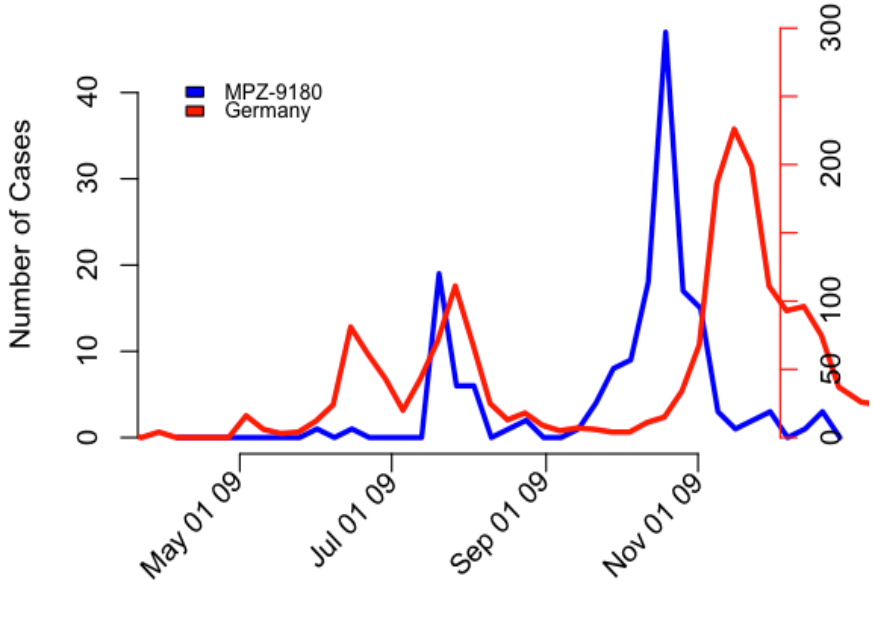
Synchronisation between civilian and military populations



