ADM Analysis

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In [703]:
```
import pandas as pd
import numpy
from IPython.display import display, HTML
%matplotlib inline
```

In [704]:
```
#Globals

#Directory and statistic locations
admStats = "/active_duty_military_DetailStats.csv"
cwopStats = "/civilian_workers_on_post_DetailStats.csv"
admFile = "active_duty_military"
cwopFile = "civilian_workers_on_post"
admControlDir = "Control/active_duty_military_Individual_Mean_Stats/"
admDir = "/active_duty_military_Individual_Mean_Stats/"
cwopControlDir = "Control/civilian_workers_on_post_Individual_Mean_Stats"
cwopDir = "/civilian_workers_on_post_Individual_Mean_Stats"

#Population sizes
admCount = 27663
cwopCount = 15912

#Interventions of note

#ve70vtd17milworkers/ate25atl30apl30/sq90sqg25sqtd10sql28', u've70vtd38milworkers/ate2
strongImpStrongEffect = "ve70vtd17allonpost/ate87atl30apl30/sq90sqg25sqtd10sql28"
strongImpWeakEffect = "ve30vtd17allonpost/ate25atl30apl30/sq90sqg25sqtd10sql28"
weakImpStrongEffect = "ve70vtd38active/ate87atl10apl30/sq90sqg25sqtd10sql7"
weakImpWeakEffect = "ve30vtd38active/ate25atl10apl30/sq90sqg25sqtd10sql7"

#Variables of note
controlled = ['v','vtd','atdr','atti','attd','atl','apl','sq','sqg','sqtd','sql']
unused = ['v','atdr','atti','attd','sq','sqg','sqtd']
natural = ['ve','ate']
experimental = filter(lambda x:x not in unused,controlled)
epistats = ['attackRate','peakDay','peakNumber']

#Percentage text formatting
def percent(number):
    return "{0:.3f}%".format(number * 100)
```

In [705]:
```
#Loader functions

#Pulls attack rate from dataframe
def getAR(meanData,cell):
    return meanData.ix[cell]['attackRate']

#Loads curve for target cell
def loadSingleCell(folder,subpop,cell,label):
```

```
    fileIn = folder + '/' + subpop + '_'*(len(subpop) > 0) + 'MeanPlots.csv'
    data = pd.read_csv(fileIn, index_col='index')
    toReturn = data.ix[cell]
    toReturn.name = label
    return toReturn

#Loads whole experiment from GetSlice.py output
def getExperiment(experimentCSV):
    data = pd.read_csv(experimentCSV, skipinitialspace=True, index_col='directory')
    means = data[data['iteration']=='Mean'].replace(-1,NaN).replace('Mean',NaN).dropna
    iterations = data[data['iteration']!='Mean'].replace(-1,NaN).replace('Mean',NaN).d
    return {'data':data,'means':means,'iterations':iterations}
```

In [706]:
```
#Stats derivation

def getCorrelations(iterations,natural,experimental):
    attackNatural = iterations[natural].corrwith(iterations['attackRate'])
    numberNatural = iterations[natural].corrwith(iterations['peakNumber'])
    dayNatural = iterations[natural].corrwith(iterations['peakDay'])
    attackExperimental = iterations[experimental].corrwith(iterations['attackRate'])
    numberExperimental = iterations[experimental].corrwith(iterations['peakNumber'])
    dayExperimental = iterations[experimental].corrwith(iterations['peakDay'])

    naturalStats = pd.concat([attackNatural, dayNatural, numberNatural], join='outer',
    experimentalStats = pd.concat([attackExperimental, dayExperimental, numberExperime
    naturalStats.columns = experimentalStats.columns = ['attackRate','peakDay','peakNu

    print "Experimental Variable v. Epistat Correlation coefficients:\n"
    print "Pharmaceutical Effectiveness\n",naturalStats
    print "\nIntervention Sequence\n", experimentalStats,'\n\n'
    return {'naturalStats':naturalStats,'experimentalStats':experimentalStats}
```

In [707]:
```
#Mean intervention efficacy maxima and minima detection

def getMaxima(means):
    weakest = means.ix[means['attackRate'].idxmax()]
    strongest = means.ix[means['attackRate'].idxmin()]
    weakRef = weakest.name; strongRef = strongest.name
    weakest.name = 'Weakest Intervention'; strongest.name = 'Strongest Intervention'
    maxMin = pd.concat([weakest, strongest], axis= 1)

    print "Attack Rate Extrema by Intervention Parameters\n\n",maxMin,'\n\n'
    return {'weakRef':weakRef,'strongRef':strongRef,'maxMin':maxMin}
```

