SIMULATED TABLETOP EXERCISE FOR RISK MANAGEMENT - ANTI BIO-TERORISM MULTI SCENARIO SIMULATED TABLETOP EXERCISE

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ABSTRACT

In this paper we focus on the concept of simulation supported tabletop exercise and its application to risk management for bio-terrorism by smallpox. For the purpose we have developed the simulation model of the infection process by smallpox on a virtual city. The simulation supported tabletop exercise has designed on our simulation model for risk management by evaluating several types of policy scenarios against bio-terrorism by smallpox. The simulation supported tabletop exercise was executed by some professionals against bio-terrorism at Global Security Center, Keio University. We clarify the model structure of the simulation against bio-terrorism and its countermeasure policies. We also show the result executed at Global Security Center.

MODEL FOR SIMULATION EPIDEMIOLOGY

SIMULATION EPIDEMIOLOGY

The development of a simulation epidemiology model that enables various specialists in fields such as urban development and infectious diseases to easily get involved in modeling of emergent and re-emergent infectious diseases like smallpox and influenza and to conduct tabletop exercises based on that model has an important role to play in the evaluation of countermeasures to deal with the threat of these diseases.

The epidemiology model is equipped with a large number of parameters. By combining these parameters, a wide variety of scenarios can be created. These can be roughly divided into three types: 1) Urban scenario; 2) Pathological scenario; and 3) Policy scenario. By conducting simulations based on these created scenarios, it is possible to effectively assess policy proposals.

Thus, the simulation epidemiology model makes it possible to experience and assess infectious disease preparedness – something that is impossible to do in the real world (non-virtually) – through computer simulations.

The simulation model is composed of three modules: 1) Pathological transition module; 2) Urban and population structure module; and 3) Infection process module. Infection prevention countermeasures are introduced to the model at various levels, and assessments are conducted.

PATHOLOGICAL TRANSITION MODEL

In order to describe a pathological transition of emerging or re-emerging infectious diseases such as smallpox and influenza, we categorized infection levels into several states, and utilized a model that is defined by 1) the number of days spent that each state endures, and 2) the probability of transition between states. Figure 2 shows the general framework of the model, and Figure 3 and 4 show the pathological transition models in the cases of smallpox and influenza, respectively.

Circled numbers denote pathology levels.

1) Level 0 denotes the stage before infection;
2) level 1 denotes a state of infection before the appearance of symptoms, before the virus is eliminated;
3) level 2 denotes a state of infection after the appearance of symptoms, after the virus is eliminated;
4) sequence 2m→3m→5→0i shows a transition of states expressing an unapparent infection;
5) sequence 3→5→0i shows a general transition of states from infection to recovery;
6) level 3s denotes that symptoms are more serious than at level 3;
7) sequence 3s→4c→D shows a transition of states from serious symptoms, to life-threatening condition, and to death;
8) sequence 3s→4m→5→0i shows a transition of states from serious symptoms to recovery;
9) level 0i denotes a state of recovery and acquisition of immunity.

The lines between pathological states represent transition routes, and numbers and letters over the lines express transition probability.

The items circled by the dotted lines express the duration of each pathological state.

The process of pathological transition also varies according to medical treatment patterns. However, here we have omitted any variation of transition processes due to medical treatment.

URBAN AND POPULATION STRUCTURE MODEL

Population Composition Model. The population is categorized into five generations (baby, schoolchild, student, young, middle, and old). We assumed that the "middle" and "old" generations make up 30% of the population, all of which has permanent immunity, while the remaining generations (baby, schoolchild, student, young) make up 70% of the population and do not have immunity. Table 1 summarizes this assumed population composition model.

City Structure and Human Activity Model. The urban structure in this model is not a replica of an actual city. It has been created as a generic city model by extracting factors related to infection. These factors related to infection are as follows.

1) Family composition ratio: The proportion of families having a particular number of members
2) School enrollment rate: Proportion of "schoolchild" and "student" generations going to school
3) Employment rate: Proportion of "young" and "middle" generations commuting to a workplace. Does not include the self-employed working from home or farmers. "Young" people commuting to university are included here.
4) City size: Assumed size of city in terms of population. Here we assumed a city of 10,000 people.
5) Number and size of offices: Number of offices and their size (small, medium, large)
6) Number of schools: Number of elementary, junior high and high schools

The characteristics of the human activity model are as follows.

1) Workers and students commute to their workplaces and schools via transportation channels (such as train carriages and buses of certain capacities).
2) Infected persons are taken to hospital, depending on their condition.

Figure 5,6 and 7 show a city structure model, a family structure model and a human activity model respectively.

Table 1
Population Composition Model

Generation	Age	Rate	Immunity
baby	0-5	10 %	absence
schoolchild	6-12	20 %	
student	13-18	20 %	
young	19-34	20 %	
middle	35-59	20 %	presence
old	60	10 %	

Note that infection in a hospital is not included within the scope of this model.

INFECTION PROCESS MODEL

In this model, we assume the two way of virus contamination process. The one is "person to place" contamination (Figure 8) and the other is "place to person" contamination (Figure 9). In other words, we do not discuss direct person-to-person infection.

Several contamination and infection protection filters exist among the infection processes. In this model, we used the following four types of filters (Figure10, 11) and vaccination (Figure 12).

(1) Discharge (Excretion) suppression filter: We assume that "filters" such as masks are used as a measure to suppress contamination of places by infected persons.

(2) Decontamination filters for places: We assume that "decontamination filters" such as disinfectants are used to attenuate the contamination of infected places over time.

(3) Infection prevention filter: As means of suppressing infection from places to people, we assume that "prevention filters" such as the spatial (population) density of places and individual safeguards such as N95 masks are used. Note that the lower the spatial (population) density of a place, the lower the risk of infection.

One possible form of spatial density countermeasure is to promote more flexible working hours so that people can commute at staggered times, in order to ease the congestion of public transportation. Another way is to change the layout of classrooms to reduce proximity between students.

(4) Disinfection filter for individuals: We assume that "disinfection filters" are used to reduce the degree of infection of people over time.

Furthermore, the contamination of individuals will ultimately be determined by the risk of infection to individuals. This risk depends on "antibody titer," which is determined by vaccination (Figure 12). In addition to medical countermeasures such as vaccination, these several social filters (Figure 11) play a major role in protection from infection. In this epidemiology model, infection countermeasures combining medical countermeasures and social filters can be set using parameters. Multiple policy scenarios can be assessed by simulating such countermeasures. The parameter setup method is explained in detail in the

Table 2
List of Externally Definable Parameters

Parameter name	Explanations	Notes	Example of Value	Range of variance
$EnSAF_home	Environment attenuation filter (Family)	Filter for space Be derived from environmental factor (for example humidity) 0: extinction 1: no attenuation	0.8	0-1
$EnSAF_office	Environment attenuation filter (Workplace)		0.8	0-1
$EnSAF_school	Environment attenuation filter (School)		0.8	0-1
$EnSAF_traffic	Environment attenuation filter (Traffic)		0.8	0-1
$StSAF_home	Disinfect attenuation filter (Family)	Filter for space Virus is attenuated by disinfection with time. 0: extinction 1: no attenuation	1	0-1
$StSAF_office	Disinfect attenuation filter (Workplace)		1	0-1
$StSAF_school	Disinfect attenuation filter (School)		1	0-1
$StSAF_traffic	Disinfect attenuation filter (Traffic)		1	0-1
$VSS_home	Space density filter (Family)	Filter for space to people The size of space can be infection defense. The larger size of space, the smaller risk of infection	400	Counting number
$VSS_office	Space density filter (Workplace)		1000	Counting number
$VSS_school	Space density filter (School)		800	Counting number
$VSS_traffic	Space density filter (Traffic)		400	Counting number

$a	Infection Parameter	Fitting Parameter[2]	0.05	fixed
$ability	Vaccination ability	Showing vaccination ability of health center. The value shows, how many people can be given a vaccine a day	300	Counting number
$agent_ACPF	Pollution defense filter	Filter for space to people Protecting from pollution from space is possible with mask etc. 0: complete protecting 1: no protecting	1	0-1
$agent_EPF	Discharge prevention filter	Filter for people to space Wearing mask etc. can prevent pollution to space 0: no pollution 1: complete pollution.	0.3	0-1
$agent_EnAAF	Environment attenuation filter（People）	Filter for people Derived from environmental factor (for example humidity) 0: extinct 1: no attenuation	0.8	0-1
$agent_PC_baby	antibody value（Infant）	Showing, how much antibody value each generations have. This value can be varied from vaccine etc. 0: perfect antibody 1: no antibody	0.8	0-1
$agent_PC_middle	antibody value（Middle-age）		0.3	0-1
$agent_PC_old	antibody value（Elderly people）		0.3	0-1
$agent_PC_schoolc hild	antibody value（Child）		0.8	0-1
$agent_PC_student	antibody value（Student）		0.8	0-1
$agent_PC_young	antibody value（Young people）		0.8	0-1
$agent_StAAF	Disinfect attenuation filter（People）	Filter for people. 0: Virus is killed off by etc sterilization. 1: no sterilization	1	0-1
$expname	Scenario name	Note: Letter string set here will be an output as a log-file.	scenario1	Letter string
$iso2	Hospitalization rate at level 2	The chance of being hospitalized at pathology level 2	0/100	0-1
$iso3	Hospitalization rate at level 3	The chance of being hospitalized at pathology level 2	80/100	0-1
$maxvactine	Stock of vaccination	The amount of vaccination stock by the government; they are available in the beginning of simulation and the number does not increase.	3000	counting number

