Jennier Shelton, Richmond Ambulance Authority

Enough Stuff:

Inventory Management in EMS

A lot of skill (and a little guessing) goes into keeping the stocks you need

By Mike Rubin

You're back in quarters after an asymptomatic cardiac patient refuses transport. You finish your PCR, attach a copy of the precautionary rhythm strip, then head to the supply closet for a fresh pack of electrodes. The bin is empty. Before you have a chance to start a scavenger hunt, another call comes in. With no electrodes in your vehicle, you grab the only set from another ambulance and make a mental note to ration EKGs for the rest of your shift.

Some of us don't have to try hard to imagine a situation like that one. Missing items won't always affect patient care, but when they do, anyone who uses, orders or checks supplies is partly responsible.

Material control is hardly a glamorous topic. I've never seen a movie or television show about tracking inventory (reality-TV producers, take note), and I don't remember Johnny or Roy ever saying, "Ah, Rampart, negative on that IV, we're out of needles." But stocking adequate quantities of mission-critical items in EMS is just as important as maintaining vehicles or hiring enough people to staff them. Each of those tasks requires planning and is usually undervalued until it's not done. What, then, should EMS providers know about inventory control?

Inventory Management Basics

Inventory is a collective term for goods you store—not only salable products, like cars and trucks in the automotive industry, but also the tires, spark plugs, steering wheels and other components needed to build those vehicles. We don't manufacture products in EMS, so we'll focus on buying items rather than building them.

Say you purchase nonrebreather masks—you lose the option to use those funds for other supplies or income-producing investments. That "time value of money" used to be a big factor in inventory decisions, but with interest rates so low these days, money in the bank is almost free—that is, if you "borrow" cash

from yourself to buy something, you're neither paying interest nor losing much of it.

That doesn't mean inventory costs nothing to keep. You still have to store it, move it, track it and throw it out when it expires. An even bigger factor is having enough stock to service your customers—or, in the case of EMS, to care for your patients.

In the corporate world we talk about "lost-opportunity costs" as penalties for running out of products. The opportunity we're losing is almost always selling more. In EMS, lost opportunities to treat people due to missing or expired supplies can carry consequences much more severe than lower revenues. EMS providers need to protect themselves and their patients by embracing inventory control as a well-documented business practice with much higher stakes in the essential services than in the companies that invented it.

So what can we learn from the ways other industries keep track of their stuff?

Push or Pull?

There are two fundamental approaches to managing materials: "push" systems, most of which are derivatives of something called *material requirements planning* (MRP), and "pull" systems, also known as *just-in-time* (JIT). Both schemes were introduced in the 1960s—MRP in the U.S. and JIT in Japan. Although MRP and JIT have different rules, their goals are the same: minimize inventory costs while maximizing sales of manufactured items. In EMS the latter objective would be comparable to maximizing preparedness for patient care.

MRP "pushes" component parts—the tires, spark plugs and steering wheels in our automotive example—through factories, based mostly on the following information:

Basic Material Control Technique

If you're looking for a basic material control technique that's easier than manual number crunching, build an Excel spreadsheet (or comparable tool) with the following columns left to right:

A. Item—A short, unique descriptive term;

B. Starting balance—A physical count of each item at a particular point in time (you'll reset columns B–H when you take a new count at least once a year);

C. + Receipts—A running sum of quantities received (e.g., 50 + 100 + 25);

D. Last receipt—The date of the most recent delivery, to help track which transactions have already been entered;

E. – Usage—A running sum of quantities used. Getting this information from field personnel will be one of your biggest challenges. You'll have to establish a procedure whereby usage of supplies is documented along with other patient-care details;

F. Last usage—The date of the most recent usage;

G. Adjust +/-—A running sum of corrections for waste, expiration, returns, etc. Most adjustments will be subtractions and should be preceded by minus signs;

H. Last adjustment—The date of the most recent adjustment;

I. On-hand quantity—Starting balance + receipts – usage + adjustments expressed as a formula (e.g., = Bn + Cn – En + Gn, where *n* is the row number);

J. On order—A running sum of quantities due, adjusted after each delivery;

K. Next due—The next expected delivery date, if any;

L. Available quantity—On hand plus on order expressed as a formula (e.g., = In + Jn);

M. Annual forecast—Expected annual usage, probably estimated from prior usage;

N. Lead time—The average number of days it takes to restock from the time an item is ordered until it's delivered;

O. Standard purchase—A reminder of how many units are normally ordered at one time. Such so-called "economic purchase quantities" depend on vendor quantity/price breaks, forecast accuracy and storage space. Calculating them according to all those factors is outside the scope of this article. To keep it simple, order an amount that doesn't take up too much space, won't expire before it's used and won't often leave you with unanticipated shortages. That's usually a few months' worth;

P. Stock alert—A formula (=IF(Ln/Mn<Nn/365,"Buy", " ")) that produces a conditional message (*buy*) when the available quantity will be exhausted according to the forecast, before more can be delivered, based on standard lead time;

Q. Comments—Miscellaneous remarks.

You're going to populate the spreadsheet with every item you wish to track, one to a row. You might wish to start with just a few supplies to get an idea of the discipline involved. Later you could insert a column after ID called *Location* and start tracking inventory movement from and to each station and vehicle.

Adjust column widths and formats as needed. Feel free to make any other changes to the spreadsheet that best fit your agency.

To take material planning further, you'd need a database management system (DBMS) instead of a spreadsheet. DBMS software is much better at tracking the details behind each of those row-and-column entries—histories of inventory transactions, for example. A generic DBMS package like Microsoft Access is the next step for agencies that don't want to buy a dedicated inventory management program but would prefer to develop something more sophisticated than a spreadsheet without needing an IT professional in house.

Homegrown software isn't a solution for everybody; at the very least you'd need someone on staff who can master DBMS software like Access and has experience managing digital information. If your agency doesn't have such a resource, professionally developed software would be a better option.

Case Study: Finding the Needles in the Haystack

By Rob Lawrence, MCMI

In a previous article, I discussed how an ill-managed logistics department can lead to an unnecessary hemorrhage of cash (EMSWorld.com/12112648). Procedures must be in place to conduct checks and balances to account for equipment issued and to justify use, cost and a comparison against clinical treatments delivered. For example, if an organization only responded to 100 cardiac arrests in a year, yet issued and expensed 200 sets of defibrillator pads, there is an obvious disconnect of provision, use and expenditure.

The **Richmond Ambulance Authority (RAA)** uses the Operative IQ system to track moving stores from arrival to issuance to a stock-controlled bin, which is then placed on the vehicle as part of the "make-ready" system. Resultant reports allow logistics staff and operational and clinical managers to conduct cross checks to ensure fast-moving or expensive items are being employed efficiently.

Soon after the bar-coding system went into action, a cross check of the use of intraosseous needles revealed more needles issued than eligible patients by a large margin. The ensuing investigation of what is a very expensive line item revealed that foul play was not to blame: It transpired that the first and second needles in the prepackaged equipment were so close together that when extracting one, providers contaminated the other, which was then cast aside as unusable. A simple fix involved moving the second needle into a separate bin. The annualized savings for RAA, which runs 60,000 calls for service in a year, amounted to a four-figure sum!

This is just one example of how an ordered systems approach can save money. The amount of kit and equipment on an average ambulance runs to hundreds of line items. While it is important to check equipment out, it is equally as important to check invoices in. Many items are contracted and locked in for large organizations on an agreed cost-per-item basis. Automated logistic systems—or, if those aren't available, manual checks—should always ensure that the invoice delivered equates to the contract price. A few cents extra on a bandage may be something the eye misses, but if you take delivery of thousands of them it adds up. In the same vein, ALWAYS know when equipment contracts expire and plan ahead. With no contractual relationship, prices can rise and logistic managers (under most local procurement laws) must obtain quotes for everything. This affects another precious commodity—time.

Other Checks and Balances

» **Oxygen:** Unless you are bottling your own, develop a minimum amount limit and don't swap out until you reach that point of the tank. You could be returning "empty" tanks that are actually half full.

» **Sweat the small stuff:** Who takes more ECG dots, tape and small expendable items out for patient use than are needed, only to discard them in the waste? You may have just thrown the cost of your merit raise out—enough said.

The harsh reality is that, dependent on payer mix or municipal budget, you may be expensing more on the patient in terms of equipment cost than you recoup from the insurance or payer. In the near future, reimbursement models for EMS will change as we claim our share of the bundle payment and of that, every logistic penny must be pinched.

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» Sales forecasts of finished goods, such as cars;

» Bills of materials, which are "recipes" showing everything needed to make one complete car;

» Available quantities of components and cars;

» Lead times for buying components to make cars.

Right away MRP sounds more complicated than what we need in EMS; we're just stocking basic items like dressings and drugs that are purchased whole from medical suppliers. There are useful elements of MRP that we'll come back to, though.

JIT "pulls" components through factories as needed. Sticking with our car example, when the last spark plug leaves the supply bin, an order is generated for more. That order, in true JIT companies, initiates a purchase of parts from a vendor so close, and so coordinated with the factory, that delivery occurs within hours. That level of cooperation between vendors and their customers is difficult to achieve in the U.S., where partnerships between buyers and sellers of goods are much more difficult to establish than in JIT's birthplace, Japan.

So far neither MRP nor JIT sounds like an ideal system for EMS, but let's see which features of each might help us manage supplies.

MRP vs. JIT for EMS

MRP is a sophisticated tool. It considers three important aspects of inventory control: how much you have of each item, how many more finished goods you should build or buy to satisfy demand, and what components you'll need to do that. Even if we ignore that last part about components, MRP can still teach EMS providers a few things:

» Do the best you can to estimate how much of each purchased item you'll need in the coming year.

» Include allowances for expiration, waste and theft of supplies when forecasting demand.

» Report usage of supplies as it occurs.

» Be able to track and occasionally verify stock at multiple locations.

» Factor lead times and inaccurate usage forecasts into purchase timing and quantities.

Push systems like MRP depend on reasonably accurate sales forecasts in most industries. When you know what you're going to sell, you can calculate what components you'll need to make those items.

EMS is different because we're not manufacturing anything, but we still need to estimate how many masks, electrodes, dressings, gloves, etc. we're going to need in the coming year. Ideally we'd do that based on the expected distribution of presenting problems, then average the supplies needed for each.

For example, we'd need either a nasal cannula or an NRB, a package of electrodes, an IV set, and averaged amounts of oxygen, aspirin and nitroglycerin for each instance of acute coronary syndrome. We'd multiply the number of expected ACS cases by the quantity of each associated therapeutic item to get our gross material requirements for that illness.

Here's the problem: I have yet to see reliable, zero-based projections of chief complaints. Plugging inaccurate forecasts or inventory balances into fully automated MRP systems merely makes it possible to screw up at the speed of light. The only way I can think of to estimate demand in EMS is to begin with last year's, then massage it according to known or suspected changes.

JIT is less about forecasting and more about minimizing or even eliminating inventory. It reminds us that close cooperation with vendors is mutually beneficial; suppliers are assured business by customers who want to depend on quick turnaround of purchase orders. JIT's lessons for EMS are:

» **Don't buy more material than you need.**

» **Establish long-term relationships with vendors whenever possible.**

» **When you notice a shortage, communicate that promptly to further reduce lead times.**

What can go wrong? Well, EMS agencies aren't going to house mini-branches of suppliers, as some big manufacturers do. Anything that gets in the way of immediate response by vendors to customers' needs—bad weather, distance, missed payments, delayed orders—will quickly drive inventory to zero and, therefore, threaten continued operations.

If you're thinking it's so much easier to *talk* about implementing even modified forms of MRP or JIT than to make either happen, you're right. Most EMS agencies don't have enough manpower or broad-based business expertise to babysit such complex initiatives. There's software out there that can help—programs like Operative IQ, with comprehensive inventory-management modules, and ePCR packages that bundle stock-control capabilities with core features. Or you could try the basic material control technique shown on page 47.

The Essence of Inventory Control

Whether you use computers or pencil and paper, the fundamental principles of inventory management are the same:

1. Everyone who touches items you're tracking is accountable for inventory accuracy.

2. Begin by counting everything, then add or subtract every transaction that changes opening balances.

3. The causes of missing or erroneous transactions that lead to incorrect balances and therefore jeopardize patient care need to be whittled down until inventory figures are routinely believable.

4. Forecasts are inherently inaccurate. Keep trying to fine-tune yours.

5. In this time of extremely low inventory carrying costs, it's better to buy more material to take advantage of volume discounts and avoid stock-outs than to test JIT-oriented razor-thin margins of error.

6. Rule #5 is, of course, limited by expiration dates and storage space. You can help maximize the latter by paying attention to the former.

Conclusion

Inventory management isn't a self-serving administrative exercise; it's an undervalued but strategic element of EMS. Agencies that control their materials improve their chances of offering patients the right care at the right time.

ABOUT THE AUTHOR

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