In [708]:
```
#Plot best, worst, and control curves

def getCurves(expDir,weakRef,strongRef,admFile,end):
    admBestCurve = loadSingleCell(expDir,admFile,strongRef,'Strongest')[0:end]
    admWorstCurve = loadSingleCell(expDir,admFile,weakRef,'Weakest')[0:end]
    seedNumber = str(admBestCurve[1])
    admControlCurve = loadSingleCell('Control','','seeds' + seedNumber,'Control')[0:en

    admCurves = pd.DataFrame(zip(admBestCurve,admWorstCurve,admControlCurve), columns=
    cumsumCurves = admCurves.cumsum()

    admCurves.plot()
    cumsumCurves.plot()
```

In [709]:
```
#Find percent attack rate

def getRankedInterventions(ADMMeanStats, CWOPMeanStats):
    SISE_ADM_AttackRate = getAR(ADMMeanStats, strongImpStrongEffect)
    SISE_CWOP_AttackRate = getAR(CWOPMeanStats, strongImpStrongEffect)
```

```
    SIWE_ADM_AttackRate = getAR(ADMMeanStats, strongImpWeakEffect)
    SIWE_CWOP_AttackRate = getAR(CWOPMeanStats, strongImpWeakEffect)
    WISE_ADM_AttackRate = getAR(ADMMeanStats, weakImpStrongEffect)
    WISE_CWOP_AttackRate = getAR(CWOPMeanStats, weakImpStrongEffect)
    WIWE_ADM_AttackRate = getAR(ADMMeanStats, weakImpWeakEffect)
    WIWE_CWOP_AttackRate = getAR(CWOPMeanStats, weakImpWeakEffect)
    SISE_ADM_Percent = float(SISE_ADM_AttackRate) / admCount
    SISE_CWOP_Percent = float(SISE_CWOP_AttackRate) / cwopCount
    SIWE_ADM_Percent = float(SIWE_ADM_AttackRate) / admCount
    SIWE_CWOP_Percent = float(SIWE_CWOP_AttackRate) / cwopCount
    WISE_ADM_Percent = float(WISE_ADM_AttackRate) / admCount
    WISE_CWOP_Percent = float(WISE_CWOP_AttackRate) / cwopCount
    WIWE_ADM_Percent = float(WIWE_ADM_AttackRate) / admCount
    WIWE_CWOP_Percent = float(WIWE_CWOP_AttackRate) / cwopCount
    print "Theoretical strongest and weakest pharmacuetical intervention (PI) & logist
    print "\nActive Duty Military on base:", admCount
    print "Civilian Workers on post", cwopCount
    print "\n\t\tActive Duty\tCivilian Workers"
    print "Strong PI, Strong LI\t", percent(SISE_ADM_Percent), '\t', percent(SISE_CWOP
    print "Weak PI, Strong LI\t", percent(SIWE_ADM_Percent), '\t', percent(SIWE_CWOP_P
    print "Strong PI, Weak LI\t", percent(WISE_ADM_Percent), '\t', percent(WISE_CWOP_P
    print "Weak PI, Weak LI\t", percent(WIWE_ADM_Percent), '\t', percent(WIWE_CWOP_Per

    return 'null'
```

In [710]:
```
#Main action

def pullExperiment(expDir,end):
    text = 'Experiment ID: ' + expDir + '     Length: ' + str(end)
    display(HTML("<b>" + text + "</b>"))

    admExperimentStats = getExperiment(expDir+admStats)
    cwopExperimentStats = getExperiment(expDir+cwopStats)
    correlationData = getCorrelations(admExperimentStats['iterations'],natural,experim
    maximaData = getMaxima(admExperimentStats['means'])
    curves = getCurves(expDir,maximaData['weakRef'],maximaData['strongRef'],admFile,en
    ranks = getRankedInterventions(admExperimentStats['means'],cwopExperimentStats['me
    print '\n\n'
```

In [711]:
```
pullExperiment('FtLewis5',50)
```

```
<IPython.core.display.HTML at 0x111be8c90>

Experimental Variable v. Epistat Correlation coefficients:

Pharmaceutical Effectiveness
     attackRate   peakDay  peakNumber
ve    -0.279254 -0.025465   -0.187938
ate   -0.058289 -0.020835   -0.025321

Intervention Sequence
       attackRate   peakDay    peakNumber
vtd  3.406174e-01 -0.011575  4.527300e-01
atl  2.571136e-18  0.000000  5.402729e-18
apl -2.281914e-01 -0.060962 -7.351200e-03
sql -2.953325e-01  0.074852 -8.026916e-02
```