2 Fitting parameter is a parameter, which determines the risk of infection, but that's applied as fixed value here.

$middle_jobrate	Percent of middle-aged individuals at work	The percentage of the middle-aged at work/office; not an employment rate. The percentage tends to be lower for farming society.	0.8	0-1
$officeclose	Workplace closure	Whether or not to close office. If closed, the spread of infection stops but so is economic production.	no	yes, no
$p23	Transition probability from level 2 to level 3	The chance of moving from pathology level 2 to 3.	0	0-1
$schoolclose	School closure	Indicator, whether closing the school or not at the beginning of vaccination. Infection at school can prevent by closing school.	no	yes, no
$st_attrate	Percent of students at school	This percent of students goes to school.	1	0-1
$strategy	Vaccine policy	What kind of vaccine policy should be made? For mass-random or only young generation? How much range should be the target at the network of infected people?	young_red	no, all, all_red, all_yellow, young, young_red, young_yellow
$symptom	Rate of apparent infection	chance of the infection being an apparent one With the rate of 1-$symptom, pathology level will move to 2m which indicates unapparent infection.	90/100	0-1
$timer1	Duration of time for level 1	Duration of time for pathology level 1. After this, moving into pathology level 2 with the rate of $symptom.	timer=+14/0:0	
$timer2	Duration of time for level 2	Duration of time for pathology level 2. After this, moving into pathology level 3 with the rate of $p23	timer=+3/0:0	
$vacdelay	Delayed vaccination	Duration of time from the start of the pathology level 3 until the start of vaccination; The longer the delay, the larger the number of infected at the time of vaccination.	7	counting number
$young_jobrate	Rate of the youth at work	The percentage of the youth at work / school who show up at the office / classes; not an employment rate. It tends to be lower in a farming society.	0.8	0-1

next section.

PARAMETERS AND SCENARIO

LIST OF PARAMETERS

To enable assessment of multiple policy scenarios, pathological scenarios, and city scenarios by simulation, this model is equipped with parameters that can be set externally. Here, in Table 2, we list a total of 40 parameters that can be set externally, along with some explanations.

VACCINATION POLICY

There are seven choices of vaccination policy, and the following is their explanations.

- no vaccination
- all random vaccination for all generations
- all_red vaccination for 1) infected individuals, 2) their families, 3) their colleagues at work or school (refer to Figure 13)
- all_yellow vaccination for 1) infected individuals, 2) their families, 3) their colleagues at work or school 4) work/school colleagues of the infected individuals' family, 5) families of the colleagues who goes to school/work with the infected individuals (refer to Figure 14)
- young random vaccination for the youth
- young_red vaccination for only the youth who are also one of the following: 1) infected individuals, 2) their families, 3) their colleagues at work or school.
- young_yellow vaccination for only the youth who are also one of the following: 1) infected individuals, 2) their families, 3) their colleagues at work or school 4) work/school colleagues of the infected individuals' family, 5) families of the colleagues who goes to school/work with the infected individuals.

TYPES OF SCENARIOS

Here, we broadly divide the above parameters into three types: 1) city scenario; 2) pathological scenario; and 3) policy scenario. Furthermore, we classify the policy scenario into six categories; 1) filter policy for persons; 2) filter policy for person to place; 3) filter policy for place; 4) filter policy for place to person; 5) vaccination policy; and 6) other policies. The results of classification are shown in Figure 15.

TABLETOP EXERCISES

Here, we explain concrete methods and rules for playing tabletop exercises (gaming) using smallpox as a case study. Note that it is not suggested for the gaming players to read the next part "Simulation case studies" before playing gaming, as debriefing material for the gaming is included in the following section.

SIMULATED TABLETOP EXERCISES

This tabletop gaming exercise on infectious disease (Tabletop Gaming Exercise for Pandemic Protection of Smallpox) is to conduct exercises on and discuss emerging and re-emerging infectious disease (smallpox bio-terrorism countermeasures) at the experiential level using gaming simulation. This participation-oriented simulation technique, called gaming (simulation), is extremely useful as a means for stakeholders to share their awareness and understanding of problem situations, and to engage in communication about risk.

In the gaming simulation, participants become players and pursue the roles set in the game. In this way, they can assess the validity of scenarios and evaluate the risks and values of scenarios from the viewpoints of different stakeholders. In addition, gaming simulation can be used as a tool to share values regarding the significance and meaning of policies and decision-making, and as a study tool.

Here, we created a model based on the process of smallpox contraction in a virtual city, using an agent-based simulation, and used it in the game. In particular, this agent -based smallpox simulation model enables us to evaluate the effectiveness of multiple countermeasure scenarios. Thus, the participants of this tabletop exercise formulate countermeasures against smallpox as policy decision-makers, execute simulations in accordance with plans, and evaluate the results.

The gaming simulation is played by game participants (players) and a facilitator who facilitates the game. Here, the players form several teams, and each team plays the role of policy decision-maker and determines the smallpox countermeasure policy scenarios as described below. Computer simulations are then conducted on the countermeasure scenarios developed by different teams, and the results are compared and discussed. This is the basic flow of the tabletop exercise gaming.

The facilitator controls the overall flow of the game, assists in the execution of the simulation, holds a debriefing about the results, and coordinates discussions between the players on crisis management of smallpox countermeasures.

OUTLINE OF SMALLPOX BIOTERO TABLETOP EXERCISES

Specifically, a smallpox countermeasure tabletop exercise game proceeds as follows. The duration of the gaming is between 90 and 180 minutes, including debriefing. Here, we explain the process using the minimum configuration (90 minutes). The minimum configuration can be used with the assumption that the players have a certain level of knowledge about smallpox. Each team determines its countermeasure scenario using the risk management policy described below.

Then we simulate the scenario by "Anti-Smallpox Simulated Tabletop Policy Exercise Program", that is developed on SOARS < http://www.soars.jp> as executable program on Java 1.5 or later. The simulation supported TTE is developed by Hiroshi Deguchi. It can be downloaded from the Center for Agent Based Social Systems Sciences (CABSSS) <http://www.cabsss.titech.ac.jp/en/project/index.html>.

Next, the agent-based simulation of the scenario of each team is executed on the team's PC. Note that progress of the simulation is shown graphically, so it can be displayed for all to see using a projector, if desired. Simulation time depends on the processing power of the PC and also on the scenario. As a guide, a process of about 200 days can be simulated in approximately 15 minutes. After the simulation, a review discussion (debriefing), led by the facilitator, is held on the results of each team and the reasons for the particular results that were produced.

90 minutes case of the Simulated Tabletop Exercise

- 00～20 Explanation of Smallpox and TTE
- 20～50 Team Creation & Scenario Selection
- 50～65 Simulation
- 65～90 Results Analysis and Debriefing

PLAY OF TABLETOP EXERCISE

1) Overall explanation by the facilitator
   The facilitator will give an overall picture of smallpox, the structure of the virtual city on which the simulation will be conducted, possible countermeasures, as well as how to proceed with the game.
2) Team formation
   The minimum number of participants must be at least four, divided into four teams. Thus, although there is no upper limit, it is desirable to limit the number of participants to 20 persons for the smooth functioning of teams.
3) Scenario Selection
   In this gaming, vaccination-related scenarios are mainly selected as the basic strategy against smallpox. Here, we will select scenarios by combining the following six factors.
   1. Vaccine stocks, as a proportion of population (30%, 60%, 100%): 3 types
   2. School shutdown (yes/no): 2 types
   3. Number of vaccinations per day per 10,000 people (20/day, 300/day): 2 types
   4. Delay in commencement of vaccination (none, 7 days, 14 days): 3 types
   5. Targeted generations for vaccination strategy (all, young): 2 types

Table 3
Scenario Card Selection

Card	Explanation	Choice(the number of sheets)
Vaccine stock card	Stock rate of vaccine to population	30%（2 sheets） 60%（1sheet） 100%（1sheet）
School closure card	Indicator, closing school or not at the beginning of vaccination	○（2 sheets） ×（2 sheets）
Amount of vaccination card	Amount of vaccination per 10,000 people	20people/day（1sheet） 300people/day（3 sheets）
Delayed vaccination card	Period of time, from the beginning of simulation to the beginning of vaccination	0 days（1 sheet） 7days（2 sheets） 14days（1 sheet）
Generation target strategy card	Indicator, which generation will be targeted on vaccination	all（2 sheets） young（2 sheets）
Social target strategy card	Indicator, how to make vaccination to the people involved of infected people	random（2 sheets） red（1 sheet） yellow（1sheet）

6. Targeted social networks for vaccination strategy (random, red, yellow): 3 types

These factors are not selected freely. The following selection methods are used.

a) Preparation of cards
Prepare some cards for each of the six scenario factors for selection. (As an alternative, if you cannot prepare cards, you can write the factors on a whiteboard.)
b) Determination of selection order
Team representatives determine the order of their teams from No. 1 to No. 4 by playing rock-paper-scissors or rolling dice.
c) Card selection
Select scenario cards using the "Weber Method," as is shown in Figure 17.