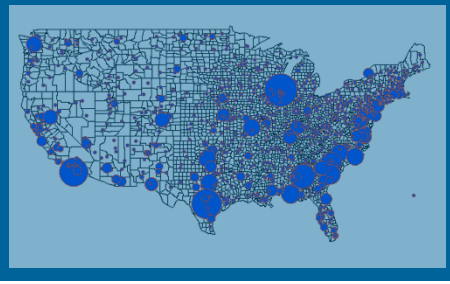


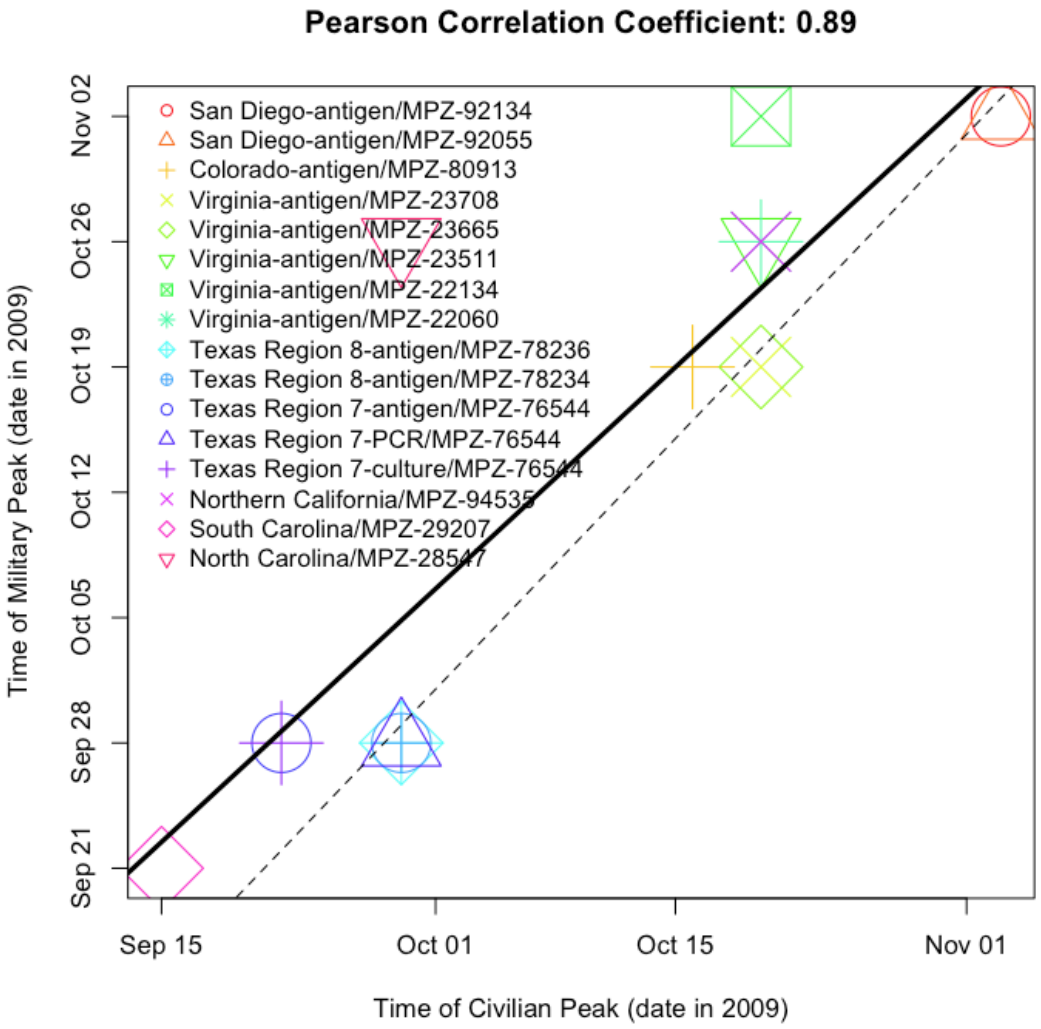






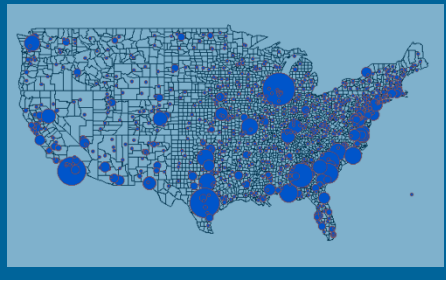
Correlation of peak times

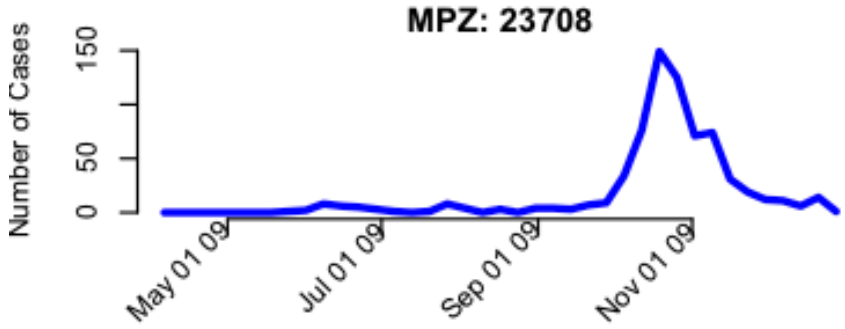


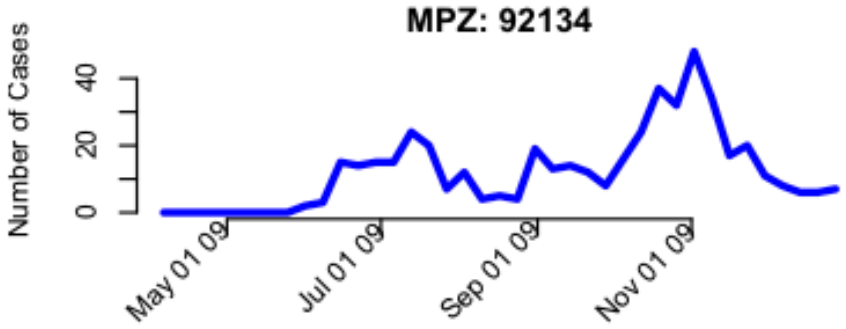


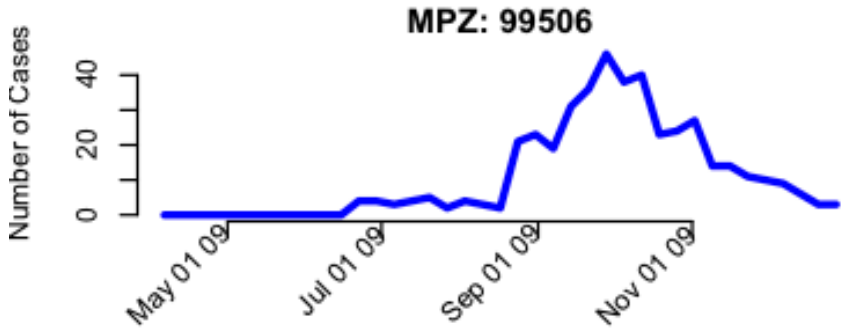
Outliers: Camp Lejune, Quantico.

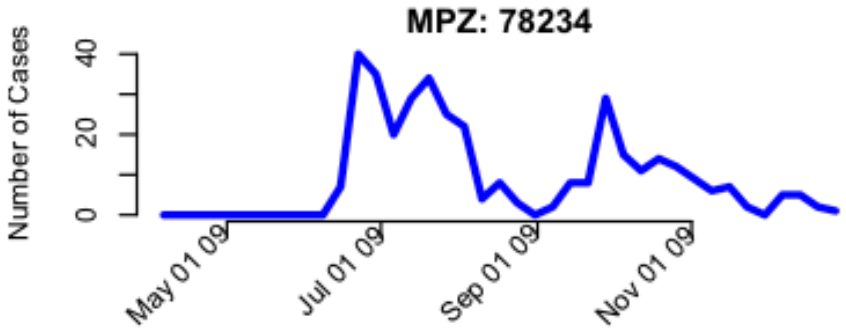
Base epidemic profiles

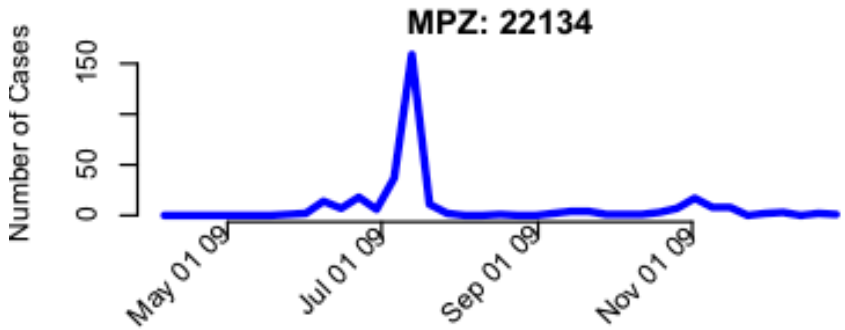


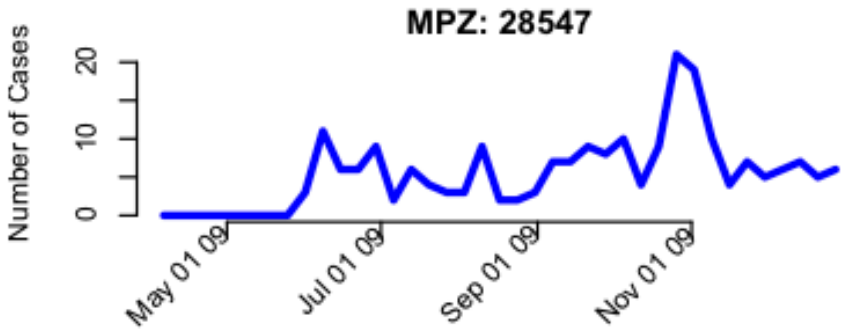












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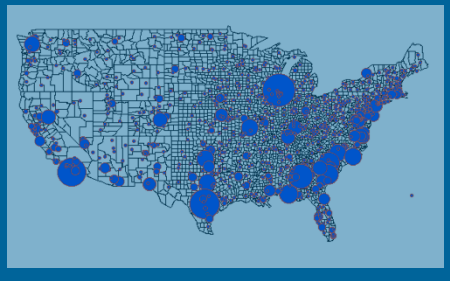