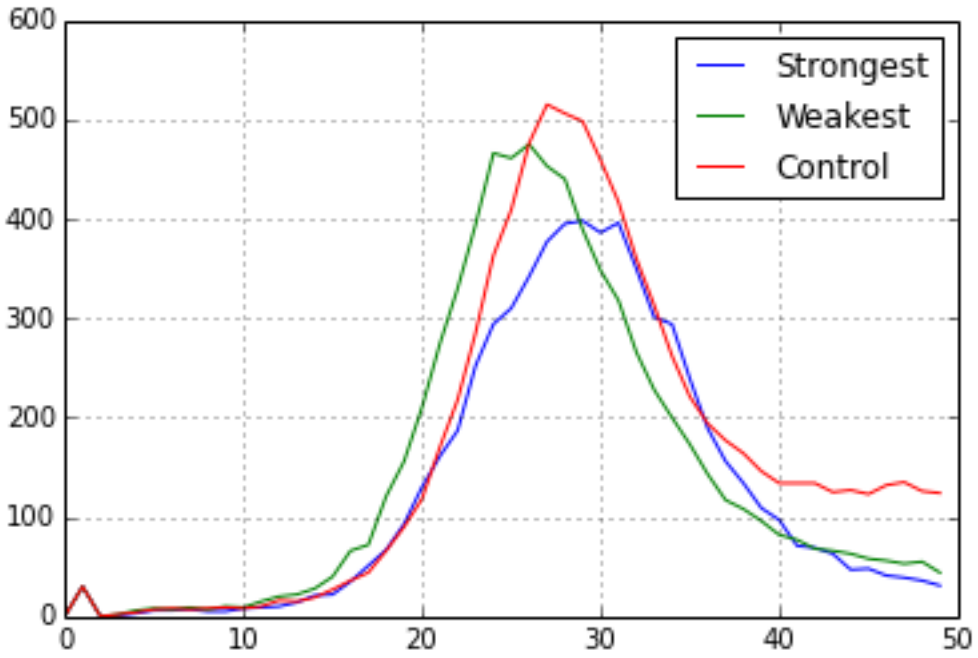
Attack Rate Extrema by Intervention Parameters

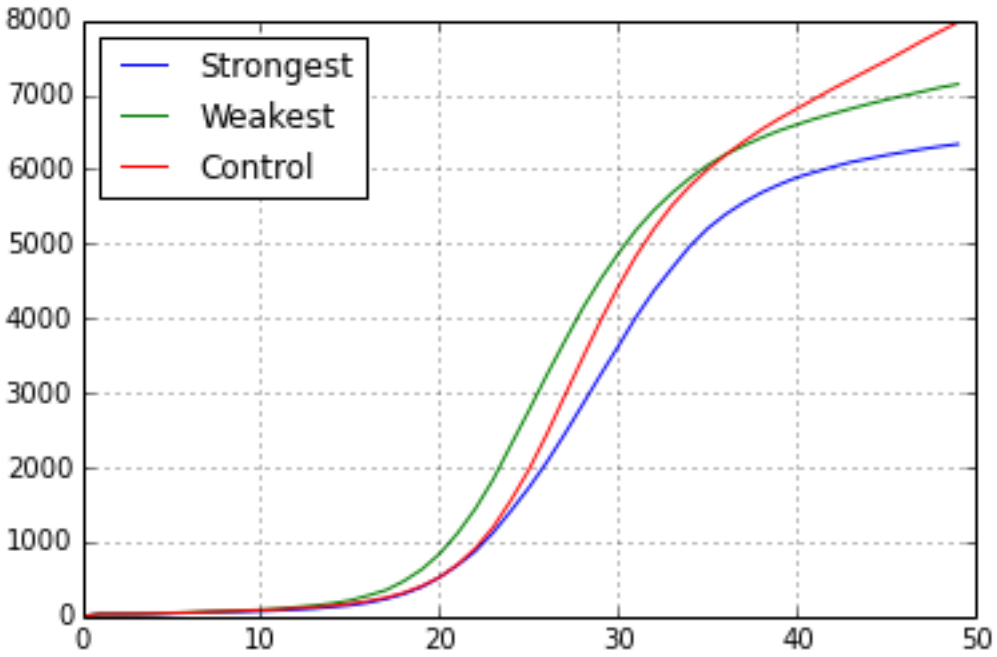
	Weakest Intervention	Strongest Intervention
ve	30	70
vtd	17	17
ate	25	25
atl	10	10
apl	10	30
sq	90	90
sqg	25	25
sqtd	10	10
sql	7	28
other	allonpost	active
attackRate	7199	6367
peakDay	26	29
peakNumber	475	398
isEpidemic	-1	-1
leftBound	15	16
rightBound	47	46

Theoretical strongest and weakest pharmacuetical intervention (PI) & logistical implementation (LI):

Active Duty Military on base: 27663
Civilian Workers on post 15912

	Active Duty	Civilian Workers
Strong PI, Strong LI	24.426%	0.038%
Weak PI, Strong LI	24.889%	0.075%
Strong PI, Weak LI	24.310%	0.031%
Weak PI, Weak LI	25.431%	0.044%





