Instructions for the Use of GAMA Platform to Run Simulations Associated with Paper

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**Introduction:** GIS-Agent-based Molding Architecture, also known simply as GAMA platform is free and open coding program created to help researchers model spatiality explicit agent-based simulations. In the paper, **“When Care is Shared: An Agent-Based Model Analysis of Infectious Disease in Nursing homes When There Exists a Shared Network of Caregivers using SARS-CoV-2 Outbreak”,** we used GAMA to create our simulations. In order for other researchers and professionals to replicate our results or if they are interested in using our project code for their own interests we give overview of how the code is structure, variables used in the code, instructions for how to change critical variables, and how to interpret the output GAMA provides.

**Selection 1: Instructions To Obtain GAMA Program, Paper Project Code, and Implementation of Code Into GAMA**

Step 1: Download GAMA installation program specific to your operating system from the following link: <https://gama-platform.org/download>.

Step 2: Install GAMA onto your local drive and set up your own GAMA workspace within the drive. Workspace is where you are going to store your personal GAMA projects, such as the code found in the paper.

Step 3: Download zip file off **GitHub** containing project folder by clicking on code button and selecting download zip.

**GitHub Link** : https://github.com/Corkran1/NH\_COVID/tree/master/models

Step 4: Open GAMA and find User Models within models tab. Create a new project and name it accordingly. Afterwards copy NH-V2 folder into your newly created project folder within your GAMA workspace. Lastly, hit the refresh button in the model window and you should see three files; **global.gaml, MainGUI.gaml, sp.gaml**, and a folder named Parametrization folder. In the parametrization folder you should have **GSA.gaml.**

**Section 2: How Do I Use GAMMA to Do Simulations?**

Step 1: Open up MainGUI.gaml file through models window in GAMA. Find your project folder within user models where you have put copied code from the download zip file.

Step 2: Find line **44**. This line of code is telling GAMA to run a certain type of experiment x amount of times, so to change it simply change number to the right of repeat to your desired number of simulations. For our simulations we set this number to 2,000.

**Section 3: How can I change parameters in GAMMA to match my specific settings?**

Step 1): Find GSA.gaml file within model window in the same manor as before with MainGUI.gaml. The only addition here is that you first have to find the parametrization folder within your project and then click on it to find GSA.gaml file.

Step 2: Use following table to find prominent parameter to change. Once found all you have is change the value that parameter is equal to.

Table 1: Parameter Values and Location

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Description** | **File & Line** | **Paper Value** | **How to Change** |
| Int nResA | Resident Size for Nursing Nome A | SP. Gmal file, Line: 23. | 56 | Replace 56 with your resident size. |
| Int nResB | Resident Size for Nursing Home B | File: SP. Gmal file,  Line: 24. | 82 | Replace 82 with your resident size. |
| Int nStaffA | Staff Size for Nursing Home A | File: SP. Gmal,  Line: 27 | 25 | Replace 25 with your estimated staff size for NH1. |
| Int nStaffB | Staff Size for Nursing Home B | File: SP. Gmal  Line: 28 | 40 | Replace 40 with your estimated staff size for NH2. |
| Float Introduction\_p | Probability of infection from community | File: SP. Gmal  Line: 48 | 5% | Replace 5% with your value you want to assign to this probability. |
| Float Test\_sensitivity | How effective is COVID picked up by testing | File: SP. Gmal  Line: 56. | 0.80 | Replace % with your sensitivity value. |
| Int TestingFreq | Frequency of testing. | File: SP. Gmal  Line: 55 | 14 | Replace with time frame with your desired time frame. |
| Int sharedStrength | Number of staff shared between nursing homes. | File SP. Gmal  Line: 37 | Depends on shared staff scenario. | To get desired percentage, change value that will what you want. |
| Map<string, float> TurnsDistribution | % breakdown of caregivers who work morning, afternoon, night | File SP. Gmal  Line: 30 | Multinomial ~ (morning = 40%, afternoon = 40%, night = 20%) | Change % breakdown to match your specific nursing homes. |
| Map<int,float> StaffDistribution | % breakdown of caregiver by type. | File SP. Gmal  Line: 31 | Multinomial ~ (RNA = 0.68, LPN = 0.18, RN =0.14) | Change % breakdown to match your specific nursing homes. |
| float Asymptomatic\_p | % of agents who are asymptomatic. | File SP. Gmal  Line: 47 | 38% | Change to match your desired asymptomatic %. |
| float PPE\_OR | Odds Ratio for the use of PPE | File SP. Gmal  Line: 58 | 14.67% | Change % to match desired PPE effect ratio. |
| float p\_PPE\_res | % of PPE used by resident | File SP. Gmal  Line : 59. | 3% | Change % to match desired PPE level used by resident ratio. |
| float p\_PPE\_staff | % of PPE used by resident | File SP. Gmal  Line: 60 | 5% | Change % to match desired PPE level used by staff ratio. |
| Int PPH\_CN | Number of expected contacts per hour for RNA | File SP. Gmal  Line: 32. | 75 | Change expected number of contacts to match desired number for RNA. |
| Int PPH\_RN | Number of expected contacts per hour for RN | File SP. Gmal  Line: 33. | 6 | Change expected number of contacts to match desired number for RN. |
| Int PPH\_LPN | Number of expected number of contacts per hour for LPN | File SP. Gmal  Line: 34 | 10 | Change expected number of contacts to match desired number for LPN |