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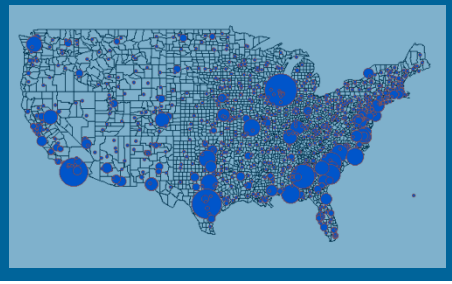
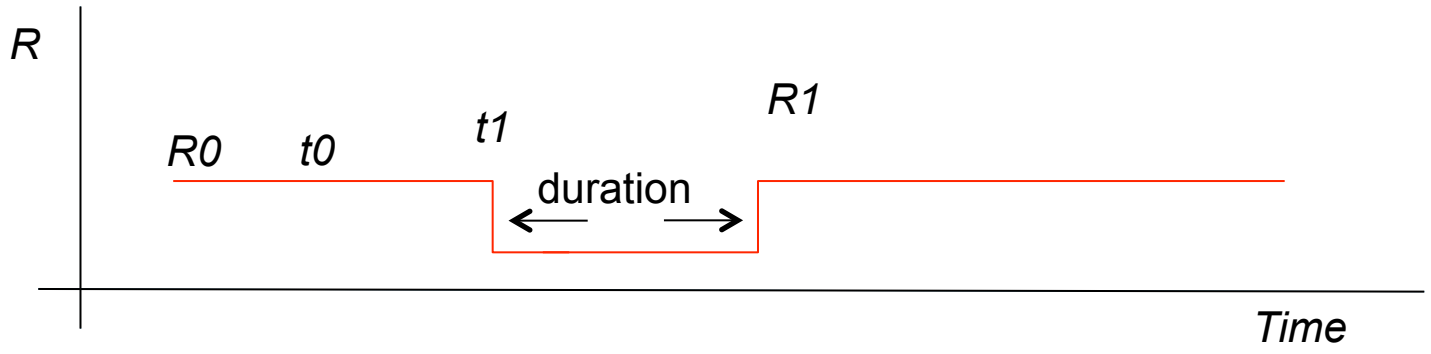
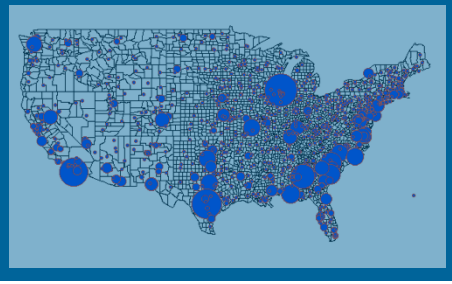
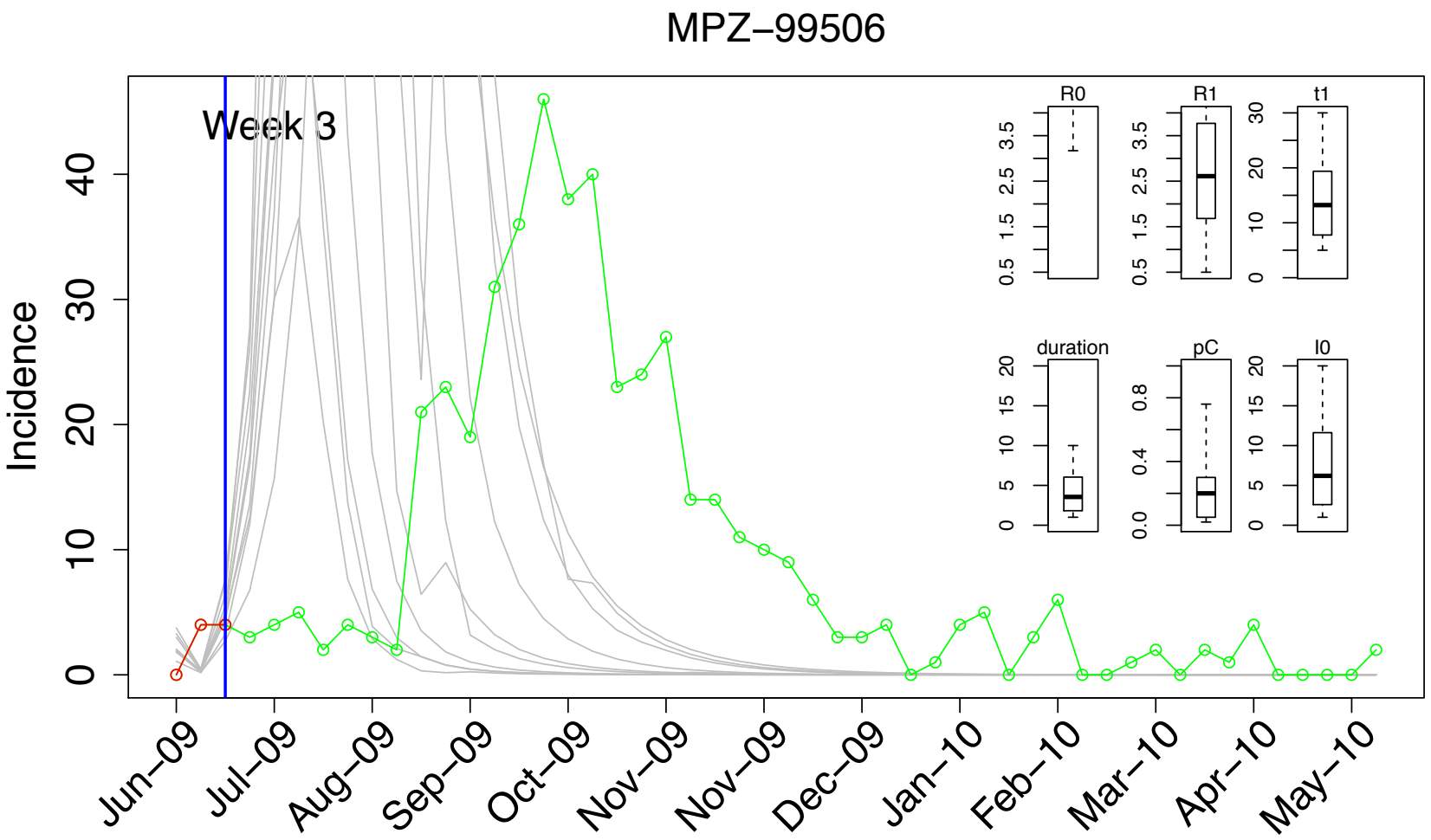
Transmissibility changes over time