In [712]:
```
pullExperiment('FtLewis6',50)
```

```
<IPython.core.display.HTML at 0x111b411d0>

Experimental Variable v. Epistat Correlation coefficients:

Pharmaceutical Effectiveness
     attackRate   peakDay  peakNumber
```

```
ve    -0.025739 -0.025801   -0.047267
ate   -0.251619 -0.284967   -0.263670

Intervention Sequence
     attackRate       peakDay    peakNumber
vtd    0.058645 -2.310544e-02  7.469193e-02
atl    0.000000  7.661454e-19  9.222918e-18
apl    0.034913  3.311780e-02  5.445559e-02
sql   -0.016052 -4.659597e-02 -1.019704e-02
```

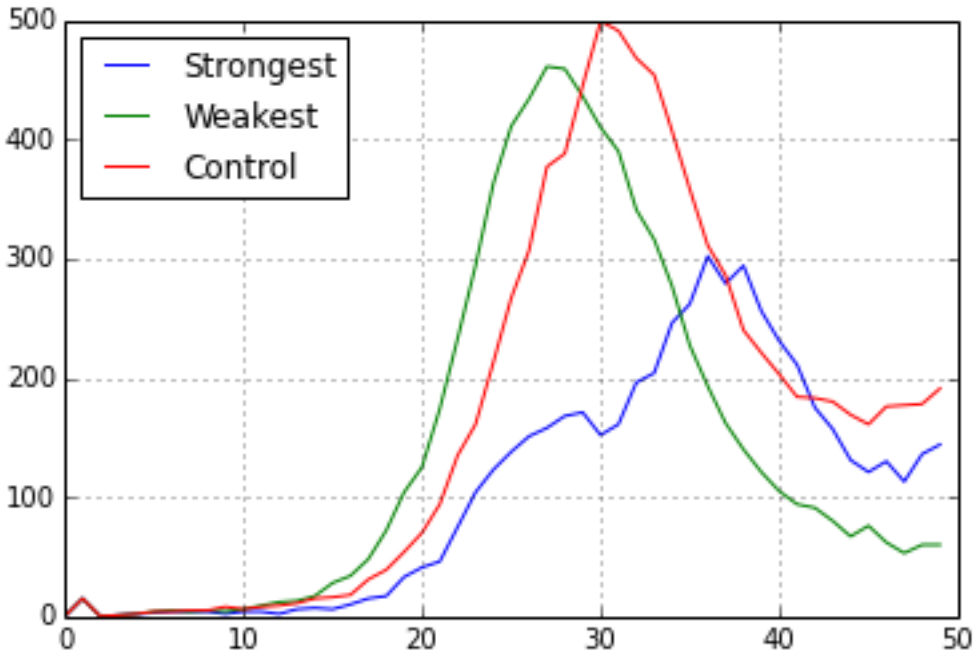
Attack Rate Extrema by Intervention Parameters

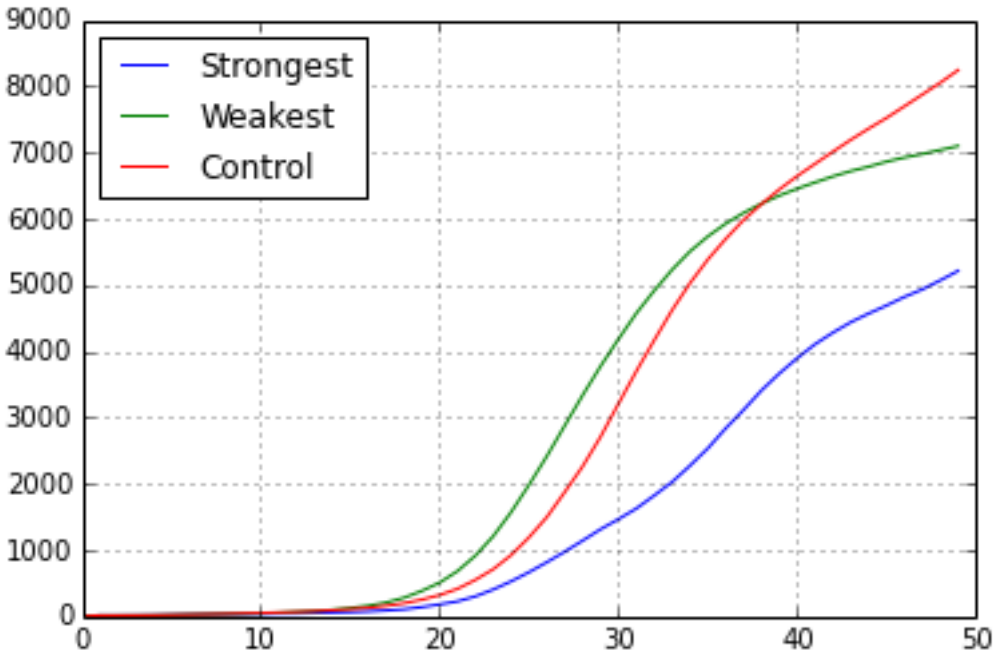
	Weakest Intervention	Strongest Intervention
ve	70	30
vtd	38	17
ate	87	87
atl	10	10
apl	10	30
sq	90	90
sqg	25	25
sqtd	10	10
sql	7	28
other	allonpost	allonpost
attackRate	7164	5398
peakDay	27	36
peakNumber	461	302
isEpidemic	-1	-1
leftBound	17	19
rightBound	48	50

