



Flu Virus Simulation Analysis

Lecturer: Dr Alexis Drogoul, Arnaud Grinard, Arthur Brugiere

Student: Hai Nguyen Ngoc





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Introduction

Research Overview

- Study focuses on urban flu epidemic modeling using GIS-integrated approach
- Examines effectiveness of local isolation measures in controlling disease spread
- Investigates impact of family structures, vaccination programs, and virus mutations

Objectives and Scope

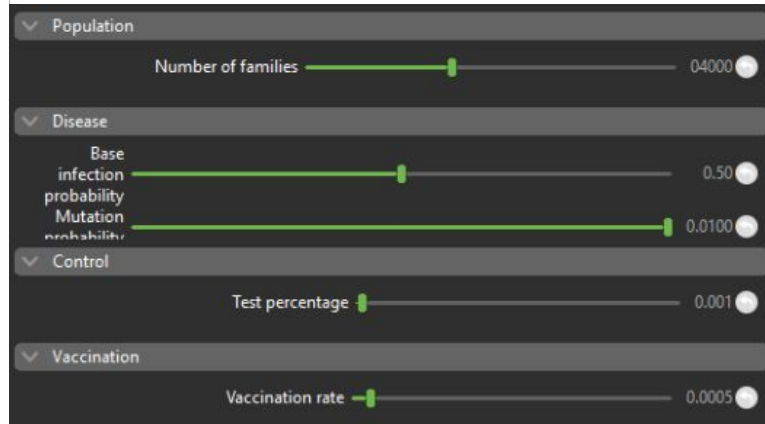
- Evaluate effectiveness of local isolation strategies
- Analyze impact of family structures on transmission
- Assess vaccination program effectiveness
- Study virus mutation dynamics
- Determine optimal vaccination coverage rates