Estimation of Severity for 2009 Pandemic





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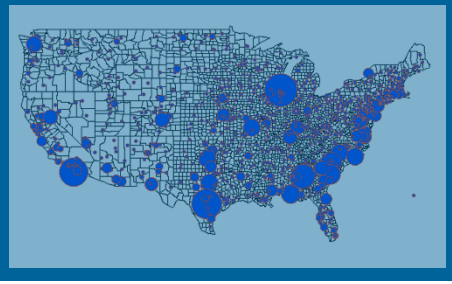
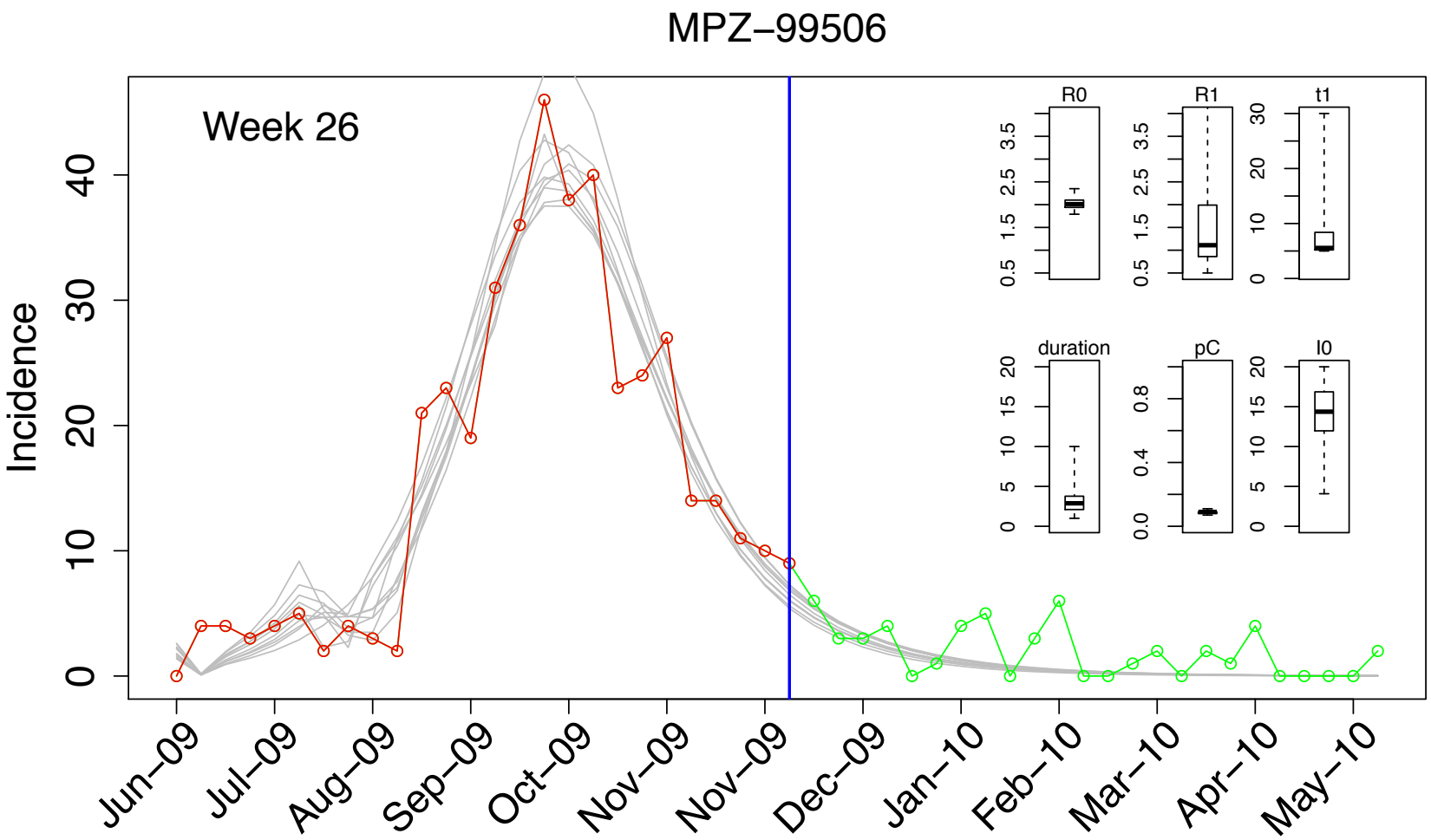
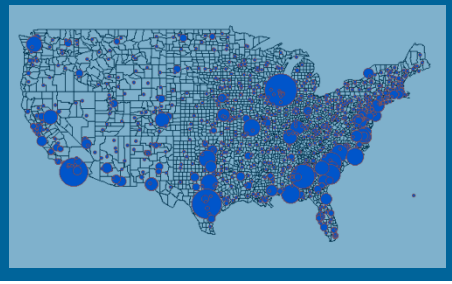
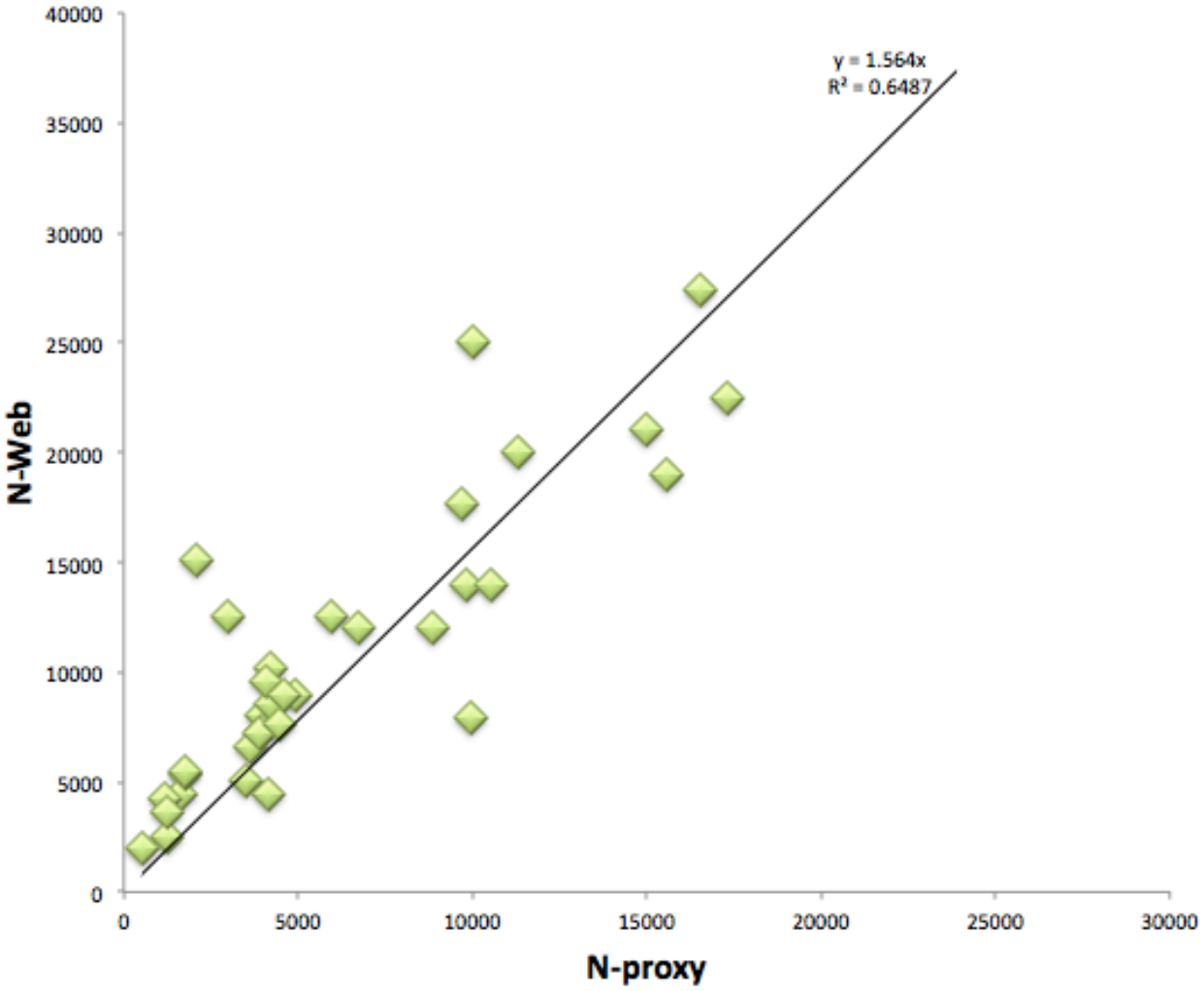