For the first card selection, the No. 1 team, as determined in b), selects its preferred scenario factor out of the six factors, and takes the selected card from the factors. In the same way, the No. 2, No. 3 and No. 4 teams, in this order, take one card from the remaining cards of scenario factors. For the second card selection, the teams select one card in the same way, but this time in reverse order (team No. 4, then No. 3, No. 2 and No. 1). Note that the scenario factors they chose in the first card selection cannot be chosen again. In the same way, card selection is conducted six times so that each team determines all scenario factors.

Ensure that the teams understand this determination method thoroughly in advance, and ask them to discuss the selection order of the scenario factors.

d) Scenario Selection
After selecting the policy scenario then find the scenario number from SmallpoxPandemicProtectionScenario216.pdf as follows in Figure 18.

Parameter names corresponding to each option are as follows.

4) Starting Simulation Program
As a software environment we need Java 1.5 or more on any operating system. Anti-pandemic simulation program is an executable application on Java that is developed on SOARS<www.soars.jp>.
Please unzip(extract) downloaded simulation.zip file. Then simulation folder will appear. You can start the program by clicking run.jar under Java 1.5 environment. Start the simulation program and select the scenario number and click run button as Figure 19.
The progress of the simulation will be displayed graphically as Figure 20. This enables the facilitator to make live comments on the progress of infection as the graphs are projected. The progress of infection of the four teams is visible, if all four simulations are displayed at the same time. This could be achieved using a split-screen setup or with four projectors.

DEBRIEFING

The simulations end after about 15 minutes. When they are finished, the debriefing starts. In the debriefing process, the players compare scenarios and the results of the scenarios. They then discuss what is important for smallpox countermeasures. The following points are important when the facilitator is coordinating the debriefing discussion.

1) About the gaming structure
Here, the teams cannot select scenarios freely. This is because players tend to always select the ideal situation when they are not restricted, making the exercise less than useful. It cannot be shown that scenarios are limited by actual organizational structure or resource restrictions. Instead, the selection of scenario cards by teams, according to the importance they place on different scenario

Table 4
Correspondence of Card Parameters

Card	Parameter	Value
Vaccine stock card	$maxvactine	3000, 6000, 10000
School closure card	$schoolclose	Yes, no
Amount of vaccination card	$ability	20, 300
Delayed vaccination card	$vacdelay	0, 7, 14
Generation target strategy card	$strategy	all, all_red, all_yellow, young, young_red, young_yellow
Social target strategy card	$strategy	

factors, reflects differences in ideas between the teams.

2) Total number of strategies
There is a total of 216 scenario combinations (3 × 2 × 2 × 3 × 2 × 3), i.e., stock cards: 3 types; school shutdown cards: 2 types; number of vaccinations cards: 2 types; vaccination delay cards: 3 types; targeted generations cards: 2 types; and targeted social networks cards: 3 types. Though omitted here, there are actually many more types of countermeasures to be considered, including "filter" type countermeasures, such as shutting down offices, spatial density countermeasure, and virus discharge restriction countermeasure. The possibilities of such countermeasures can be discussed.

3) Countermeasure implementation issues
In order to make it possible to execute countermeasures, it is essential to have the programs and project management to execute them. Therefore, discuss the social and economic circumstances surrounding infectious disease countermeasures, e.g., How these countermeasures can be implemented? What is the economic impact of implementing these countermeasures?

SIMULATION SUPPORTED TTE CASE STUDY

Tabletop exercise against bio-terrorism by smallpox is already constructed, that is called "Dark Winter"<http://www.terrorisminfo.mipt.org/Dark-Winter.asp>. This is one of the famous tabletop exercises (TTE) for policy making against bio-terrorism risk. On the other hand the TTE support only a single scenario and there is no explicit infection process model inside the TTE. Simulation supported TTE or Hybrid simulation are hybridization of gaming simulation by human players and agent based simulation by machine agents, that will support better human communication and mutual learning among agents that include the decision makers who use the model. Figure 21 shows the concept of hybrid gaming simulation and simulation supported tabletop exercise.

The TTE was executed at Global Security Research Institute, Keio University (G-SEC) <http://www.gsec.keio.ac.jp/english.php> on February 23rd in 2008.

The following picture (Figure 22) is a scene of TTE by political stakeholders against bio-terrorism. The player teams consist of professionals for anti bio-terrorism.

Figure 23 shows the results of the four teams played at Global Security Center.

The TTE supports 216 policy scenarios in the model. The total landscape of 216 scenarios is shown in figure 24, that is phase diagram of small pox infection pattern by simulation for 216 policy scenarios. X axis means the number of vaccinated persons and Y axis means the number of infected persons. The landscape shows that the total number of vaccinated persons becomes an important factor for controlling the number of infected persons even if other policies have failed.

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Figure 1
Outline of simulation epidemiology