Model Design

GIS Environment



Population Parameters



Initial Parameters

Time Step: 1 hour

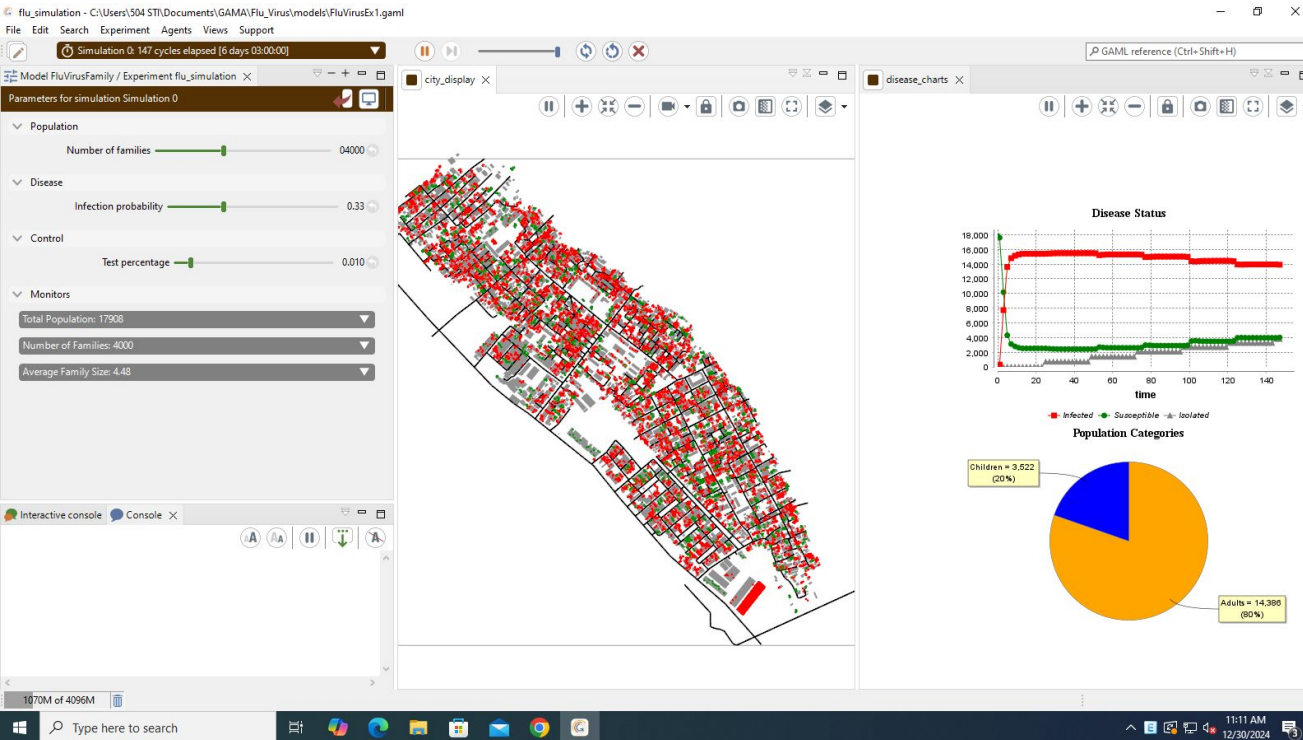
Work Hours: 8:00-17:00

Base infection probability: 33%

Daily testing rate: 1%

Isolation period: 12 days

Model Extensions: Extension 1



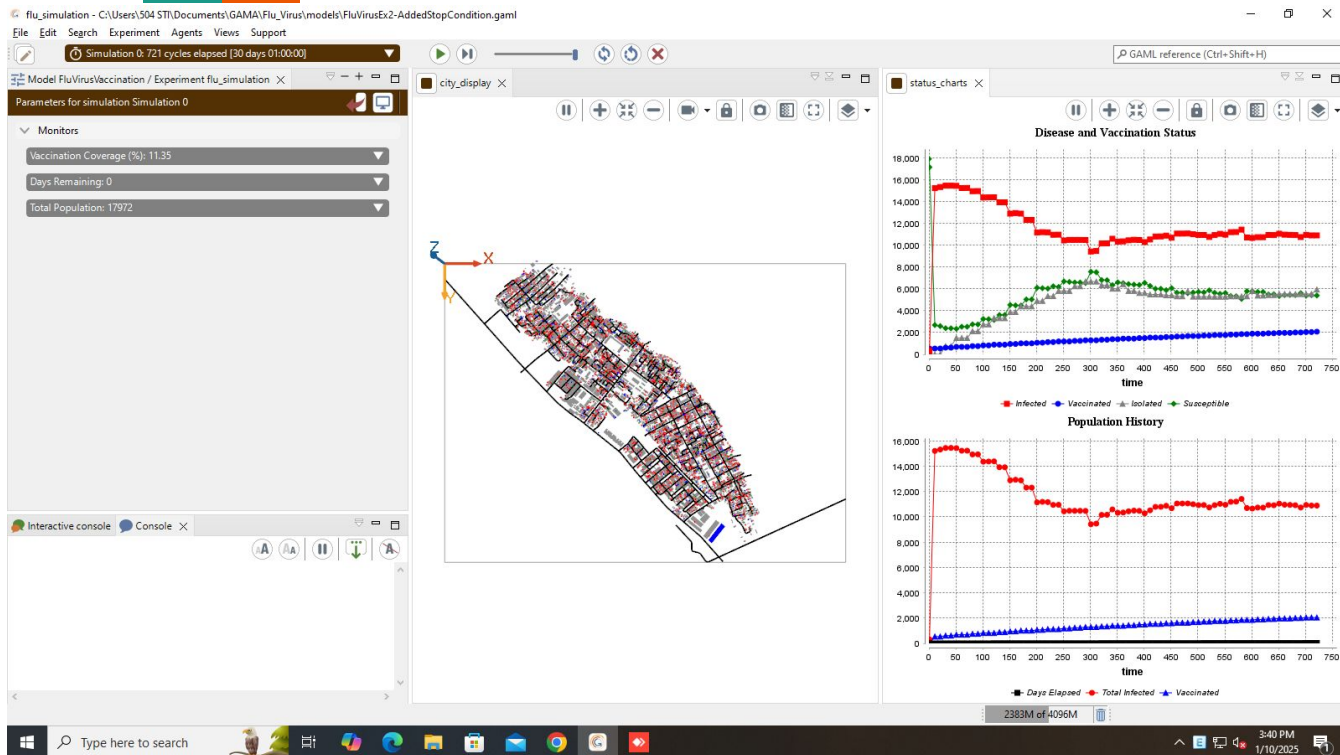
Demographics:

- Family size: 3-6 members
- Average size: 4.48 members
- Adults: 80.4% (14,386)
- Children: 19.6% (3,522)

Movement Patterns:

- Adults: Home ↔ Work commute
- Children: Home ↔ School commute
- School designated as largest building

Model Extensions: Extension 2



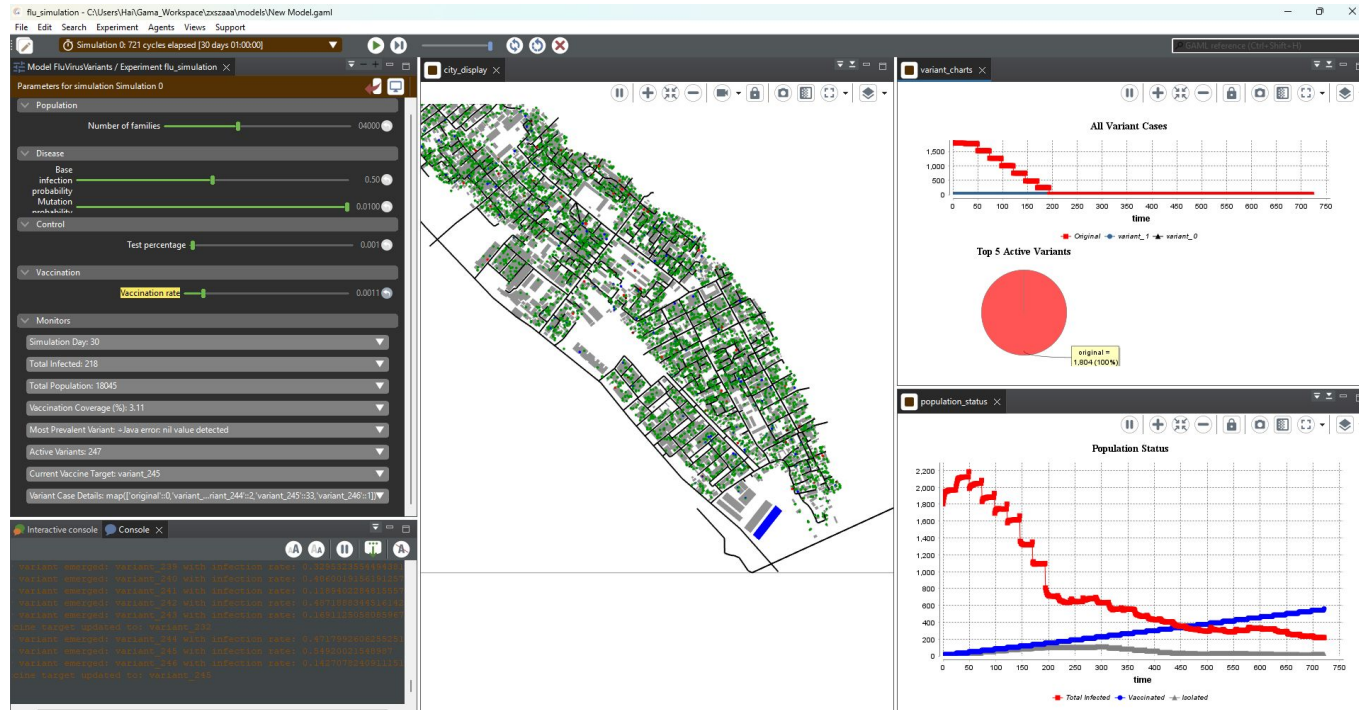
Implementation Details:

- Daily vaccination rate: 0.05% of unvaccinated
- Effectiveness: Reduces infection probability by factor of 3
- Targets non-infected, non-isolated individuals

Impact Tracking:

- Vaccination coverage monitoring
- Effect on infection rates
- Population immunity development