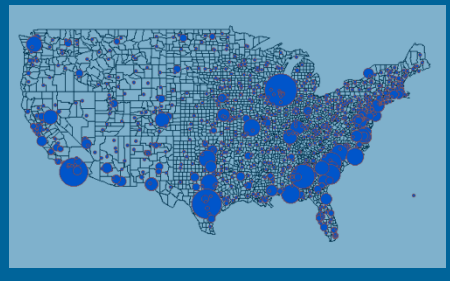
Estimate of Ntotal from AFHSC clinical visits

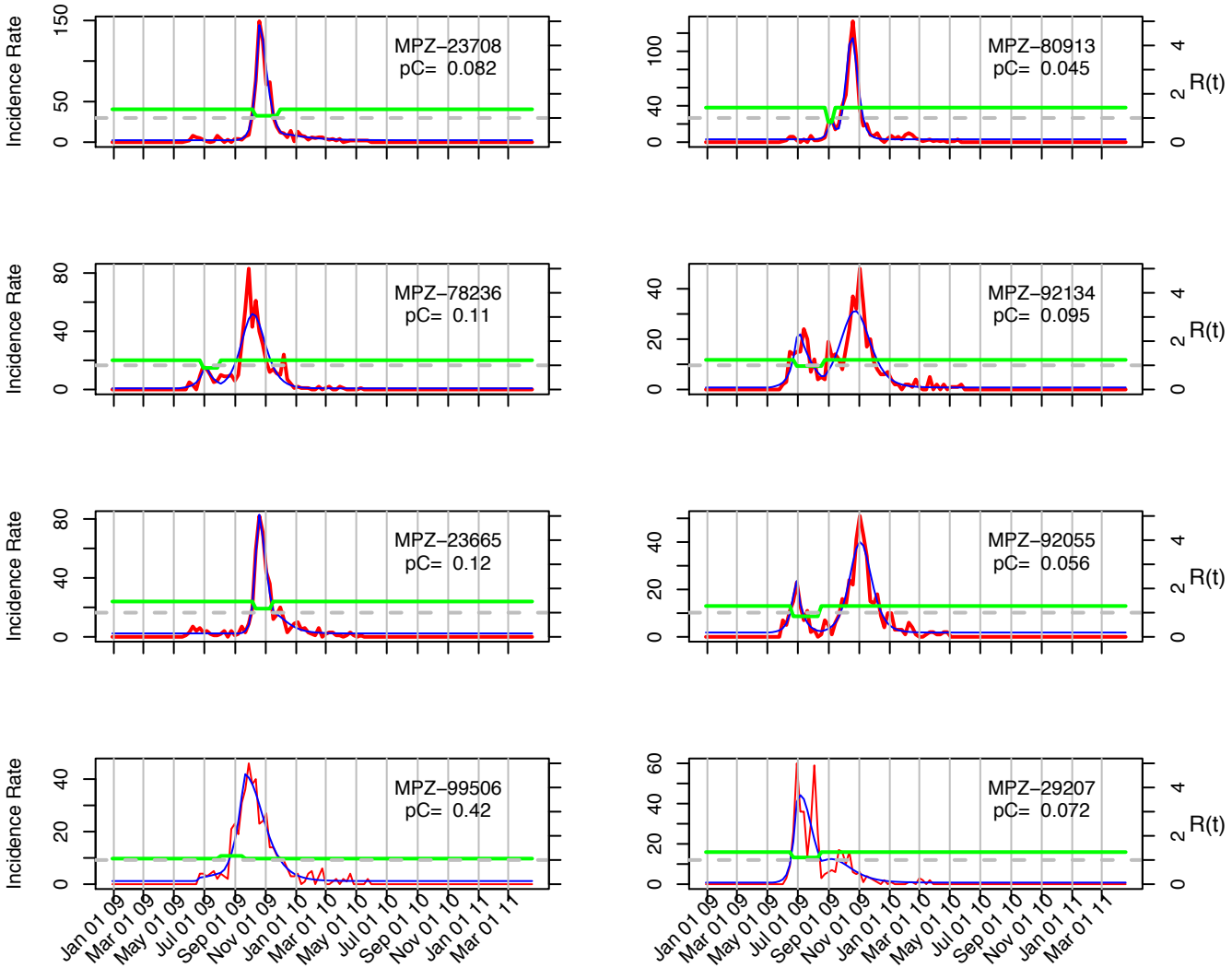




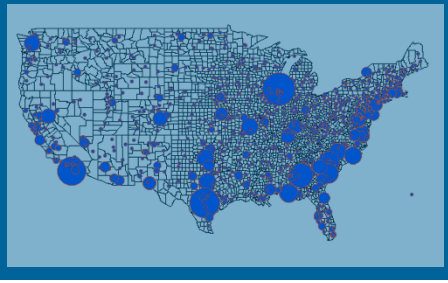
Outliers: Mayport naval Station, 29 Palms, Ft. Riley,

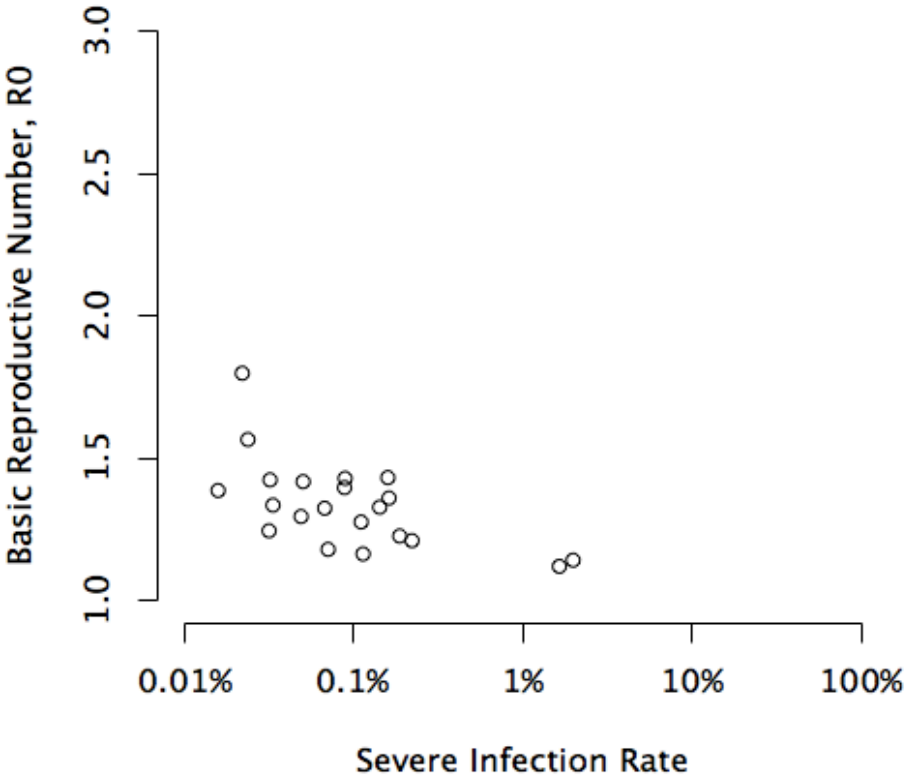
The largest 8 military populations by zip code

