Chapter 5.2
Multi-Agent Systems in Developing Countries

Dean Yergens
University of Manitoba, Canada and University of Calgary, Canada

Julie Hiner
University of Calgary, Canada

Jörg Denzinger
University of Calgary, Canada

ABSTRACT

Developing countries are faced with many problems and issues related to healthcare service delivery. Many factors contribute to this, such as a lack of adequate medical resources, a shortage of skilled medical professionals, increasing clinical demands due to infectious diseases, limited technological systems and an unreliable telecommunications and electrical infrastructure. However, the potential for multi-agent systems and multi-agent simulations to address some of these issues shows great promise. Multi-agent simulations have already been applied to modeling infectious diseases such as HIV and Avian Flu in the developing world. Furthermore, groups of smart agents, by their very design, can function autonomously and act as a distributed service, which greatly enables them to successfully operate in the kind of environments encountered in developing countries.

DOI: 10.4018/978-1-60960-561-2.ch502

INTRODUCTION

Developing countries possess an ideal environment for multi-agent systems (MAS). However, most of the published literature around multi-agent systems seems to be focused on projects and systems being developed and implemented in more

developed countries; such as in North America, Asia and Europe. This is most likely because most of the multi-agent systems research and activity is conducted and carried out in developed countries.

But recently there has been an increasing amount of literature published about the use of multi-agent simulations in developing countries, most noticeably around simulating the spread of infectious diseases. This is probably a reflection of the increasing awareness that the general public in developed countries has around infectious diseases in developing countries, such as HIV, Tuberculosis and Avian Flu. This awareness is also creating concerns about the potential spread to the developed world, and due to these concerns more effort and research is occurring in modeling epidemics in order to understand how to react to and contradict these outbreaks.

The application of Multi-agent Simulations to the area of infectious disease management and response is a promising avenue for public health in terms of modeling these potential epidemics. If we were to take a hypothetical SARS epidemic, a multi-agent simulation would be a great method in modeling the spread of the disease and the effects on the general population. Containment strategies could then be applied against the developed model to see what reaction is the most effective and by what time that reaction would need to be executed in order have an impact on counteracting the outbreak. Agents could be created to simulate people in the community and their (relevant) interactions. The infectious disease could then be modeled into the population and various factors examined such as the incubation time of the virus, the period of time that a person is contagious to others, and the mortality rate once infected. Other agents could be designed around transportation activities. Details about transportation mode and transfer locations could then be factored into the model. This would allow public health investigators to answer questions such as: How many people may have been passengers on planes from an infected area? How many other passengers were on those aircraft and might have potentially been infected? What are the destinations of those flights, and should those cities or countries be warned as to the potential threat?

Not only could this hypothetical SARS scenario be implemented as a multi-agent simulation, but it could also be adapted into a multi-agent system acting as a real-time global health warning system. With the creation of agents able to connect to real-time information systems, such as air traffic control and flight scheduling data, comes the possibility of a quicker response to incidents and consequently containment of such incidents (outbreaks).

In addition to applying MAS to public health issues, there are many other healthcare areas where MAS could be applied in developing countries. Some examples of these include:

- Decision Support applied to direct clinical care.
- Training using agent-based resources.
- Telemedicine, having the ability to access information or other medical personal either nationally or internationally.
- Pharmacy management, including drug interaction alerts and drug treatment compliance monitoring.
- Inventory and logistic management for Medical Supplies.

However, in order to be successful in implementing these systems we also need to understand the environment in which many developing countries exist. Challenges such as not having enough medical personnel or not having the proper equipment or supplies are common problems in many hospitals and clinics. In addition, the working environment and infrastructure may have challenges such as phone lines that are inoperative and electricity systems that are unreliable, especially during certain times of the year such as the rainy season in sub-Saharan Africa.