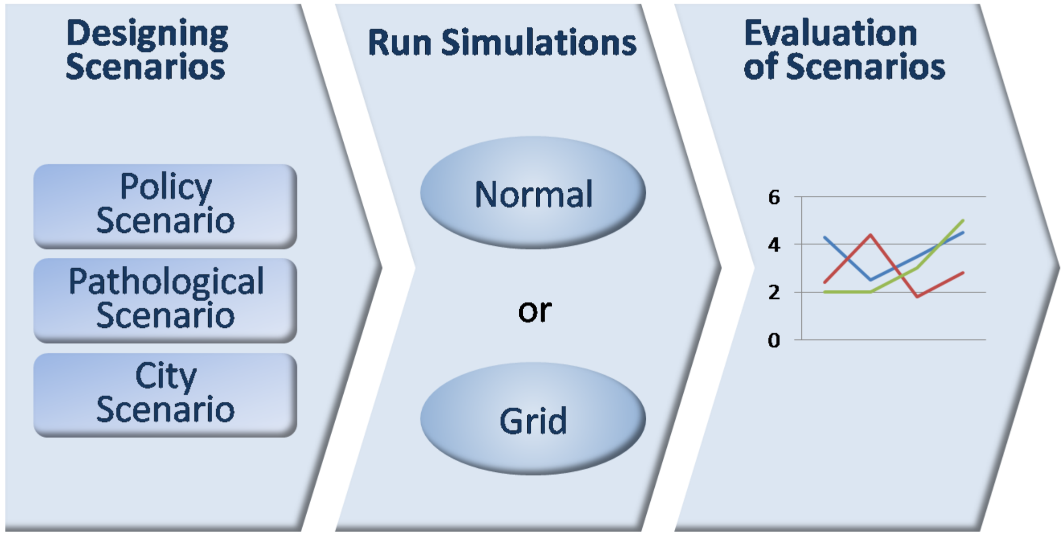


Figure 2
Pathological transition general model

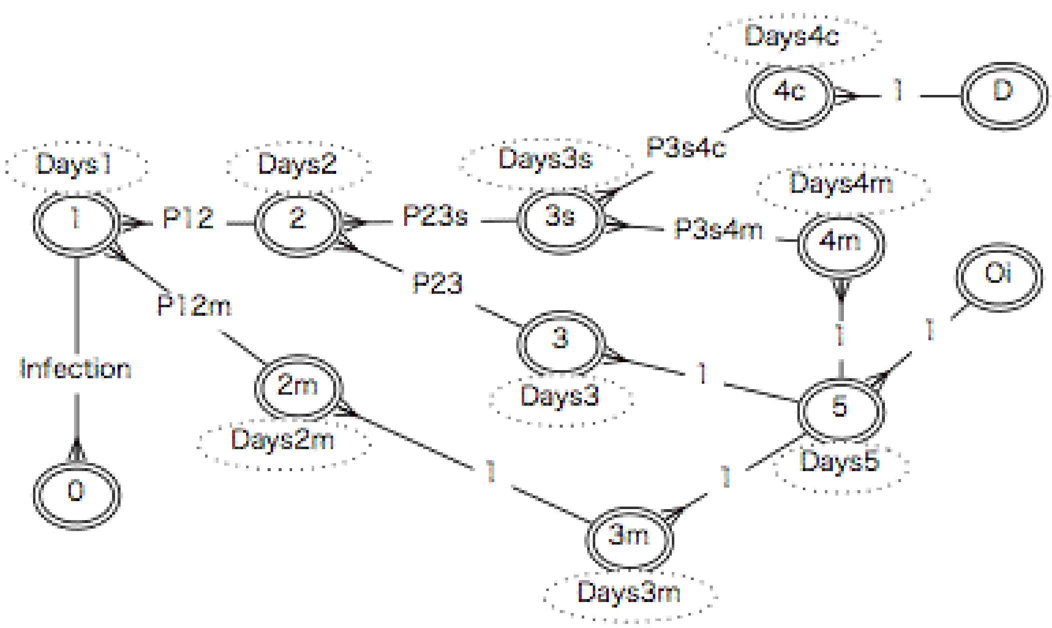


Figure 3
Pathological transition model for smallpox

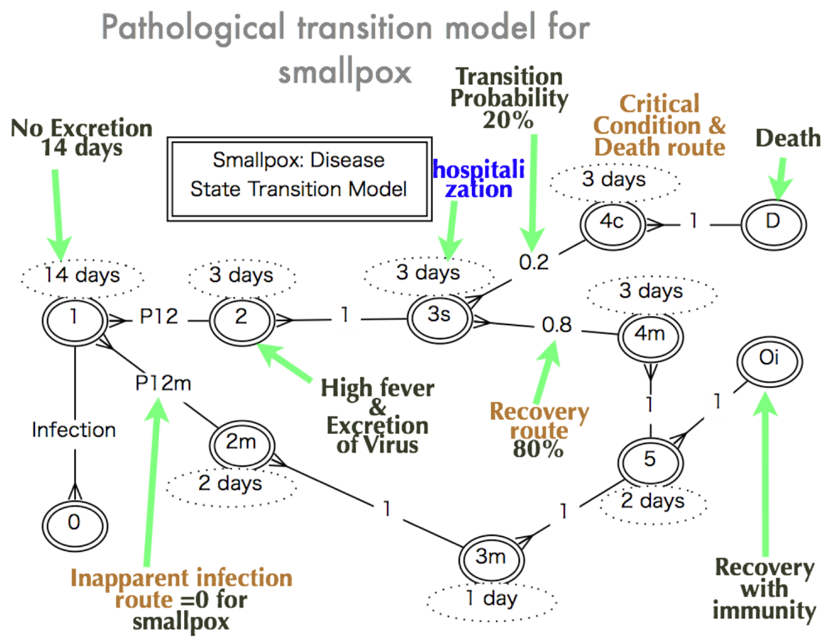


Figure 4
Pathological transition model for influenza

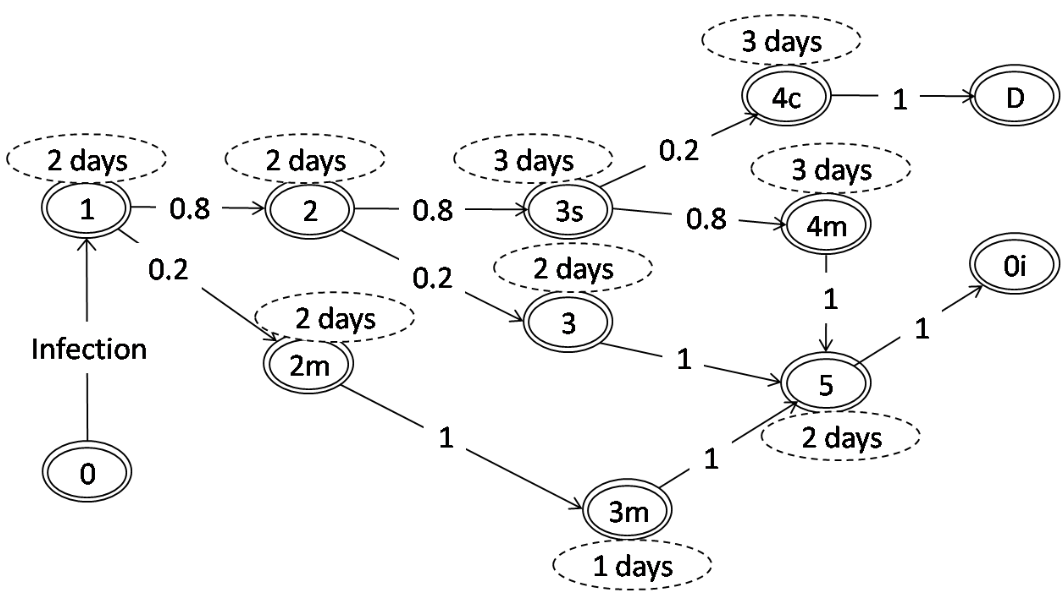


Figure 5
City Structure Model

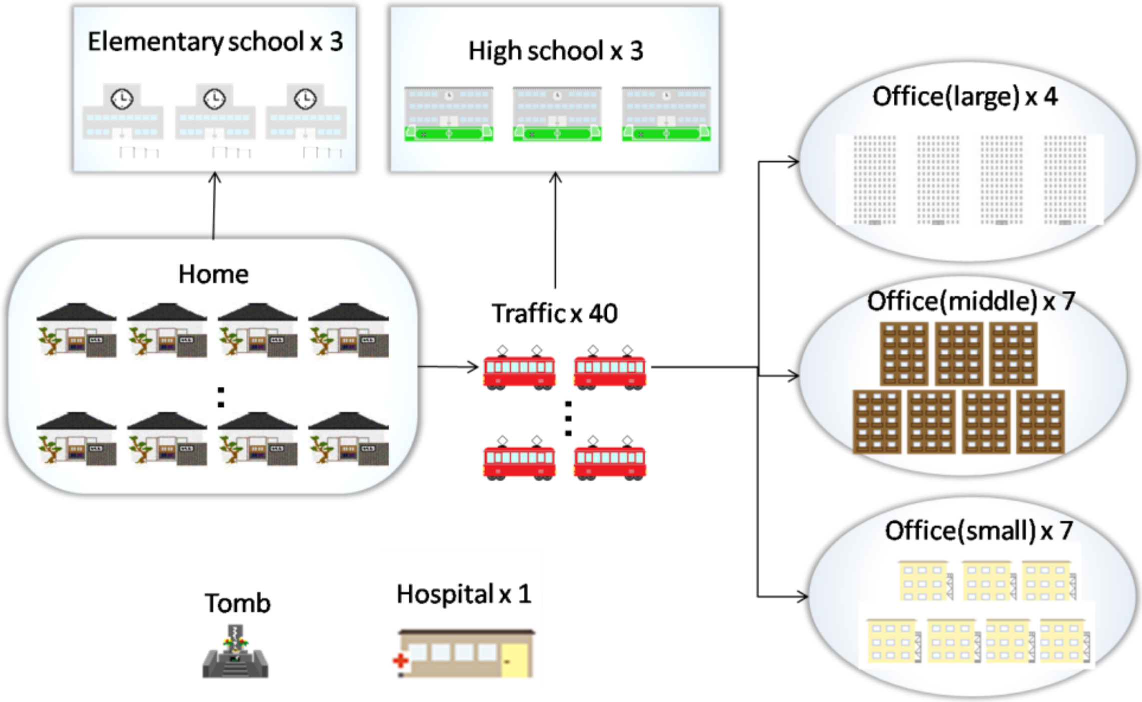
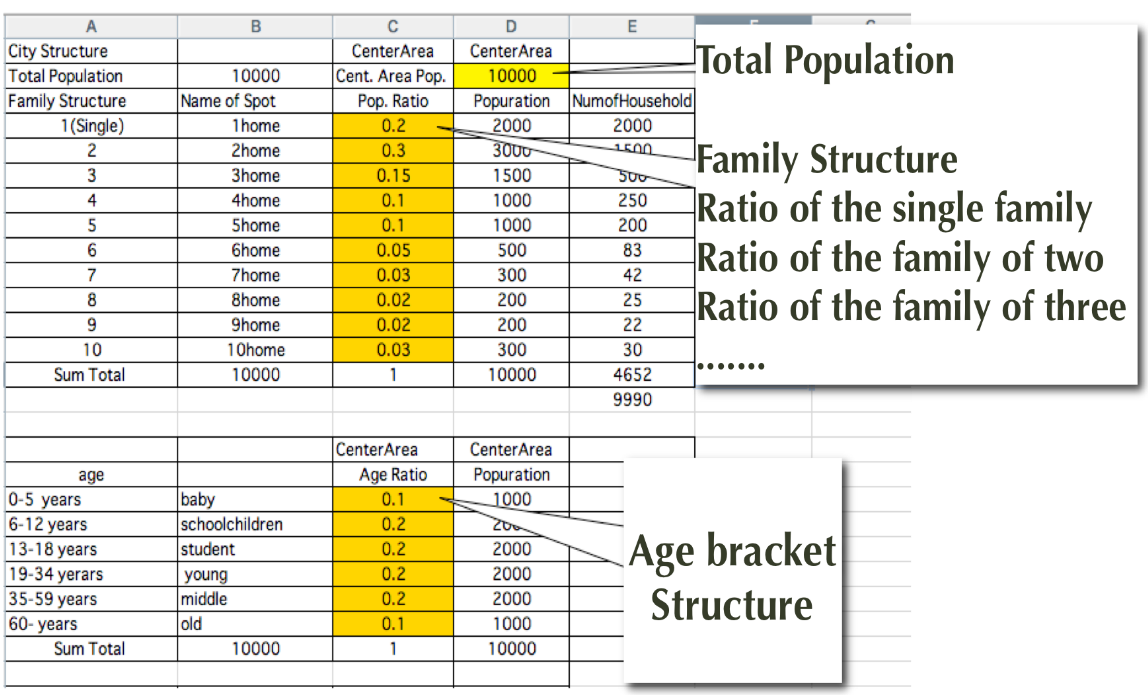


Figure 6
Family Structure Model



A	B	C	D	E
City Structure		CenterArea	CenterArea	
Total Population	10000	Cent. Area Pop.	10000	
Family Structure	Name of Spot	Pop. Ratio	Popuration	NumofHousehold
1(Single)	1home	0.2	2000	2000
2	2home	0.3	3000	1500
3	3home	0.15	1500	500
4	4home	0.1	1000	250
5	5home	0.1	1000	200
6	6home	0.05	500	83
7	7home	0.03	300	42
8	8home	0.02	200	25
9	9home	0.02	200	22
10	10home	0.03	300	30
Sum Total	10000	1	10000	4652
				9990