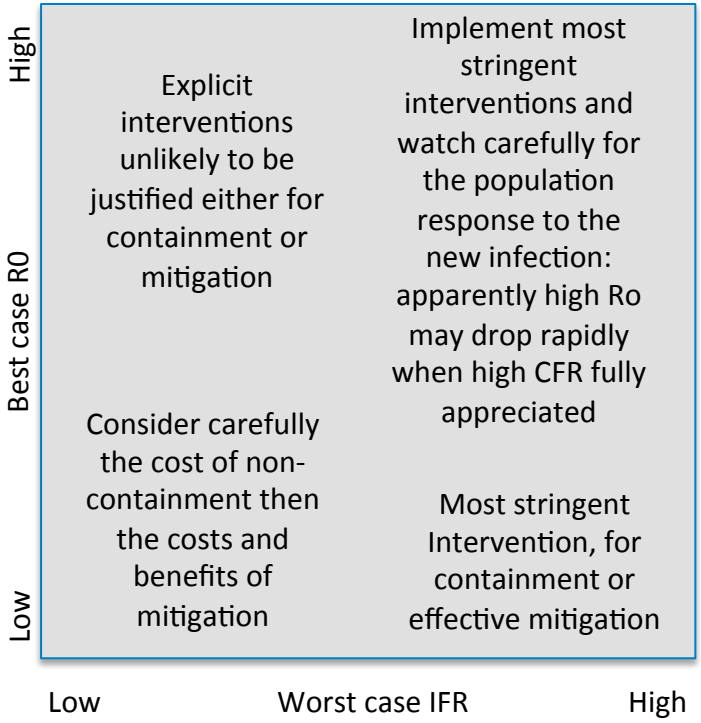




The model fit estimates R_0 and *pC for each base over 10,000*

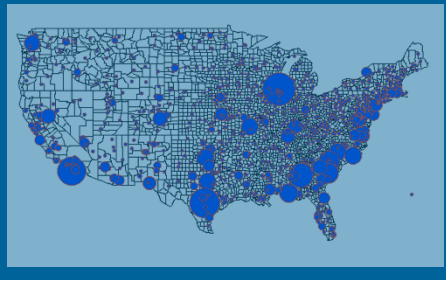


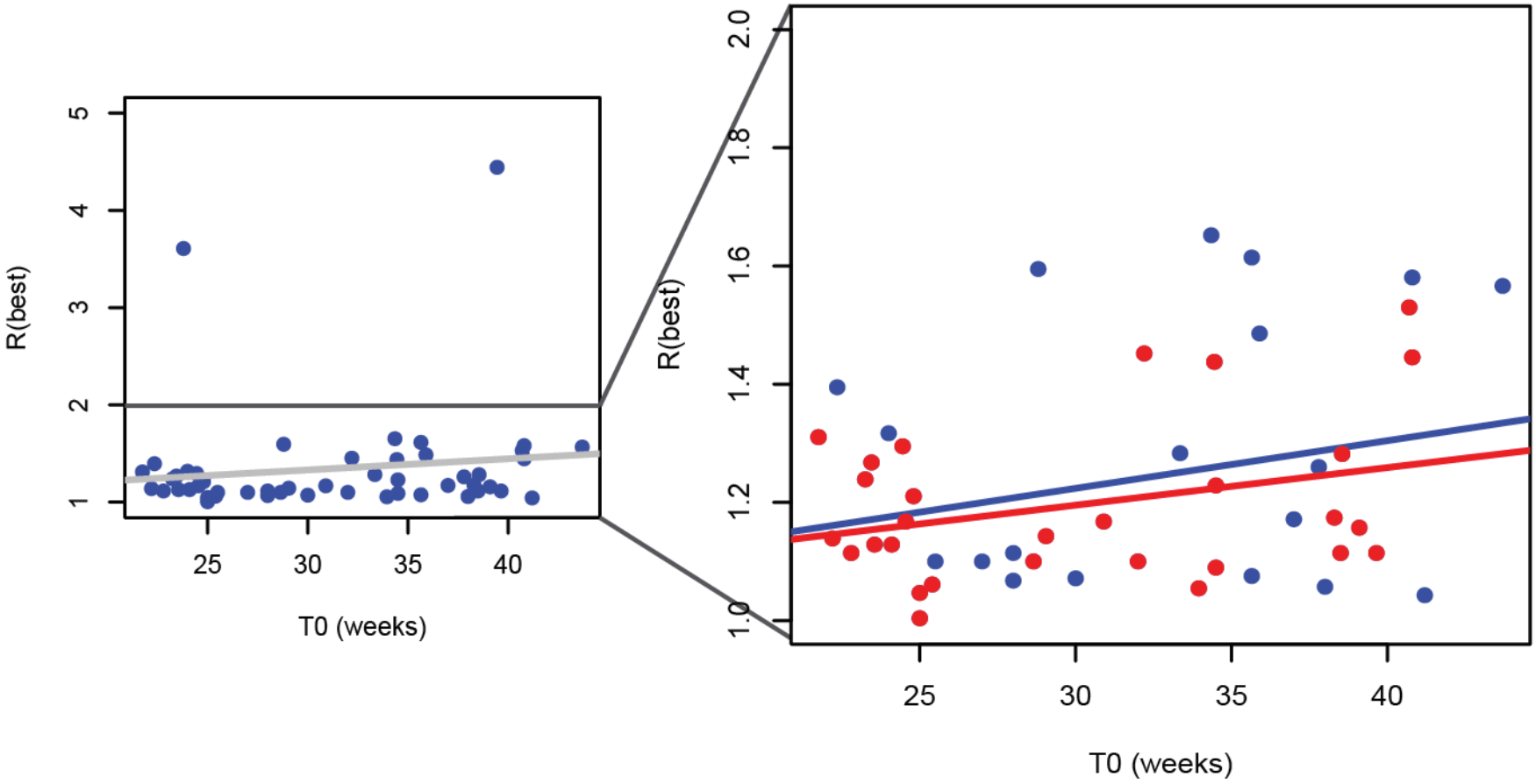




Outliers: Ft. Stewart, Ft Bragg

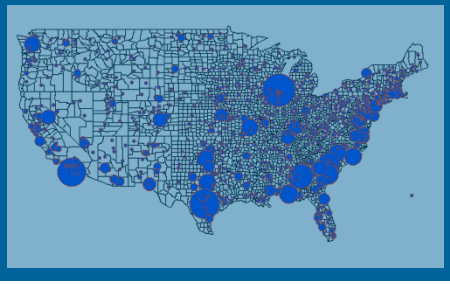
Increasing intrinsic seasonality





Red points are the top 30 bases.

Overview



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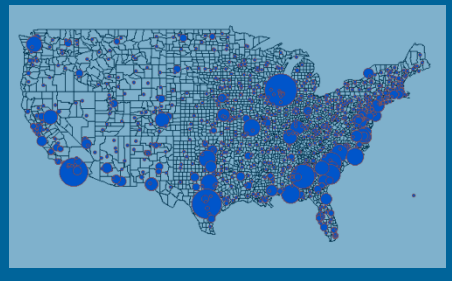
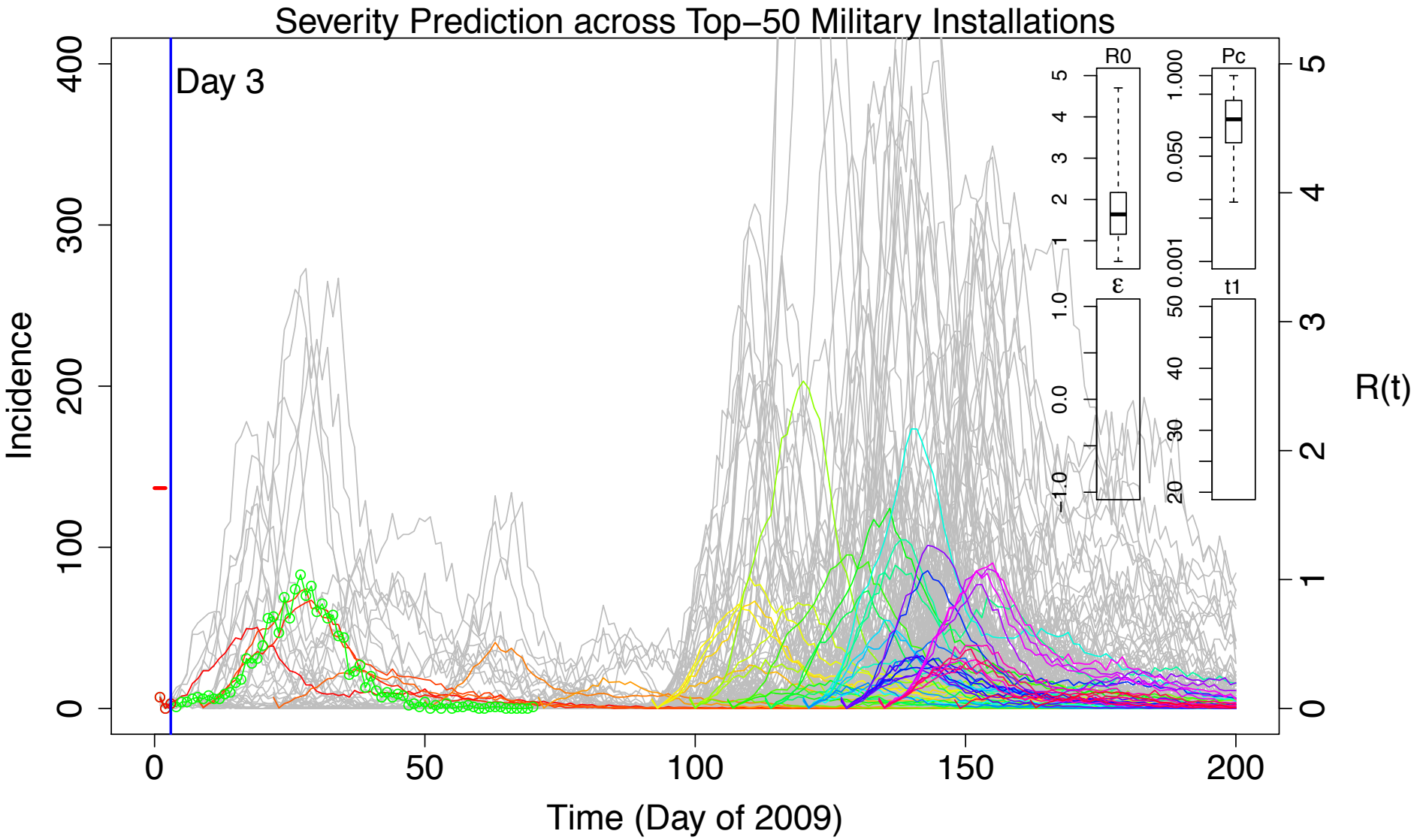
Pandemic prediction based on estimates from early bases





