WORKING
PAPER

The RSS-POD Supply Chain Management Game

An Exercise for Improving the Inventory Management and Distribution of Medical Countermeasures

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HEALTH

Summary

In the event of a large-scale public health emergency, mass dispensing of medical countermeasures (e.g., antibiotics, vaccines, antidotes) could be required to prevent illness and death. In many such instances, the CDC would send materiel from the SNS—a cache of medical countermeasures maintained at undisclosed locations around the country—to a warehouse (known as the receiving, staging, and storing facility or RSS) designated by the relevant state or local authority. From there, state and local health departments are responsible for *distributing* the materiel to points of dispensing (PODs), at which the countermeasures would be *dispensed* to the public.

Existing RSS Exercises Often Do Not Adequately Test Inventory Management

The distribution of SNS assets from RSS warehouses to PODs has been exercised in most states, usually in conjunction with full-scale exercises that test most or all SNS functions. However, these exercises typically do not test the ability of the distribution system to handle inventory shortages at PODs or at the RSS warehouse. Exercises typically assume that the RSS warehouse will have sufficient inventory to fulfill the orders that are placed by (or for) the PODs. In a real emergency situation, however, there may not be enough stock at the RSS to satisfy all the requests at a given point in time. Decisions will have to be made about how to allocate the limited materiel that is available. Poorly made decisions could result in shortages in some locations and surpluses in others, thereby taxing the distribution system because, even if inventory does become available, additional "emergency" shipments to correct imbalances require the use of more transportation resources. Even if there are enough supplies in the aggregate, improper allocation across PODs could cause some to run out of materiel, resulting in backlogs at those locations—patients[1] who have arrived at the PODs waiting for countermeasures to arrive because the PODs have run out—and thus delaying the overall delivery of countermeasures to the public.

This concern about the ability of the distribution system to appropriately allocate inventory across PODs and to handle inventory shortages is the subject of the exercise described in this paper. In this computer-based exercise, players perform the role of inventory manager at an RSS and must allocate inventory among PODs. The computer game walks the players through a set of modules to teach

- the dangers of blindly following orders from PODs
- the value of having the proper information for making decisions
- key principles of inventory management (e.g., ordering in a way that accounts for expected demand and variability in demand).

[1] In this document and in the game, we have used the term *patient* to mean any person who comes to the POD to pick up countermeasures. There is some debate about the use of *patient* in this contect; persons who are sick or injured should not go to PODs but rather to health care facilities for treatment. However, we opted to use the term both for convenience and to be consistent with the terminology used in other POD computer modeling tools.

This exercise is primarily designed as a learning experience. While it could be used for formative assessment, it is *not* designed to support measurement for accountability purposes. The game is intended to be played by staff or volunteers who would be responsible for managing inventory at the RSS or at PODs. This target audience includes the personnel operating the inventory management system at each of those locations, as well as more-senior decision makers (perhaps located at a health department operations center) who may have to adjudicate the allocation of scarce inventory.

The RSS-POD Supply Chain Management Game

We created an exercise that allows players to practice managing inventory via a Microsoft Excel-based computer game called the RSS-POD Supply Chain Management Game. The game can be played by individuals or in small groups.

In the game, the player (regardless of his or her job in an actual emergency) performs the role of the inventory manager at the RSS. This inventory manager is assumed to have all the decision-making authority necessary to allocate inventory among PODs. PODs place orders with the RSS according to their own perceived needs. (In the game, the computer determines POD orders.) In many cases, the available RSS inventory is insufficient to meet the perceived needs of the PODs. The player with the role of RSS inventory manager must allocate his/her available inventory among the PODs, with the goal of distributing countermeasures to as many people as possible.

The exercise consists of three rounds of play called *modules*. These three modules play through the same time period, so that after all three modules have been completed, performance comparisons can be made across the modules.

- *Module 1.* In the first module, the player has access to limited information about the PODs. The player has information about the design of the PODs (e.g., maximum hourly throughput) and can see POD orders. The player does not have information about the inventory levels at the PODs. The player receives feedback during the game regarding his/her performance, in the form of reports on whether PODs are experiencing backlogs of patients (patients who have arrived at the POD to receive countermeasures, but who must wait because the POD has run out).
- *Module 2.* In the second module, the player has access to greater information. The inventory levels at each POD are made visible to the RSS inventory manager, with the intent that the player will be able to make better decisions as a result.
- *Module 3.* In the final module, the player is presented with a simple mathematical algorithm to make distribution decisions. Players may choose to use this algorithm during their third module, to see if they can improve their performance.

By the end of the game, players can then see the value of information and the value of good inventory management displayed in terms of the reduced backlog of patients who are at the POD waiting for countermeasures to arrive from the warehouse, and thus an increased number of patients who will receive countermeasures within the prescribed amount of time.

We hope that this game will be a learning experience for RSS and POD inventory managers. At the most basic level, players will learn the value of increased POD-level information. While this may be an obvious concept in principle, playing through the

modules provides reinforcement through experiential learning, as players first experience the frustration and pitfalls of operating with limited information (Module 1), and then see the improvement that can be obtained by having more information (Module 2), and finally learning techniques for best making use of this information (Module 3).

Next Steps

This iteration of the RSS-POD Supply Chain Management Game should be considered an initial prototype of an experiential learning exercise. It is being released for testing by users in state and local health departments who would have to manage inventory in an actual emergency, as well as by staff of CDC/DSNS who provide technical assistance to those health departments.

During this period of testing, we are interested in learning

- which aspects of the game are confusing and which can be improved
- whether players actually learn the lessons the game seeks to teach
- whether, in a more general sense, experiential learning games such as these are an effective strategy for teaching technical concepts to health department users
- how the use of stand-alone games such as this may improve performance in more-general exercises, such as warehouse drills and full-scale mass-dispensing and mass-distribution exercises. This would be the ultimate test of validity and usefulness and would require the development of good metrics for the larger exercises, as well as data collection over time.