		CenterArea	CenterArea
age		Age Ratio	Popuration
0-5 years	baby	0.1	1000
6-12 years	schoolchildren	0.2	2000
13-18 years	student	0.2	2000
19-34 yerars	young	0.2	2000
35-59 years	middle	0.2	2000
60- years	old	0.1	1000
Sum Total	10000	1	10000

Figure 7
Human Activity Model

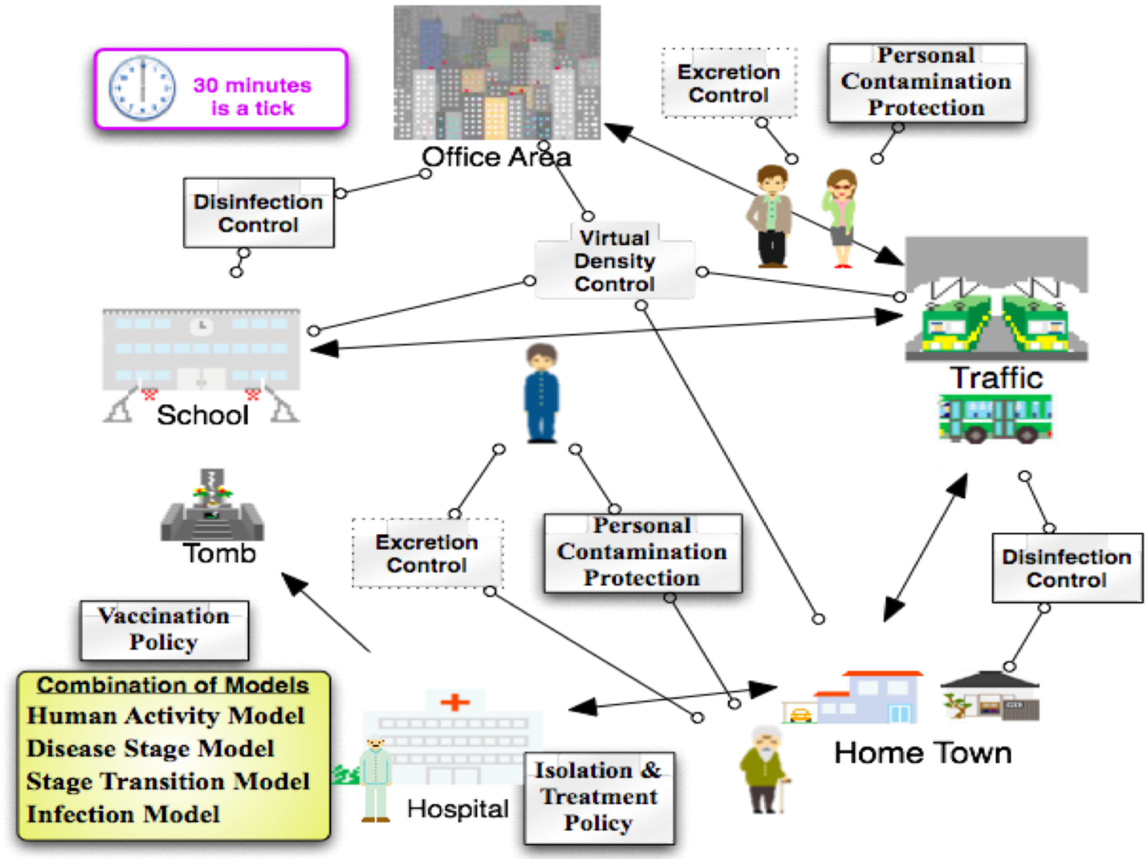


Figure 8
Person to Place Contamination

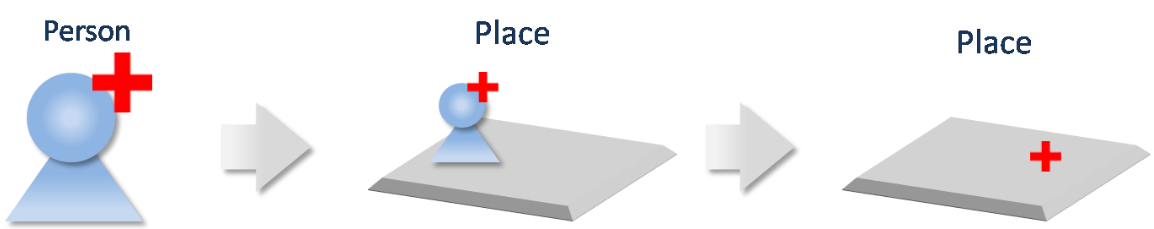


Figure 9
Place to Person Contamination

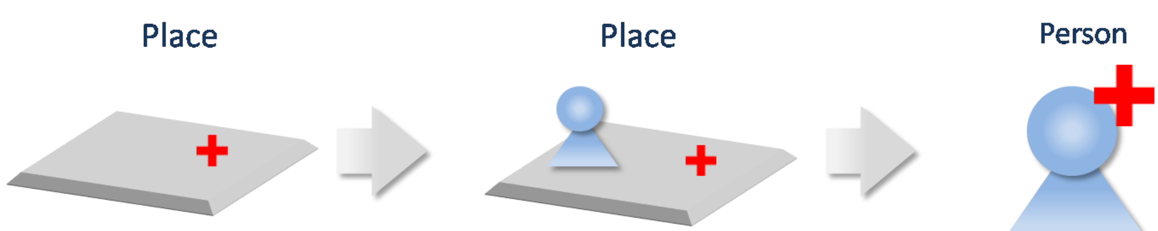


Figure 10
Filter Model

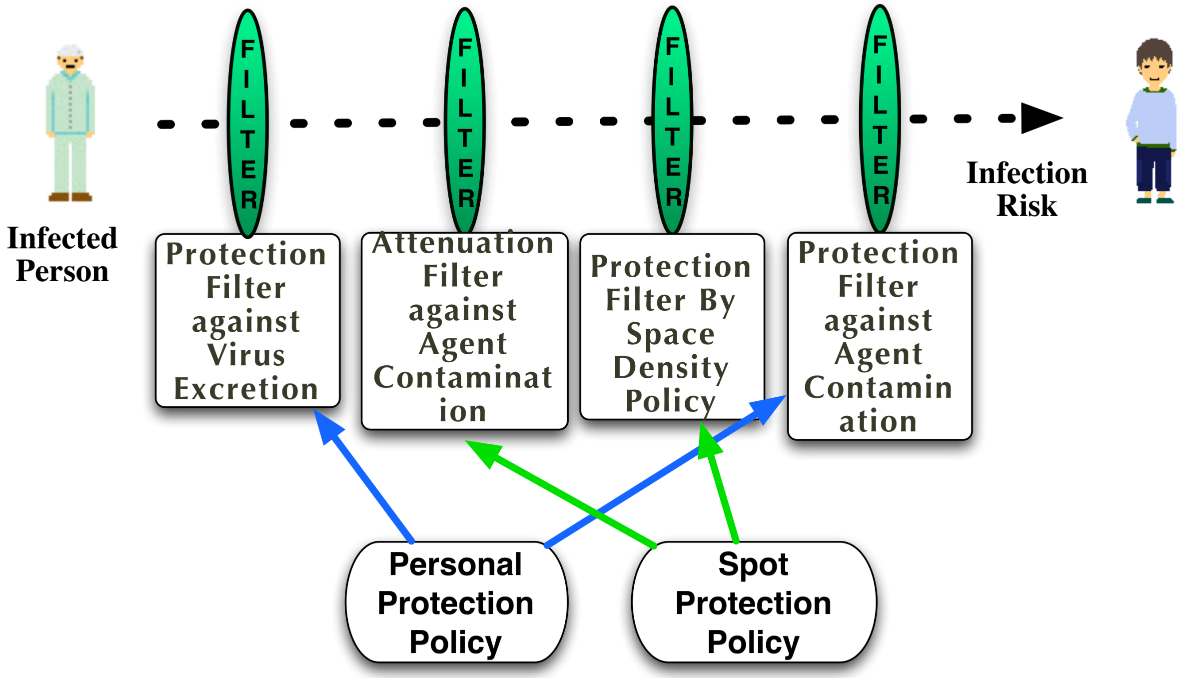


Figure 11
Four Types of Filters

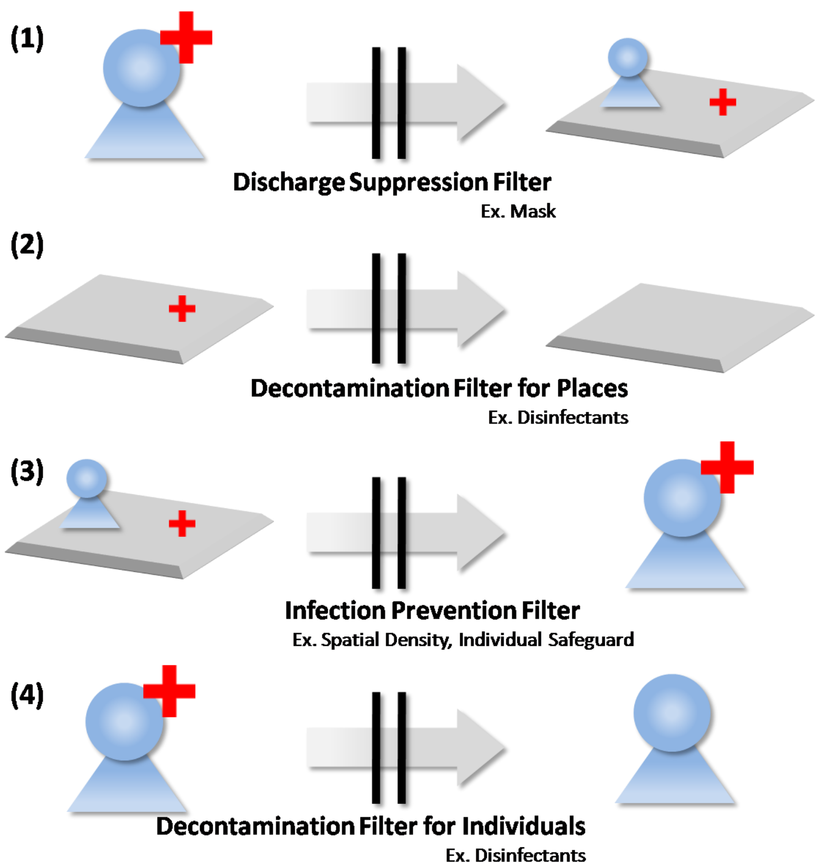


Figure 12
Vaccination as a Filter

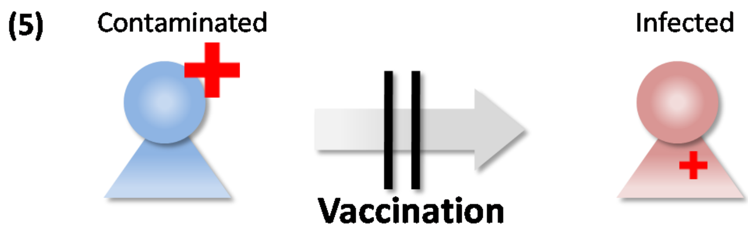


Figure 13
Red Vaccination Policy

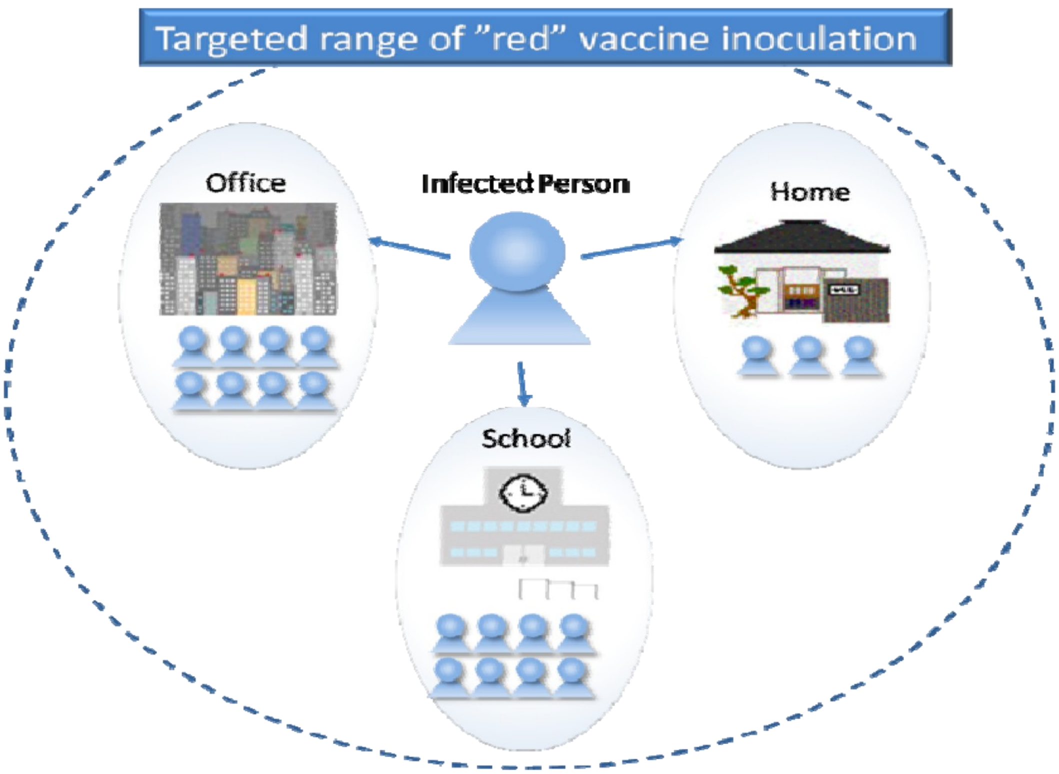


Figure 14
Yellow Vaccination Policy

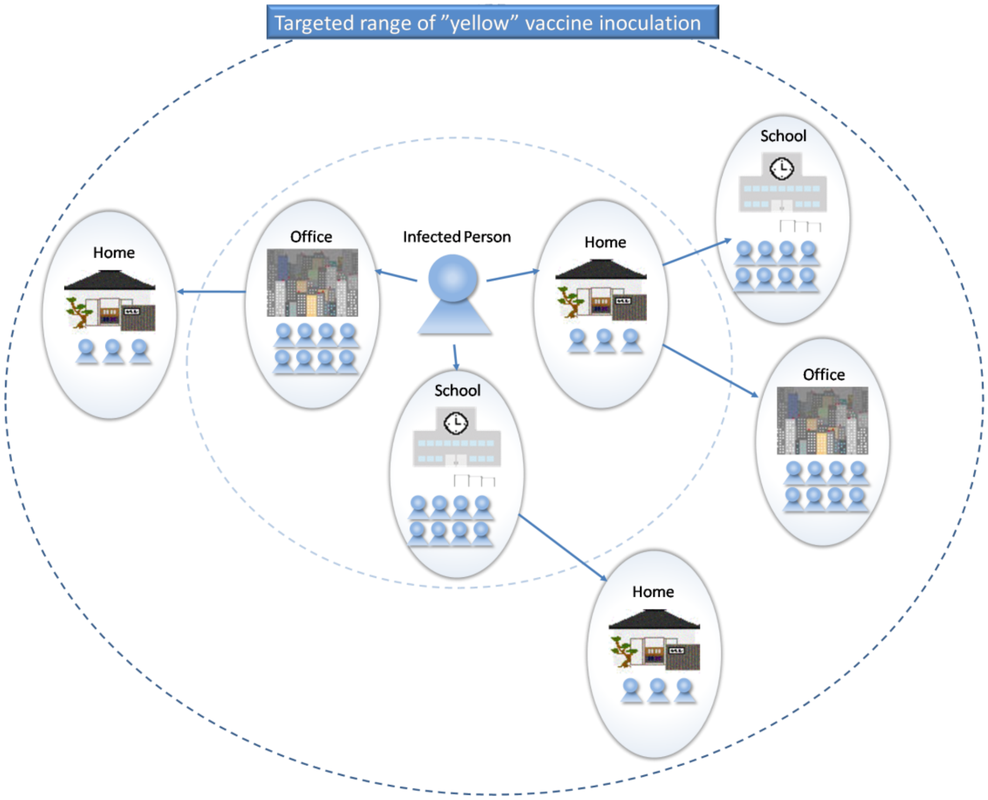


Figure 15
Three Layers of Scenarios

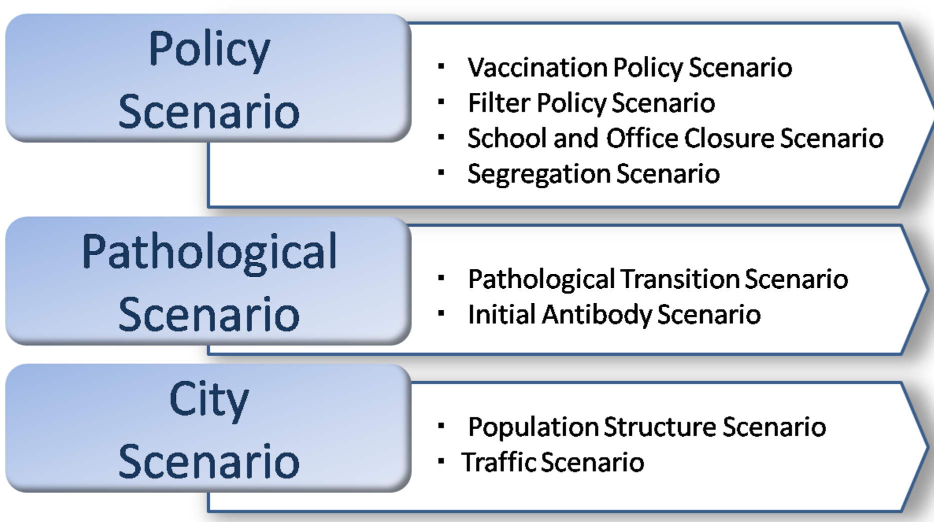


Figure 16
Policy Scenarios Selection

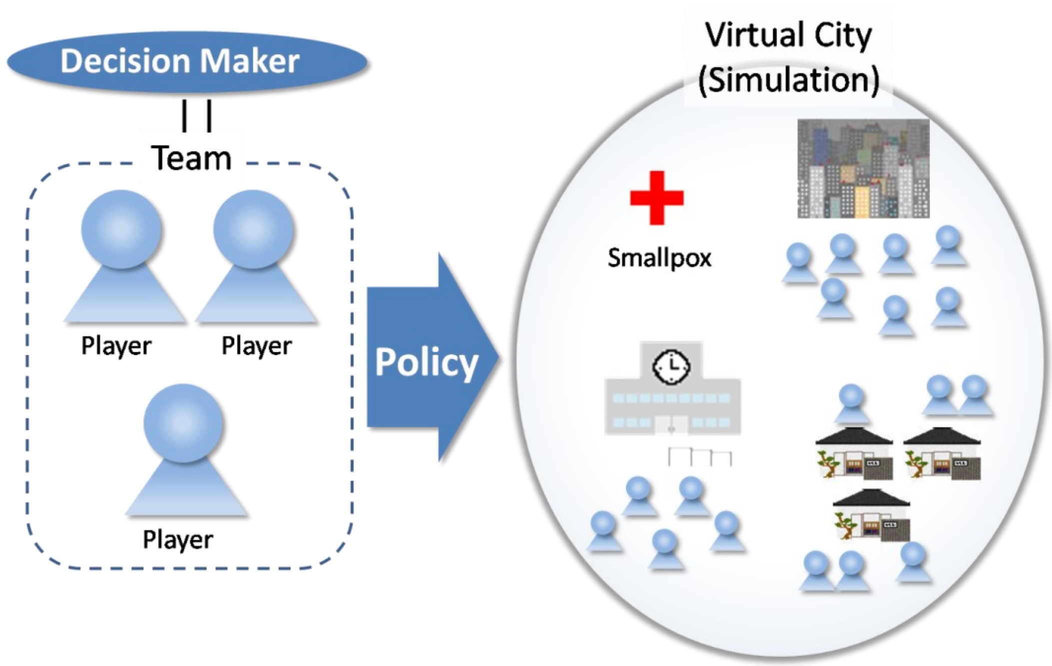


Figure 17
Weber Method for Card Selection

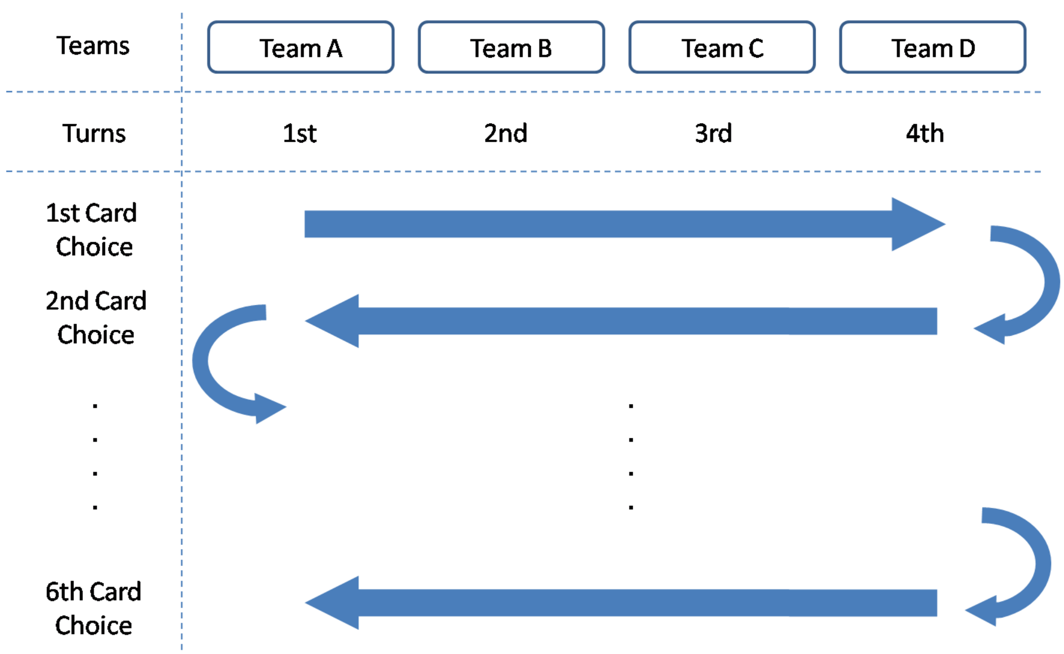


Figure 18
Anti Pandemic 216 Policy Scenarios

Anti Smallpox Policy Scenario Selection

Player name for the selected scenario	Scenario Number	Num. of vaccinated person par day for 10000 person	Stock of Vaccine	Closing of School	Targetted Generation	Targetted Social Group	Delay of Starting Vaccination	Name of Scenario
	Scenario1	20 vaccinated / day for 10000	100%	no	Young	Yellow	14	20_10000_no_yy_14