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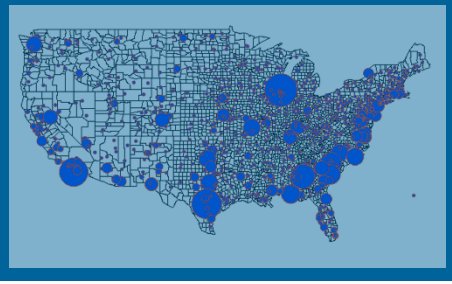
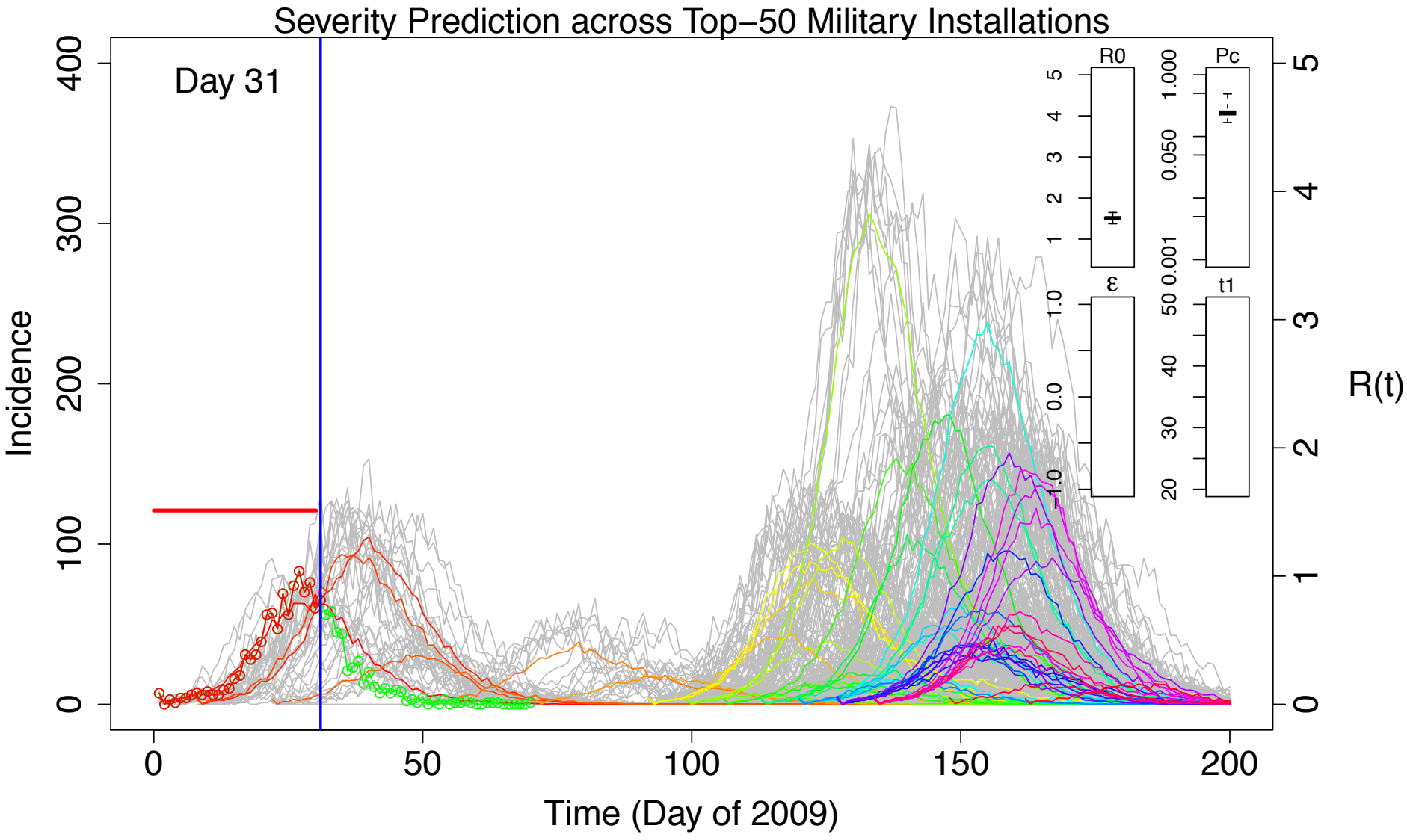
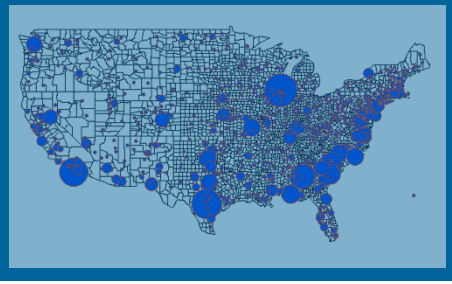
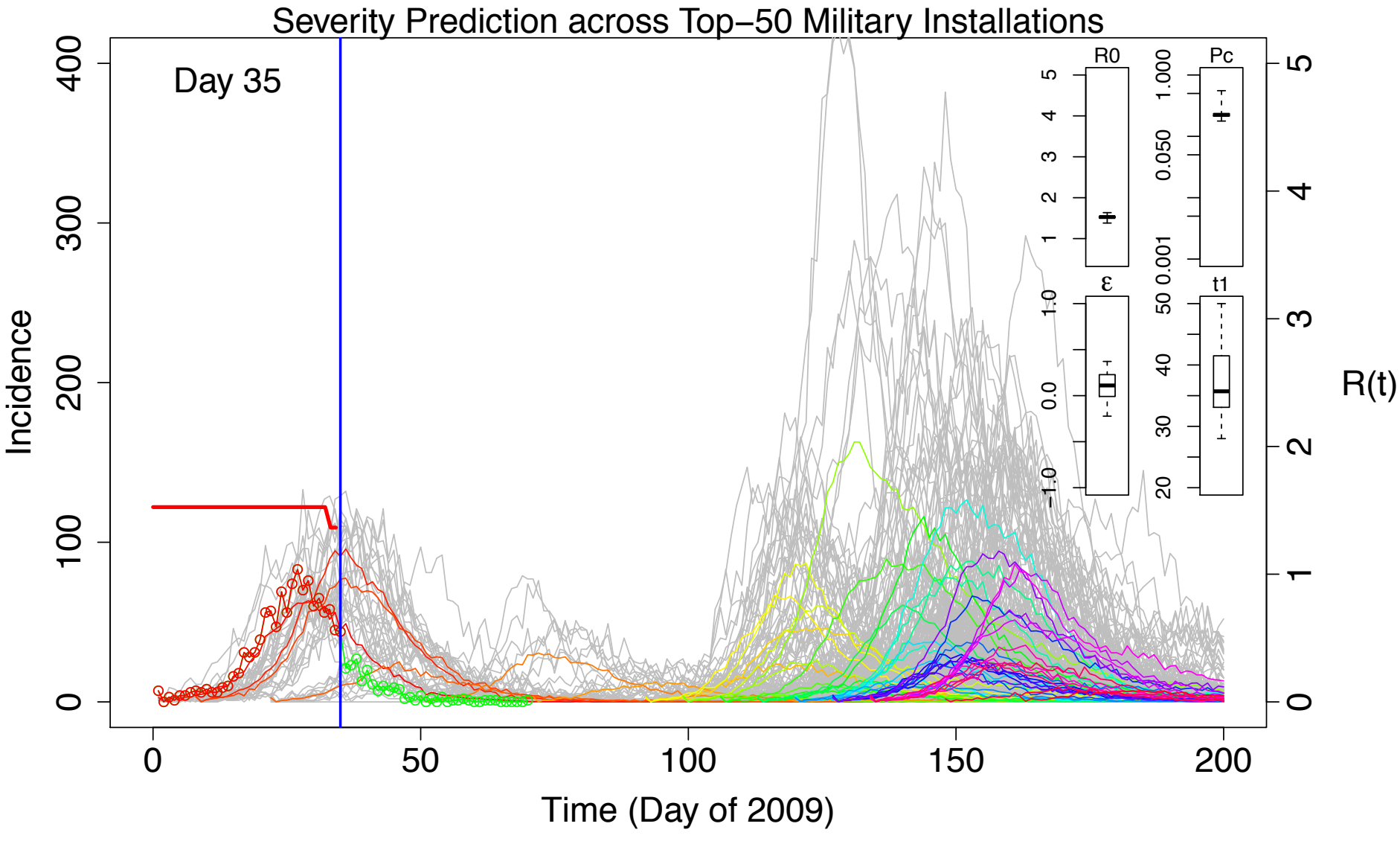