Model Extensions: Extension 3



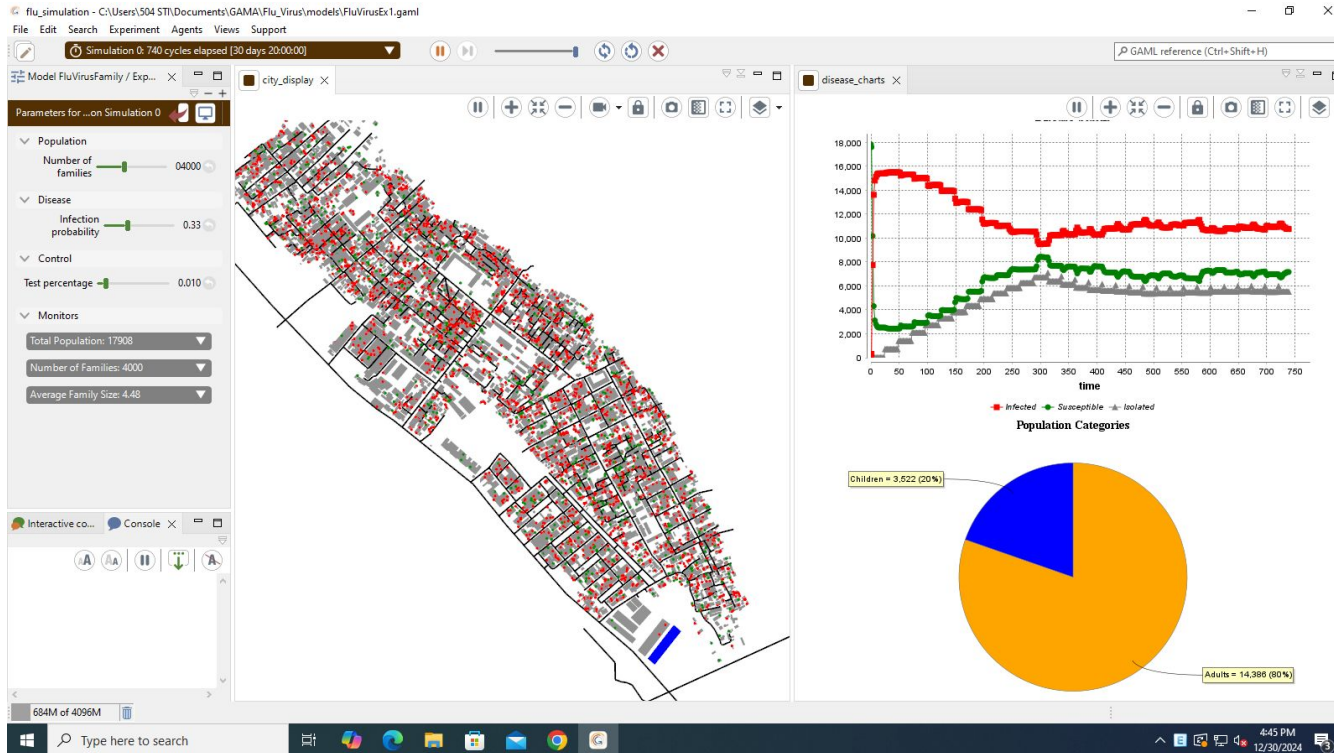
Mutation Mechanics:

- 0.1% mutation chance per infected per day
- Variant infection rate varies from parent ($0.5\times$ to $1.5\times$)
- Vaccine 50% less effective against new variants

Analysis Methods:

- Tracking variant emergence
- Studying variant competition
- Evaluating vaccine adaptation effectiveness