	Scenario2	20 vaccinated / day for 10000	100%	no	Young	Yellow	7	20_10000_no_yy_7
	Scenario3	20 vaccinated / day for 10000	100%	no	Young	Yellow	0	20_10000_no_yy_0
	Scenario4	20 vaccinated / day for 10000	100%	no	Young	Red	14	20_10000_no_yr_14
	Scenario5	20 vaccinated / day for 10000	100%	no	Young	Red	7	20_10000_no_yr_7
	Scenario6	20 vaccinated / day for 10000	100%	no	Young	Red	0	20_10000_no_yr_0
	Scenario7	20 vaccinated / day for 10000	100%	no	Young	Mass	14	20_10000_no_y_14
	Scenario8	20 vaccinated / day for 10000	100%	no	Young	Mass	7	20_10000_no_y_7
	Scenario9	20 vaccinated / day for 10000	100%	no	Young	Mass	0	20_10000_no_y_0
	Scenario10	20 vaccinated / day for 10000	100%	no	All Generation	Yellow	14	20_10000_no_ally_14
	Scenario11	20 vaccinated / day for 10000	100%	no	All Generation	Yellow	7	20_10000_no_ally_7
	Scenario12	20 vaccinated / day for 10000	100%	no	All Generation	Yellow	0	20_10000_no_ally_0
	Scenario13	20 vaccinated / day for 10000	100%	no	All Generation	Red	14	20_10000_no_allr_14
	Scenario14	20 vaccinated / day for 10000	100%	no	All Generation	Red	7	20_10000_no_allr_7
	Scenario15	20 vaccinated / day for 10000	100%	no	All Generation	Red	0	20_10000_no_allr_0
	Scenario16	20 vaccinated / day for 10000	100%	no	All Generation	Mass	14	20_10000_no_all_14
	Scenario17	20 vaccinated / day for 10000	100%	no	All Generation	Mass	7	20_10000_no_all_7
	Scenario18	20 vaccinated / day for 10000	100%	no	All Generation	Mass	0	20_10000_no_all_0
	Scenario19	20 vaccinated / day for 10000	100%	yes	Young	Yellow	14	20_10000_yes_yy_14