Theoretical strongest and weakest pharmacuetical intervention (PI) & logistical implementation (LI):

Active Duty Military on base: 27663
Civilian Workers on post 15912

	Active Duty	Civilian Workers
Strong PI, Strong LI	24.607%	0.044%
Weak PI, Strong LI	24.159%	0.013%
Strong PI, Weak LI	24.444%	0.019%
Weak PI, Weak LI	24.166%	0.038%

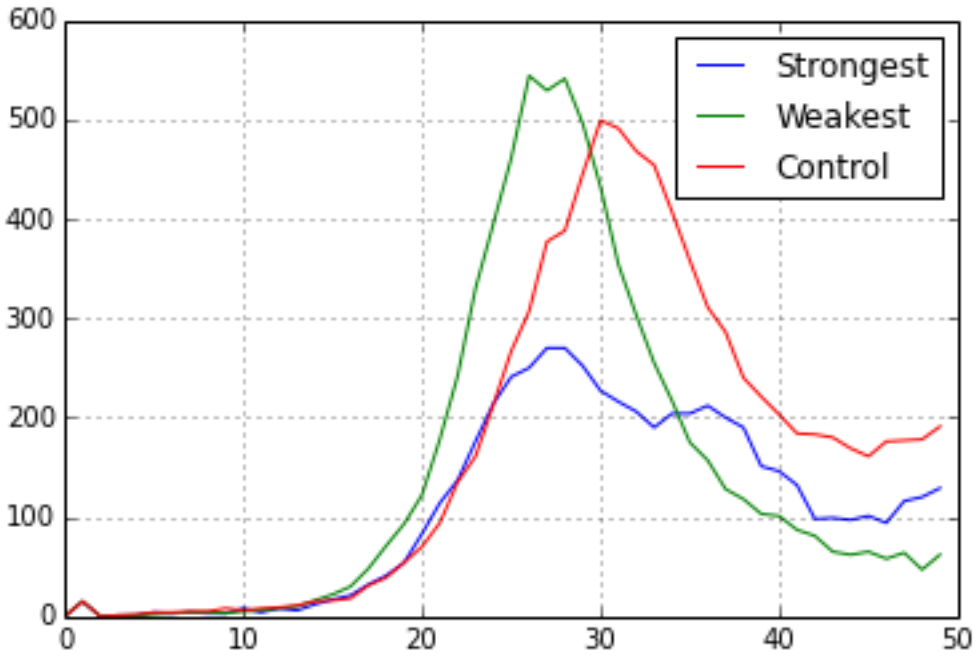


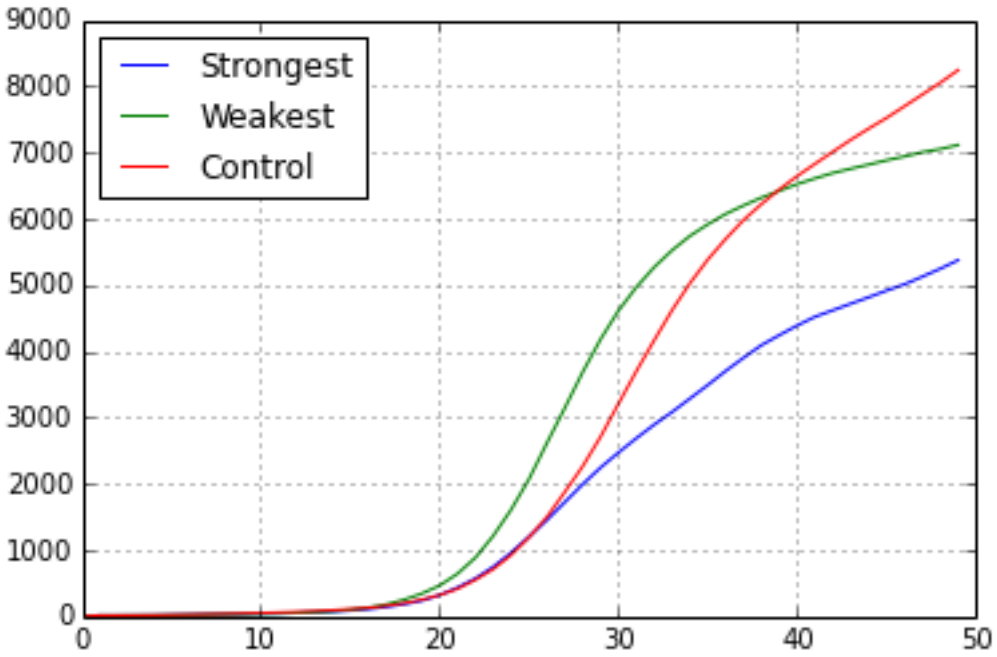


In [713]:
```
pullExperiment('FtLewis7',50)
```

```
<IPython.core.display.HTML at 0x112285510>

Experimental Variable v. Epistat Correlation coefficients:

Pharmaceutical Effectiveness
     attackRate   peakDay  peakNumber
```

```
ve    -0.075978 -0.075682   -0.093934
ate    0.200194  0.316148    0.227400

Intervention Sequence
     attackRate       peakDay    peakNumber
vtd   -0.017642 -4.734763e-02  3.631568e-02
atl    0.000000  2.543056e-18  8.127693e-18
apl   -0.010265 -3.802723e-02 -1.430956e-02
sql   -0.036417 -3.094373e-02 -2.554720e-02


Attack Rate Extrema by Intervention Parameters

           Weakest Intervention Strongest Intervention
ve                           70                    70
vtd                          38                    38
ate                          25                    87
atl                          10                    10
apl                          10                    10
sq                           90                    90
sqg                          25                    25
sqtd                         10                    10
sql                           7                    28
other                 allonpost                active
attackRate                 7172                  5537
peakDay                      26                    27
peakNumber                  544                   270
isEpidemic                   -1                    -1
leftBound                    18                    17
rightBound                   47                    50


Theoretical strongest and weakest pharmacuetical intervention (PI) &
logistical implementation (LI):

Active Duty Military on base: 27663
Civilian Workers on post 15912

                Active Duty     Civilian Workers
Strong PI, Strong LI    24.000%         0.019%
Weak PI, Strong LI      24.571%         0.013%
Strong PI, Weak LI      24.079%         0.031%
Weak PI, Weak LI        24.632%         0.031%
```