Results Analysis: Extension 1



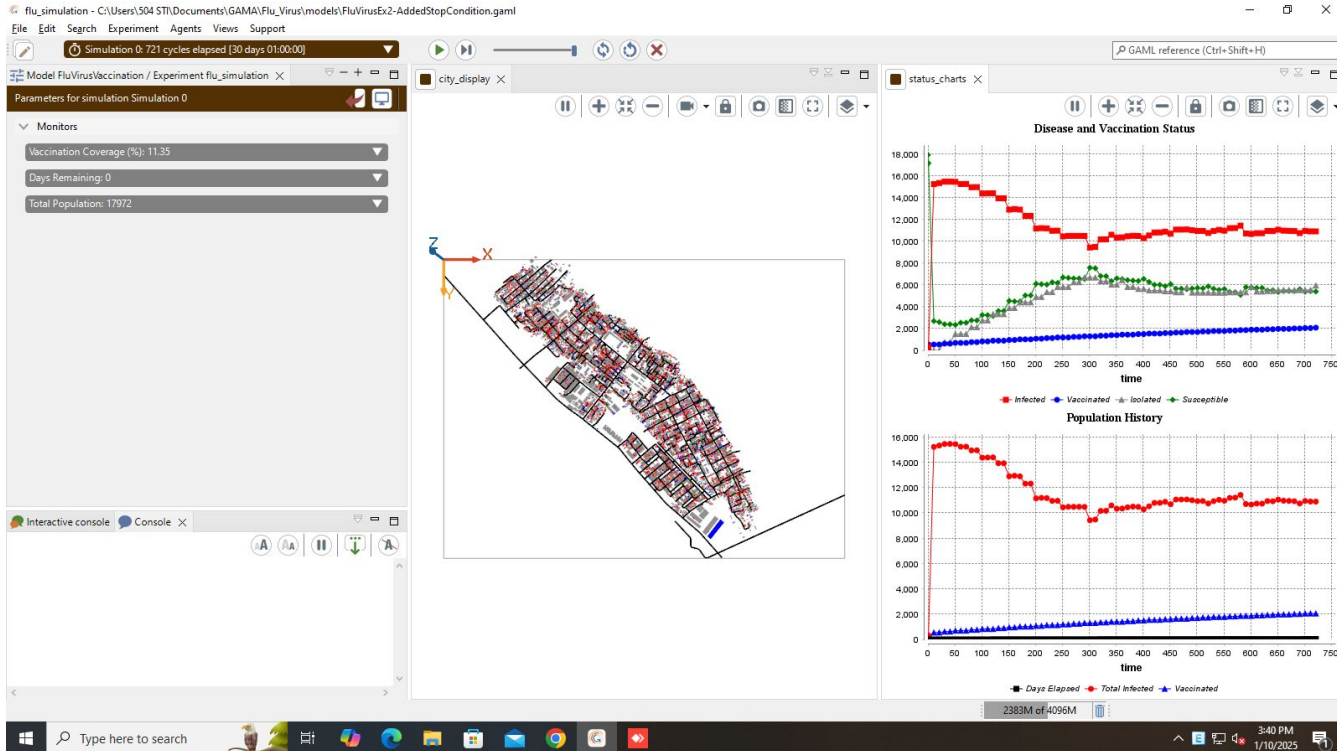
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Results Analysis: Extension 2