	Scenario20	20 vaccinated / day for 10000	100%	yes	Young	Yellow	7	20_10000_yes_yy_7
	Scenario21	20 vaccinated / day for 10000	100%	yes	Young	Yellow	0	20_10000_yes_yy_0
	Scenario22	20 vaccinated / day for 10000	100%	yes	Young	Red	14	20_10000_yes_yr_14
	Scenario23	20 vaccinated / day for 10000	100%	yes	Young	Red	7	20_10000_yes_yr_7
	Scenario24	20 vaccinated / day for 10000	100%	yes	Young	Red	0	20_10000_yes_yr_0
	Scenario25	20 vaccinated / day for 10000	100%	yes	Young	Mass	14	20_10000_yes_y_14
	Scenario26	20 vaccinated / day for 10000	100%	yes	Young	Mass	7	20_10000_yes_y_7
	Scenario27	20 vaccinated / day for 10000	100%	yes	Young	Mass	0	20_10000_yes_y_0
	Scenario28	20 vaccinated / day for 10000	100%	yes	All Generation	Yellow	14	20_10000_yes_ally_14
	Scenario29	20 vaccinated / day for 10000	100%	yes	All Generation	Yellow	7	20_10000_yes_ally_7
	Scenario30	20 vaccinated / day for 10000	100%	yes	All Generation	Yellow	0	20_10000_yes_ally_0
	Scenario31	20 vaccinated / day for 10000	100%	yes	All Generation	Red	14	20_10000_yes_allr_14
	Scenario32	20 vaccinated / day for 10000	100%	yes	All Generation	Red	7	20_10000_yes_allr_7
	Scenario33	20 vaccinated / day for 10000	100%	yes	All Generation	Red	0	20_10000_yes_allr_0
	Scenario34	20 vaccinated / day for 10000	100%	yes	All Generation	Mass	14	20_10000_yes_all_14
	Scenario35	20 vaccinated / day for 10000	100%	yes	All Generation	Mass	7	20_10000_yes_all_7
	Scenario36	20 vaccinated / day for 10000	100%	yes	All Generation	Mass	0	20_10000_yes_all_0
	Scenario37	20 vaccinated / day for 10000	60%	no	Young	Yellow	14	20_6000_no_yy_14