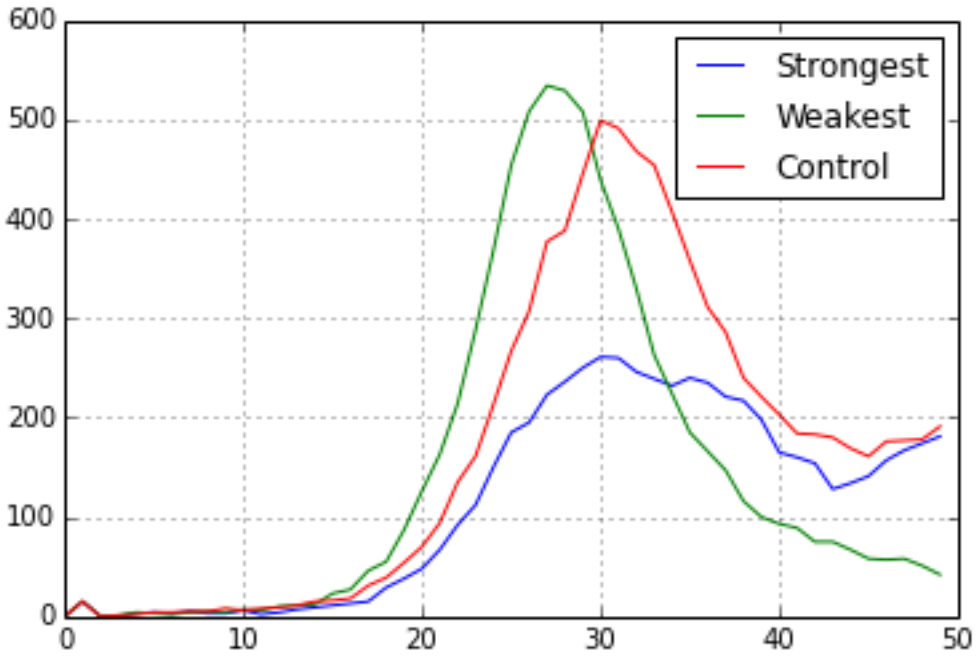


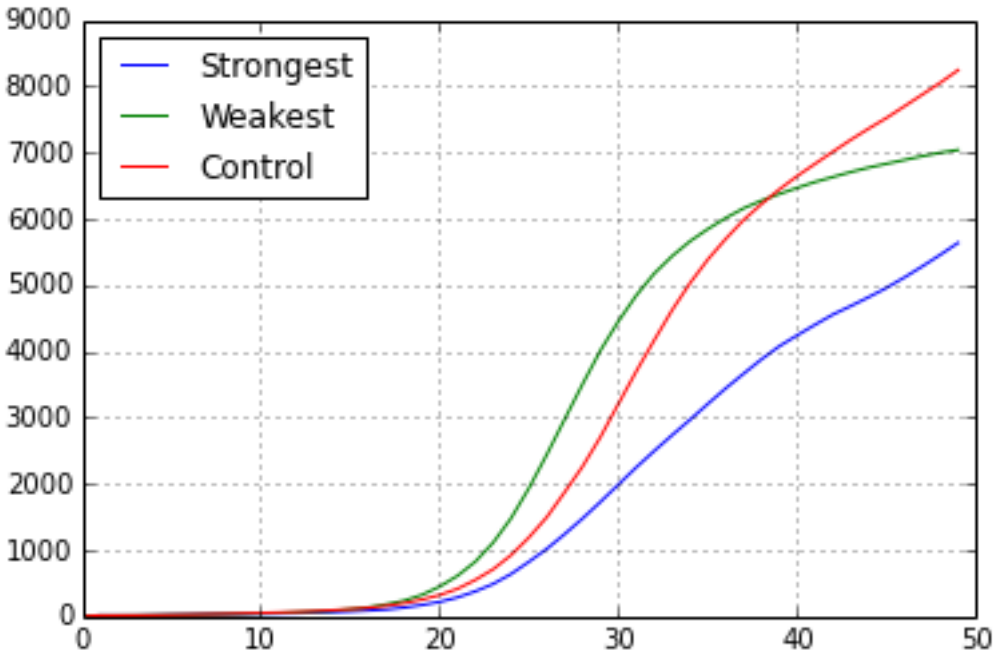


In [714]:
```
pullExperiment('FtLewis8',50)
```

```
<IPython.core.display.HTML at 0x111b41f50>

Experimental Variable v. Epistat Correlation coefficients:

Pharmaceutical Effectiveness
     attackRate   peakDay  peakNumber
```

```
ve    -0.006836 -0.028484   -0.029189
ate   -0.274242 -0.266242   -0.269018

Intervention Sequence
       attackRate       peakDay    peakNumber
vtd  5.587836e-03 -1.032527e-01  4.553079e-02
atl -6.646898e-18 -2.698500e-18  1.150571e-17
apl -1.055713e-02 -3.956043e-03 -4.027322e-03
sql  2.674206e-02  2.373626e-03  2.466300e-02


Attack Rate Extrema by Intervention Parameters

           Weakest Intervention Strongest Intervention
ve                           70                     30
vtd                          38                     17
ate                          87                     87
atl                          10                     10
apl                          10                     10
sq                           90                     90
sqg                          25                     25
sqtd                         10                     10
sql                           7                      7
other                 allonpost                 active