- Vaccinated (Blue): 12.62%
- Unvaccinated (Orange): 87%

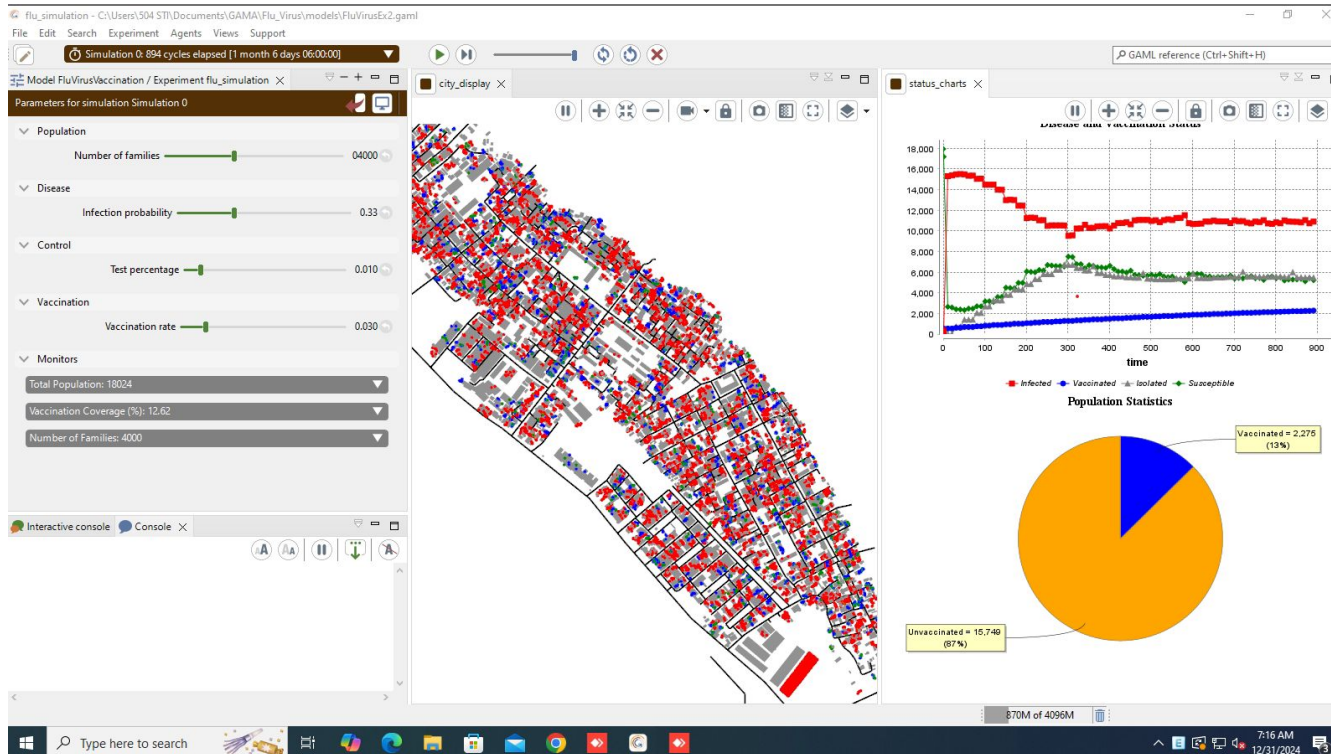
Current Status

- Vaccination Coverage: 12.62%
- Active Cases: ~11,000
- Unvaccinated: 87%

Key Findings

- Vaccine reduces transmission by 3x
- Current rate too slow for herd immunity
- Vaccination buildup insufficient to control spread