**Section 4: Where Can I find the Results within GAMMA Simulation ?**

Table2: Output Labels In CSV File and Description

|  |  |  |
| --- | --- | --- |
| **Column Heading** | **Description** | **Column Heading in CSV File** |
| Seed | Simulation # | Column A |
| Cycle | Cycle, aka timeline, #. This is split into four different timelines for each nursing home . | Column B |
| Name | Nursing Home A = 0 & Nursing Home B = 1 . | Column C |
| nResident | Number of residents per nursing home. | Column D |
| currentRes | # of residents current at nursing home. This number of will change due to hospital visits or deaths. | Column E |
| Infected\_res | # of infected res at each turn. | Column F |
| CIr | Cumulative # of infected residents for all turns up to that point. | Column G |
| Cis | Cumulative # of infected staff for all turns up to that point. | Column H |
| CIss | Cumulative # of infected who work in both homes. | Column I |
| PrevRes | Prevalence Rate among residents. | Column J |
| Activetest | # of active testing among population. | Column K |
| ActivePositive | # of active positive test in population. | Column L |
| pasiveTest | # of passive test in population. | Column M |
| pasivePositive | # of passive test in population. | Column N |
| GlobalShedding\_p | Shedding % per turn. This constant throughout simulations. | Column O |
| Introduction\_p | % of introduction to COVID to staff from community. | Column P |
| sharedStrength | # of staff who are shared between two nursing homes. | Column Q |
| TotalSharedStaff | Cumulative shared staff up to that turn. | Column R |
| TestingFreq | How often routine testing is done on residents and staff. | Column S |
| Test\_Sensitivity | % of test picking up a true positive of COVID-19. | Column T |
| PPE\_OR | How effective PPE is for preventing spread. | Column U |
| Vaccination\_OR\_S | How effective the vaccine is for reducing transmission. | Column V |
| Vaccination\_dist | Level of vaccination among residents and staff. | Column W |
| VaccineEff | We considering the vaccine to be effective for both agent types | Column X |
| Desinfect | Probability that transmission will come from room. | Column Y |
| Deaths | # of Deaths per turn. | Column Z |

**Section 5: Adding Columns to CSV File Output**

If you want to add a variable to the CSV file output, put the name of desired variable and add it to line 47 in the SP. Gmal file. Before you do that make sure to put a comma on the last word on line 47 and then add variable name. For example

Say line 47 has Disinfection, Deaths, and you want to add variable, **Int E\_r (This exposed per resident per time step)**  from the Global. gaml file to the csv file. So that would like that this:  
  
line 47: Disinfection, Deaths, E\_r