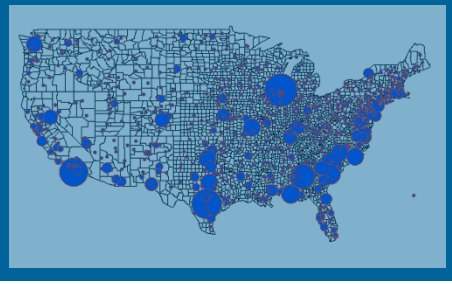


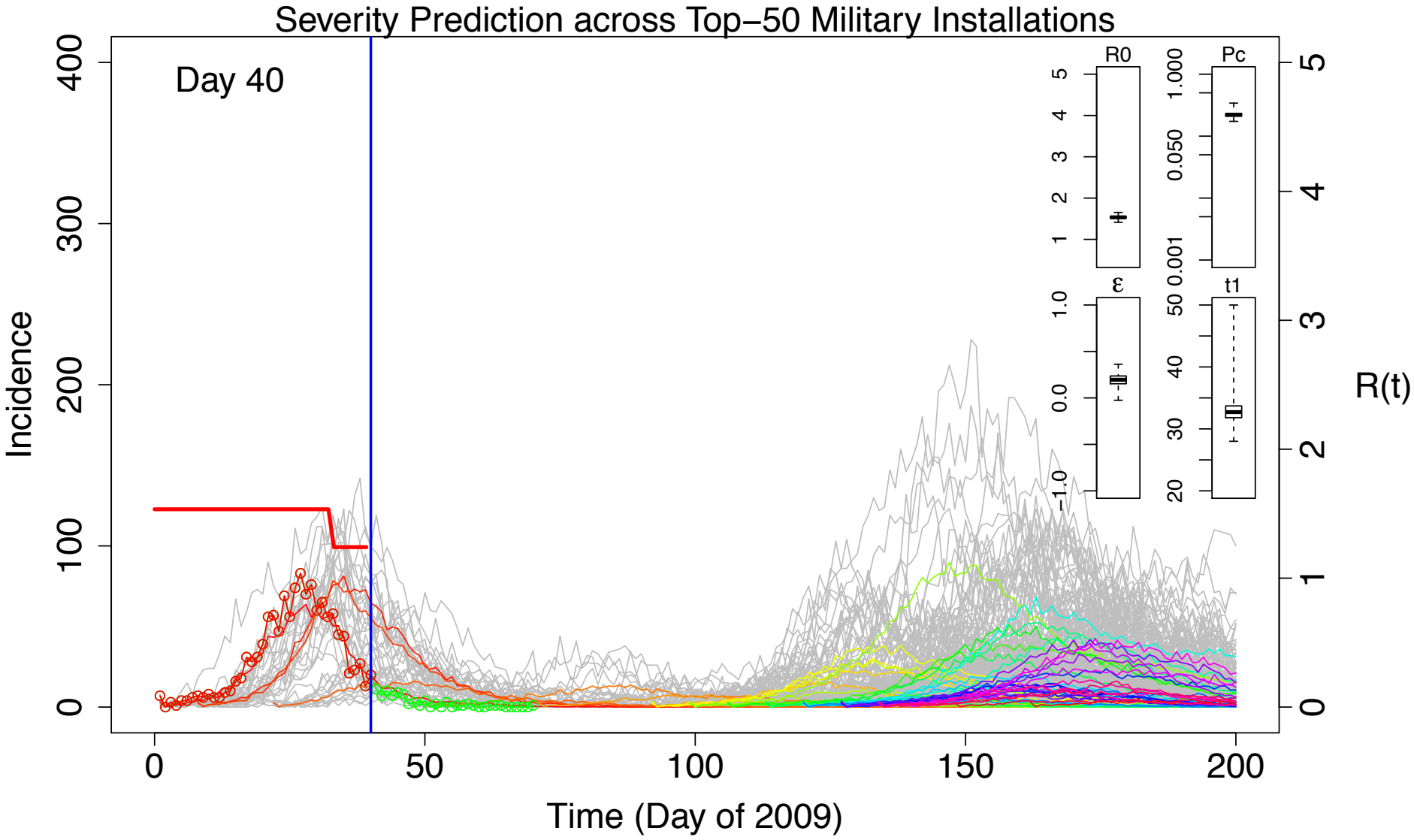
Pandemic prediction based on estimates from early bases



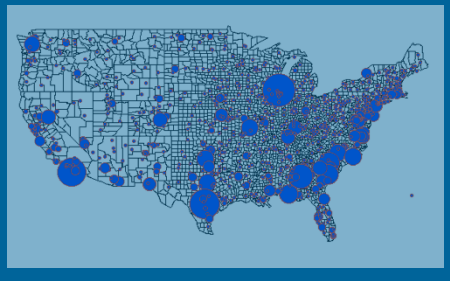


Pandemic prediction based on estimates from early bases



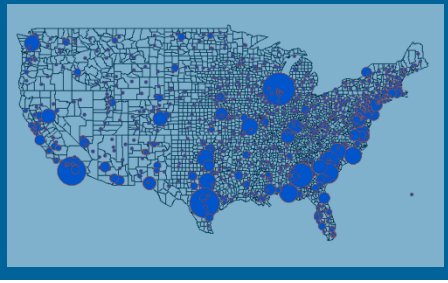


Overview



- Background and key parameters
- Features of the 2009 pandemic
- Disease dynamics of 2009
- Simulating worrisome future scenarios
- Conclusions and future work

Manuscripts



- Paper 1 in revision for PLoS Computational Biology:

Multiple estimates of transmissibility for the 2009 influenza pandemic based on influenza-like-illness data from small US military populations

Pete Riley[1,*], Michal Ben-Nun[1], Richard Armenta[1], Jon A. Linker[1], Angela A. Eick[2], Jose L. Sanchez[2], Dylan George[3], David P. Bacon[4], Steven Riley[1,5]

1 Predictive Science Inc., San Diego, CA, USA

2 Armed Forces Health Surveillance Center, Silver Spring, MD, USA

3 National Center for Medical Intelligence, Fort Detrick, MD, USA

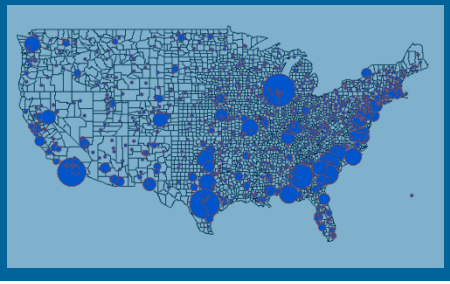
4 Science Applications International Corporation, McLean, VA, USA

5 MRC Centre for Outbreak Analysis and Modelling, Imperial College London, UK

* E-mail: pete@predsci.com

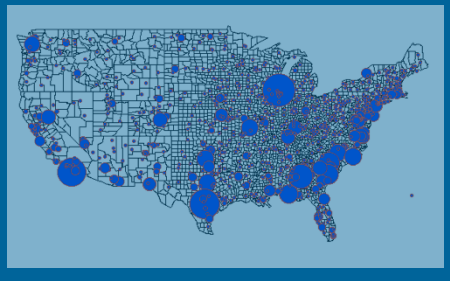
- Paper 2:
  - Rapid assessment of pandemic impact using clinical episode data from spatially distinct military populations, Pete Riley, Michal Ben-Nun, Angela A. Eick, Jose L. Sanchez, Dylan George, David P. Bacon, and Steven Riley, *In prep.*

Conclusions



- DMSS data could be useful in real-time for assessing pandemic severity
- “Simple models” of 2009 capture key parameters
- Accurate population size will improve estimates
- Single analytical framework can address planning and response goals

Future Directions



A prototype tool to perform analysis described here

- Clearly adds to available tool set
- Substantial additional motivation for making key data be available more quickly

Additional modeling science to enable seasonal use

- Winter 12/13 proving to be an excellent example

Process of ongoing tool / scientific refinement