attackRate                 7094                   5831
peakDay                      27                     30
peakNumber                  534                    261
isEpidemic                   -1                     -1
leftBound                    17                     19
rightBound                   47                     50


Theoretical strongest and weakest pharmacuetical intervention (PI) &
logistical implementation (LI):

Active Duty Military on base: 27663
Civilian Workers on post 15912

                Active Duty     Civilian Workers
Strong PI, Strong LI    24.621%         0.031%
Weak PI, Strong LI      24.028%         0.063%
Strong PI, Weak LI      23.826%         0.013%
Weak PI, Weak LI        24.141%         0.050%
```





In [715]:
```
pullExperiment('FtLewis9',50)
```

```
<IPython.core.display.HTML at 0x112285550>

Experimental Variable v. Epistat Correlation coefficients:

Pharmaceutical Effectiveness
     attackRate   peakDay  peakNumber
```

```
ve    -0.073782  0.008363   -0.064721
ate   -0.261181 -0.348168   -0.280434

Intervention Sequence
       attackRate   peakDay    peakNumber
vtd  8.023694e-02 -0.020600  1.136680e-01
atl  4.861192e-18  0.000000  6.784788e-18
apl -2.953274e-02 -0.051195 -2.939462e-02
sql -2.038740e-02 -0.031207 -1.055222e-02
```