Results Analysis Extension 2



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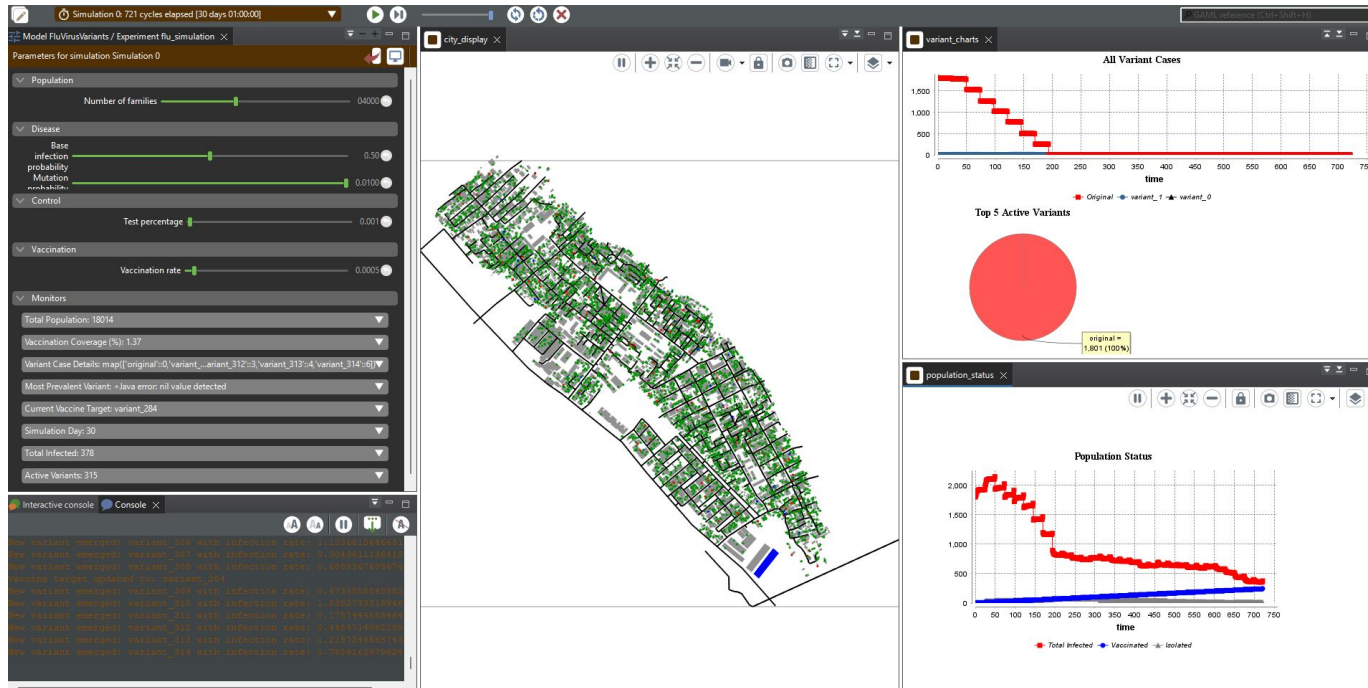
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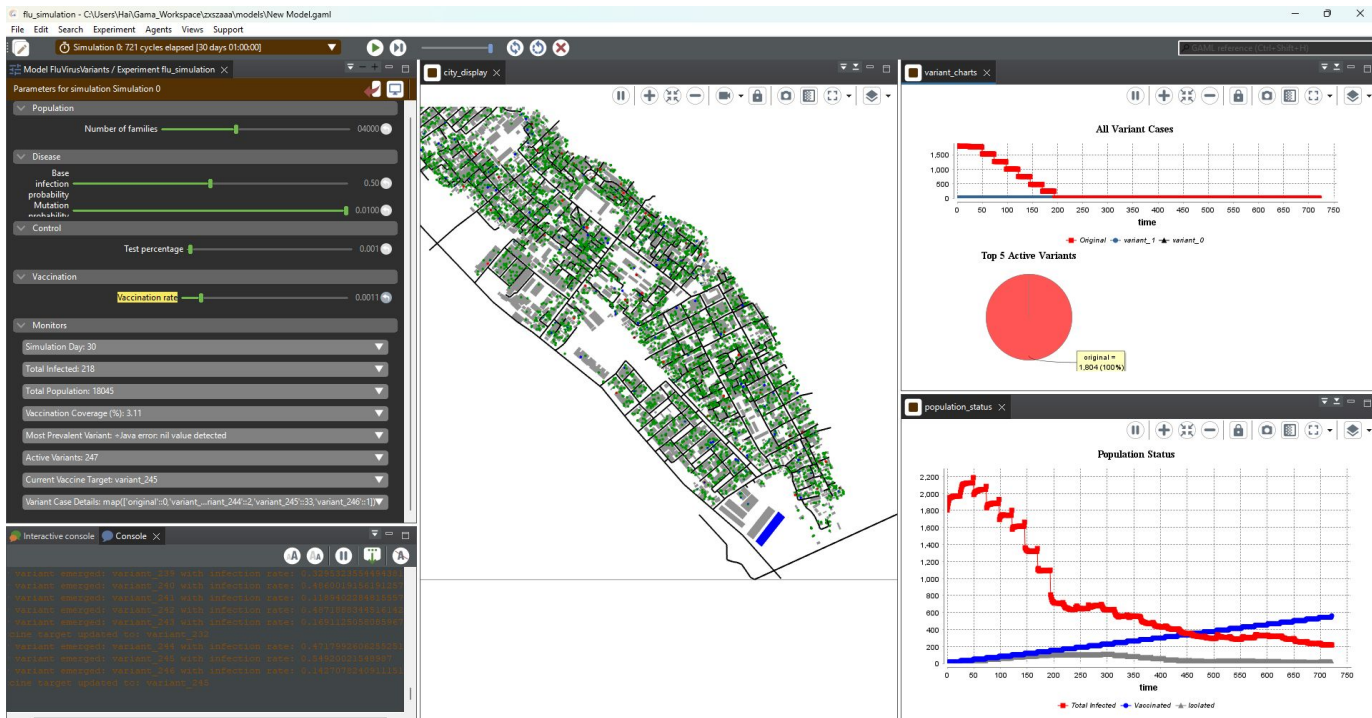
Results Analysis: Extension 3



With a low vaccination rate (0.05%), we can see the results:

- Population reached only 1.37% vaccination coverage
- 315 active variants emerged
- Total infected peaked at 2,000 and stabilized around 400
- Map shows mostly green (susceptible) and red (infected)
- Very low presence of blue (vaccinated) individuals
- Weak impact on controlling variant spread

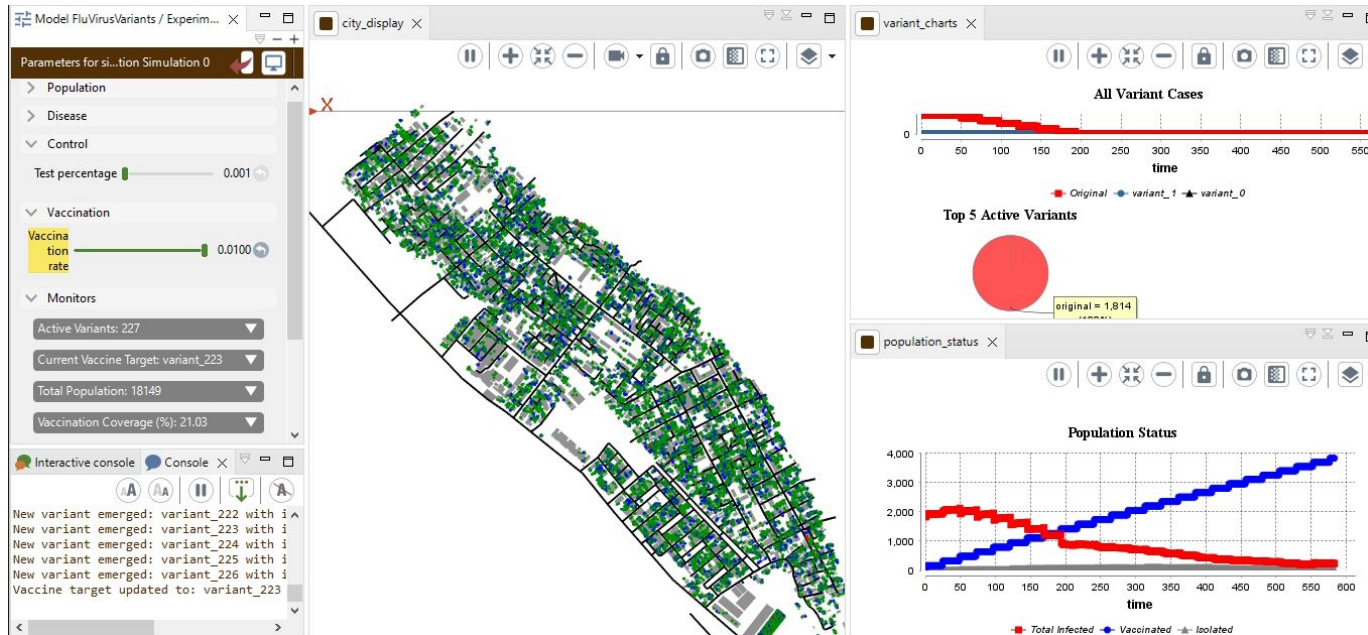
Results Analysis: Extension 3



With a higher vaccination rate (0.11%), the result was becoming better with:

- Achieved 3.11% vaccination coverage
- 247 active variants detected
- Total infected initially peaked at 2,200, declined to 600
- More visible blue dots in population map
- Better distribution of infection patterns

Results Analysis: Extension 3



In the case vaccination rate (1%), we observe:

- Reached 21.03% vaccination coverage
- Only 227 active variants - lowest among all scenarios
- Initial infection peak 2,000, dropped below 500
- Significant blue presence in population map
- Shows potential for long-term epidemic control

Key Findings & Conclusions



Critical Thresholds

- Vaccination rate threshold between 0.11% and 1%
- Higher rates significantly reduce variants
- Family-based isolation proves effective

Intervention Effectiveness

- 1% daily vaccination rate most effective
- School-focused interventions crucial
- Family isolation helps contain spread

Policy Implications

- Need for sustained high vaccination rates
- Importance of family-based strategies
- Value of school-centered control measures
- Model useful for public health planning



Thanks for listening
Do you have any question ????