Figure 19
Start the Simulation after Selecting a Scenario

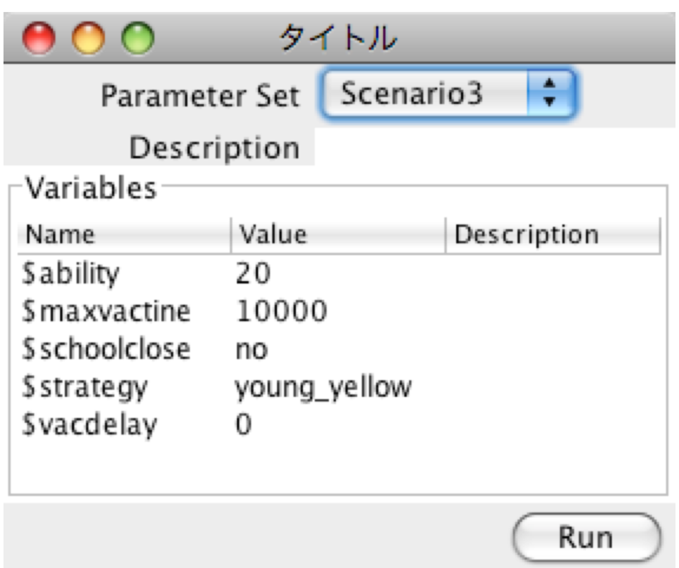


Figure 20
Real Time Graph of Simulation Process

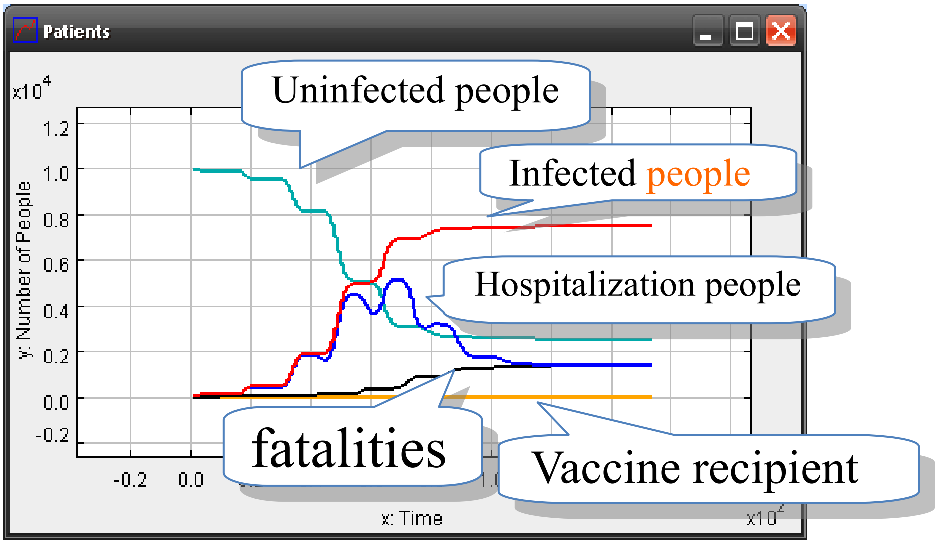


Figure 21
Concept of Hybrid Simulation & Simulated Tabletop Exercise

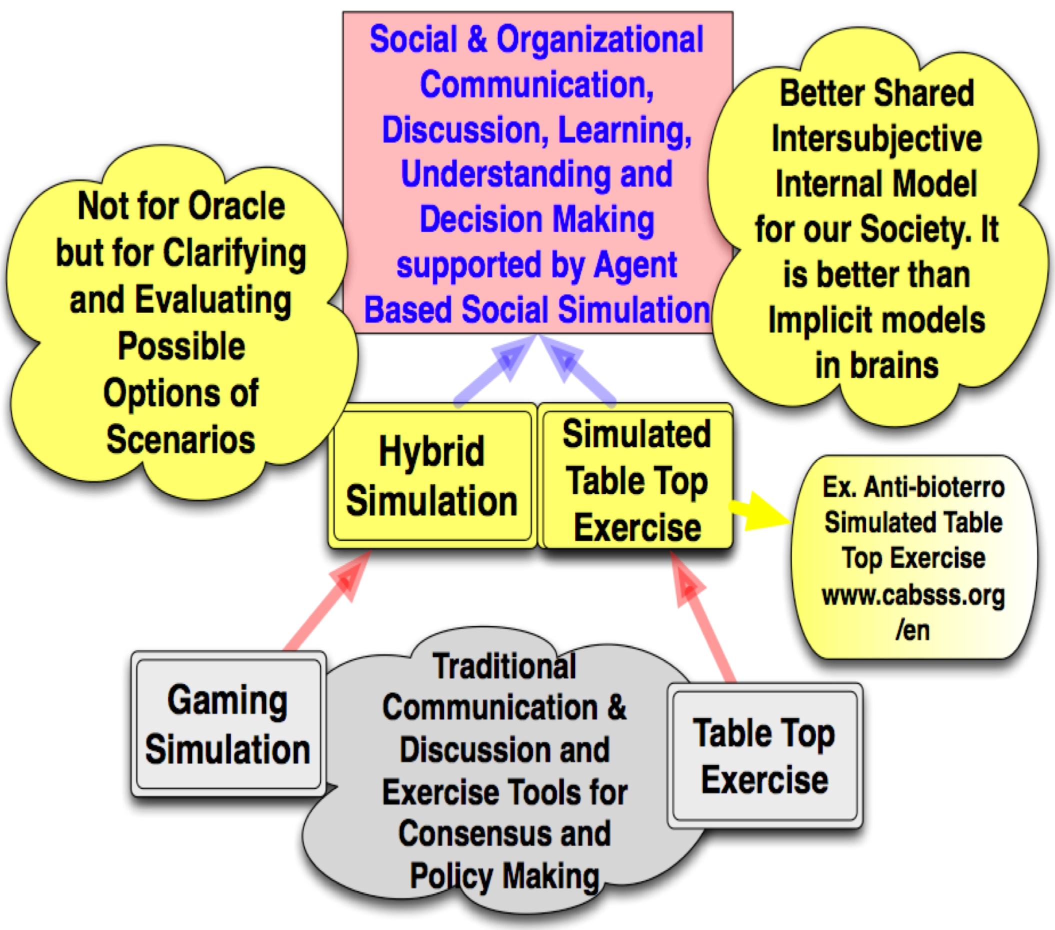


Figure 22
Simulation Supported TTE executed at Global Security Center

Figure 23
Results by Four Teams

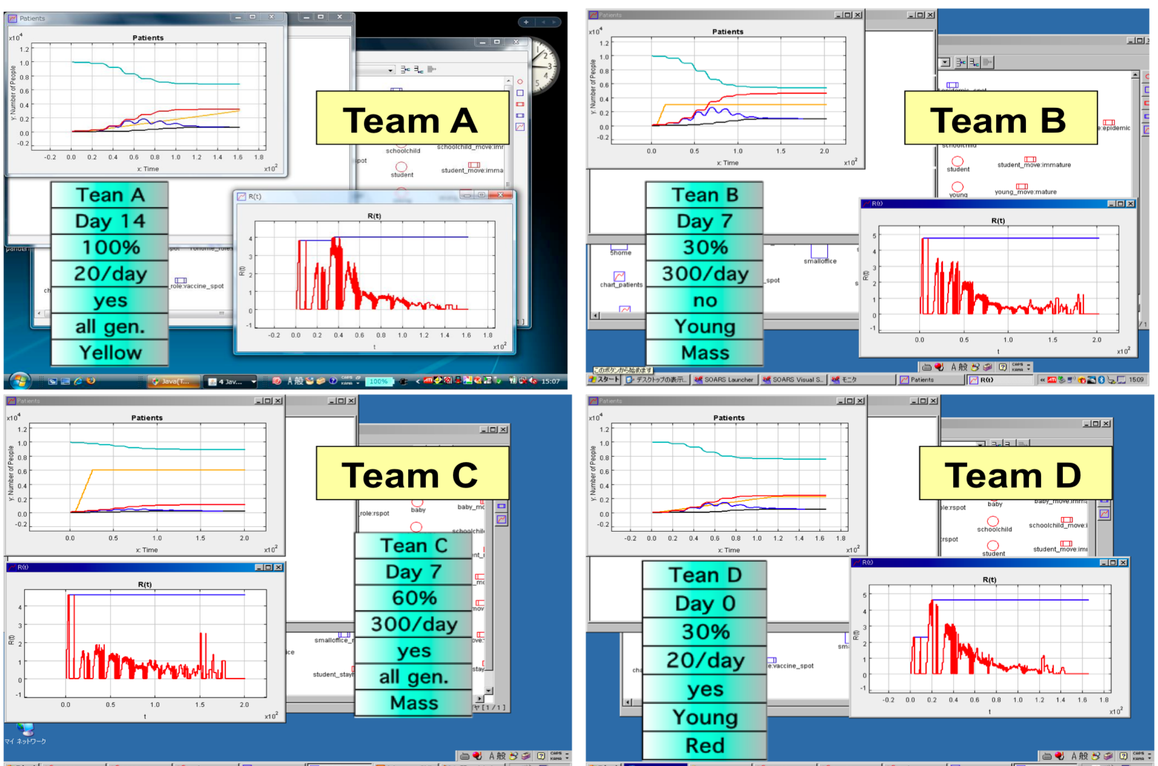


Figure 24
Total Landscape of 216 Scenarios