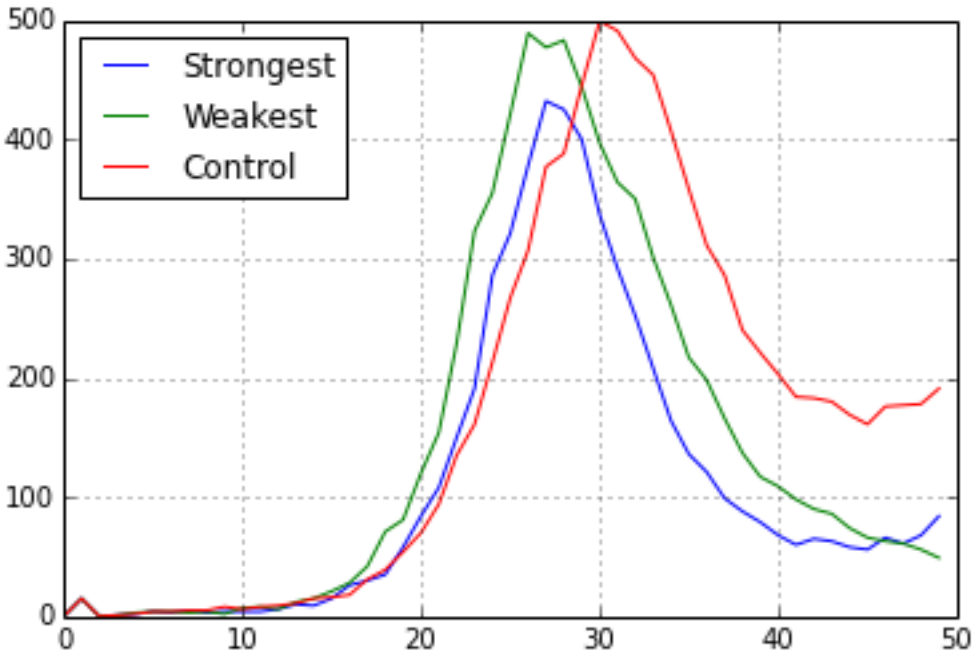
Attack Rate Extrema by Intervention Parameters

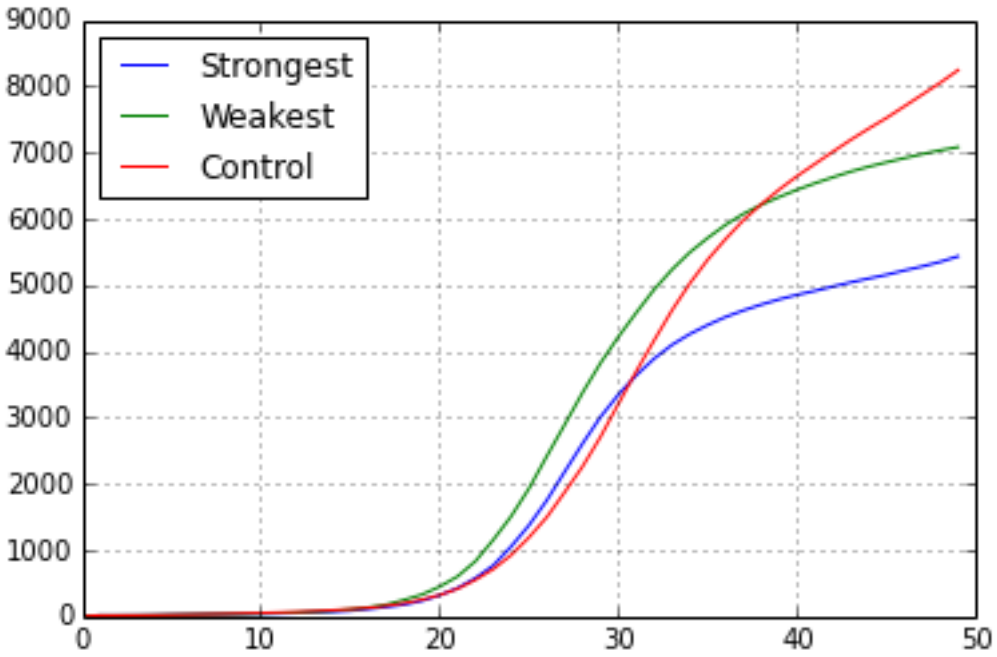
	Weakest Intervention	Strongest Intervention
ve	30	70
vtd	38	17
ate	87	87
atl	10	10
apl	10	10
sq	90	90
sqg	25	25
sqtd	10	10
sql	7	7
other	allonpost	allonpost
attackRate	7144	5547
peakDay	26	27
peakNumber	489	432
isEpidemic	-1	-1
leftBound	18	17
rightBound	47	49

Theoretical strongest and weakest pharmacuetical intervention (PI) & logistical implementation (LI):

Active Duty Military on base: 27663
Civilian Workers on post 15912

	Active Duty	Civilian Workers
Strong PI, Strong LI	24.560%	0.019%
Weak PI, Strong LI	24.173%	0.057%
Strong PI, Weak LI	23.045%	0.214%
Weak PI, Weak LI	24.600%	0.101%


Strongest
Weakest
Control
500
400
300
200
100
0
0
10
20
30
40
50


Strongest
Weakest
Control
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50

In [715]: