

# Revenue Cycle Management at Evanston Northwestern Healthcare: Using Lean Principles to Improve Performance

Sunil Chopra  
Kellogg School of Management  
Northwestern University  
Evanston, Illinois, 60209  
(847) 491-8169  
(847) 467-1220 (fax)  
s-chopra@kellogg.northwestern.edu

Joseph Golbus, M.D.  
Evanston Northwestern Healthcare  
Evanston, Illinois, 60201  
(847) 570-5272  
(847)570-5025  
jgolbus@enh.org

Deborah Kirkorsky  
Evanston Northwestern Healthcare  
Evanston, Illinois, 60201  
(847) 570-5272  
(847)570-5025  
dkirkorsky@enh.org

Gilles Reinhardt  
Department of Management  
DePaul University  
Chicago, Illinois, 60204  
(312) 362-8849  
(312) 362-6973 (fax)  
greinhar@condor.depaul.edu

## **Abstract**

This paper focuses on the principles of lean operations to improve the revenue cycle at Evanston Northwestern Healthcare Medical Group. These principles have often been articulated in the context of manufacturing processes. Our goal is to articulate and illustrate these principles in the context of service processes.

## **Introduction**

In 2002, it took well over 100 days from the date when a patient was seen to the date when the Evanston Northwestern Healthcare Medical Group (ENHMG) collected its money. The long delay resulted in nearly \$100 million in accounts receivables. After January 2003, when ENHMG began implementing process improvements, the cash collection cycle time was cut to 59 days by December 2004, further down to 51 days in June 2005, and further still to 37 days in December 2005. The resulting reduction in accounts receivables exceeded \$50 million. This dramatic improvement can be attributed to the use of several principles of lean operations for the design of service processes. Our goal in this paper is to articulate these service design principles and illustrate them using ENHMG as the example.

Every service is a bundle of attributes that are important to the customer. The primary attributes of services to customers are quality, speed of response, variety/customization, and cost. A patient arriving at an emergency room cares more about quality and response time, whereas a patient seeing her doctor for an annual physical may care more about waiting time and cost. For ENHMG's collection process, the most important attributes are time to collection (speed of response) and accuracy of the amount collected (quality).

In this paper, we discuss how lean operations have been successfully applied to the revenue cycle at ENHMG to improve performance. We begin with a description of ENHMG's previous outpatient billing process. We then describe changes to the process that improved performance in terms of cycle time between a physician consultation and receiving payment, account receivables, quality, and operational costs. We then articulate the lean principles used at ENHMG for general service settings. Specifically, we discuss how principles such as eliminating waste, reducing batch sizes, building quality at the source, building service inventory for standardized tasks, increasing resource flexibility / pooling resources, and increasing visibility of queues to spur continuous improvement can improve the performance of a service process. In each instance we illustrate how ENHMG implemented the principle and outline the resulting impact on performance.

Authors such as Barber (2002), D'Eramo and Umbreit (2005), Graham (2001), and Laforge and Tureaud (2003) have examined ways to improve the revenue cycle in health care. Recently several articles have discussed how lean operations can be applied to improve services in general and health care performance in particular. Swank (2003) discusses the concept of lean services. Womack and Jones (2005) discuss the concept of lean consumption as applied to the production and consumption of services. Spear (2005) discusses how ideas from the Toyota production system can be applied to health care. Compared to these articles, our contribution is to focus much more on the process side and discuss how lean principles can be applied to improving service processes in general using the ENHMG revenue collection cycle as an example.

## **ENHMG's Original Outpatient Billing Cycle**

Evanston Northwestern Healthcare (ENH) consists of three full-service hospitals, the ENH Research Institute, and an employed physician group, ENH Medical Group (ENHMG). ENHMG generates nearly \$200 million annually in net revenue and employs nearly 500 physicians. Of these, roughly two-thirds are specialists, and the rest are primary care physicians. The traditional revenue cycle before re-engineering, as illustrated in Figure 1, shows how a service was administered from appointment to billing and ultimately to receiving payment.

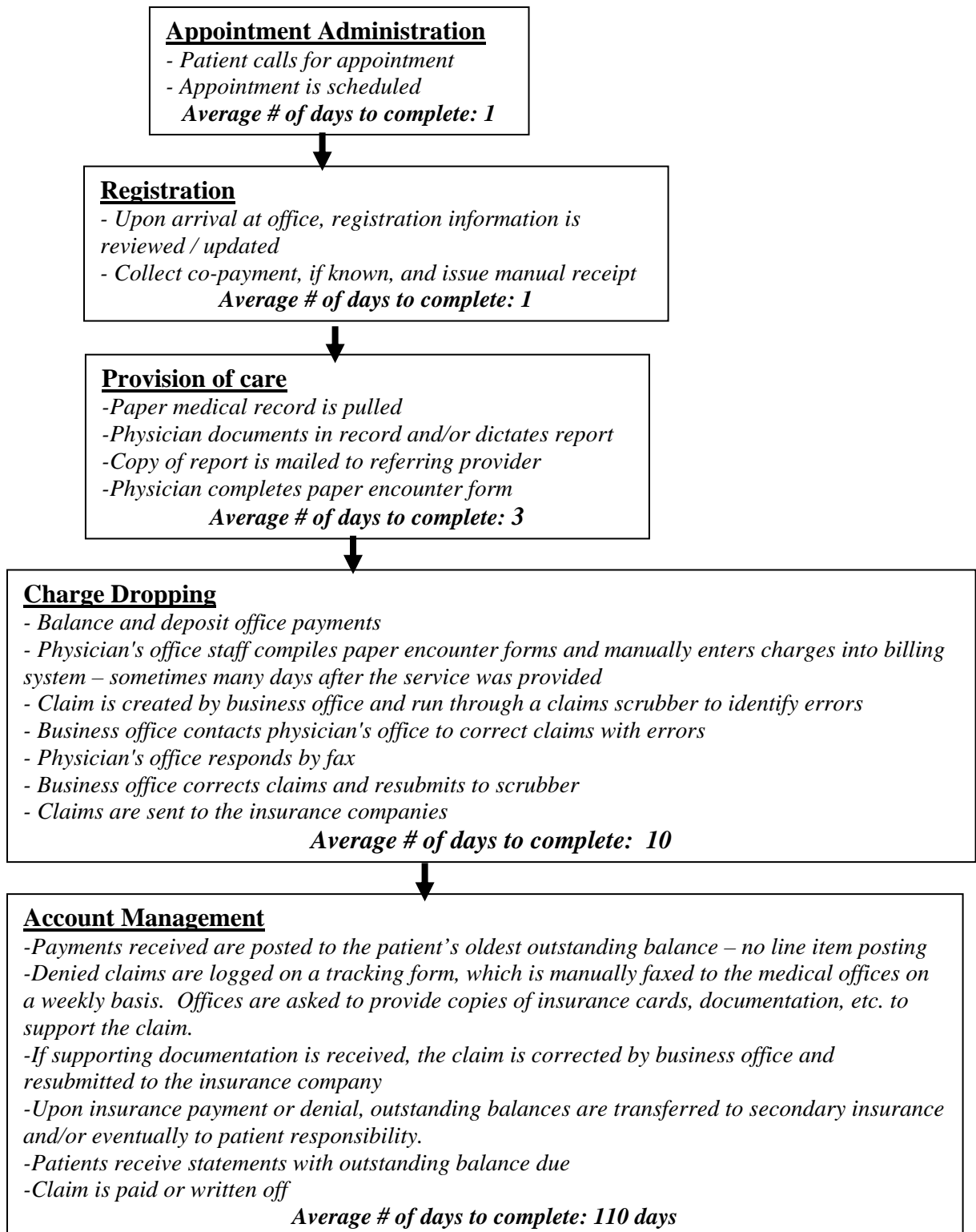


Figure 1: The outpatient billing cycle at ENHMG before re-engineering.

Prior to the process redesign, the Medical Group had approximately 160 staff performing the clerical functions (appointment administration, charge entry, pulling medical records, etc.) in about 50 physician offices, whereas the business office was centralized and had approximately 270 staff performing the claims submission and account management processes.

Many activities in the process suffered from errors and delays, and approximately one in four claims (25 percent) required rework just to generate the initial claim. As a result, the revenue collection cycle times averaged well over 100 days and, at its worst, reached 164 days. This in turn elevated the outstanding receivables to over \$100 million, well over half the annual revenues of ENHMG. Only 37 percent of patients gave ENHMG the highest rating possible on billing-related questions. This was more than 20 to 30 percentage points below the scores patients gave ENHMG on all other aspects of their care. The majority of the reasons that patients gave for leaving ENHMG physician practices were related to billing issues. We break down the issues contributing to long cycle times as per the activities in Figure 1.

#### Appointment Administration and Registration

Patient registration is the lynchpin in the entire billing process. Errors in registration result in delays and unpaid claims. Unfortunately, registration is also one of the most complex processes performed at the Medical Group, and registration errors were found to account for half of the claims denied. Each of the 50 physician offices within ENHMG was responsible for registering its own patients. As a result, staff at every physician office had to be knowledgeable on all nuances of the different and often

changing insurance plans – in addition to handling their normal office functions such as scheduling appointments, taking telephone messages, and pulling medical records. In the physician office, an uninterrupted new patient registration took, on average, 10 minutes to complete. Patients were typically asked to arrive 15 minutes early for their doctor’s appointment to give ample time for the check-in process. If patients arrived late or if the office was unusually busy or short-staffed, the check-in process, including the review of registration information and collection of co-payments, was often skipped. End of day reconciliation and deposit of payments often occurred days after service was provided. As a result, the staff often had difficulty resolving any discrepancies between what was collected and receipts issued. A daily log of the payments collected in the physician office was faxed to the business office for posting into the billing system. If the physician office staff could not identify the source of a payment, or if a day’s log was not received by the business office, the payment made by the patient at the physician office was not applied to the patient’s account.

### Provision of Care

From a revenue cycle perspective, the biggest issues during provision of care related to the accurate and timely capture of charges. After a patient was seen, the physician completed a paper encounter form, marking the services performed and the patient’s diagnosis. Although protocol dictated that these forms be turned in to the staff at the end of each visit, many physicians turned them in late – sometimes days later, and sometimes never. Encounter forms found after two or three months were typically denied by payers for “lack of timely filing.” When the forms were turned in, they were often

incomplete or illegible. Daily reconciliations to ensure that forms were completed for every patient seen were manual and inconsistent and, when they were performed, these reconciliations often did not capture every service performed (laboratory testing, EKGs, etc).

### Charge Dropping

Charge dropping refers to the entry of services provided by ENHMG into the billing system as charges. Once the completed encounter forms were received from the physicians, the physician office staff batched them and manually entered the data into the billing system. The staff simply entered the data and did not review it for accuracy from a data entry or billing perspective. If the physician staff were busy with other responsibilities or if the office was short-staffed, this function was not given priority. Charge entry could thus occur several days following the consultation. Once the charge was posted into the system, a claim was created and sent through a basic *claim scrubber*. The scrubber checked for basic errors (i.e., all required fields are filled) before forms were submitted to the insurance company. Although the checks by the claim scrubber were basic, approximately one in four claims were stopped. The stopped claims were identified by the business office, which created a log of missing information and then faxed the log each week to the physician offices, where the necessary information was to be collected and faxed back. Usually, the response from the physician offices was poor, and the size of the backlog often grew to dozens of forms. Upon receiving a response from the physician office, the business office corrected the claim and resubmitted it through the scrubber onto the insurance company for payment. This charge dropping



process required significant re-work and multiple hand-offs. No one person took responsibility or was held accountable for the entire process, because no one had access to all information necessary to fix a problem.

### Account Management

Because the computerized billing system did not allow for line-item posting, any payment received was posted to the oldest outstanding balance. This created much confusion and frustration for patients who could not understand why their insurance company had paid for a specific visit but their ENHMG bill showed a balance for that visit. Patient complaints about their inability to understand their bills were constant. Staff in the physician offices who were less familiar with the billing process could not assist in answering their questions. Also, for the payments received, there was no automated process to identify whether the payment amount was the full amount contracted with the payer or something less that required a follow-up. If a denial was received from the insurance company, a manual process was followed to identify financial responsibility. If the patient was financially responsible, he or she received monthly statements until the account was closed.

Inaccurate registrations and loose processes in the physician offices led to significant patient complaints. Bills were sent to incorrect insurance companies who would deny payment, and then the patient was held responsible for the bill. Office staff juggling multiple tasks would sometimes unknowingly create duplicate patient accounts, creating multiple bills for a single patient or family. Not collecting co-payments at the time of the visit necessitated sending a bill for an amount that typically did not cover the

cost of mailing. In some cases when a co-payment actually was collected at the physician office, it was not applied correctly (or at all) to the account, so patients received a bill for a co-payment for which they had a receipt.

The high revenue cycle times and the billing and payment concerns resulted in a crisis of confidence among physicians in the organization's ability to bill and collect for their services. Days in accounts receivable were more than double industry standards, and collection rates were at an all-time low. In addition, ENHMG's inability to provide reports from the billing system generated mistrust and a feeling that the organization was trying to conceal information from the physicians. The lack of performance in billing also resulted in a lower take-home pay for the physicians. The entire situation paralyzed the organization and hindered any new initiatives, because the physicians perceived that they would not get rewarded for them. These problems resulted in a high turnover of physicians and increased difficulty in recruiting new physicians.

## **ENHMG's Re-engineered Outpatient Billing Cycle**

In the fall of 2002, the billing process was redesigned to address the high billing cycle times and the low rate of collection. The first implementation came three months after the initial decision to redesign. During that period, physicians, administrators, staff, and other stakeholders were consulted to identify major opportunities for improvement of the system. The following priorities of the new system were established.

1. Reduce the time between a patient's visit and the payment of charges

2. Automate the billing process for the physicians and ensure that all charges are captured
3. Integrate online verification rules to ensure quality at source and minimize rework.

The re-engineered process is illustrated in Figure 2.

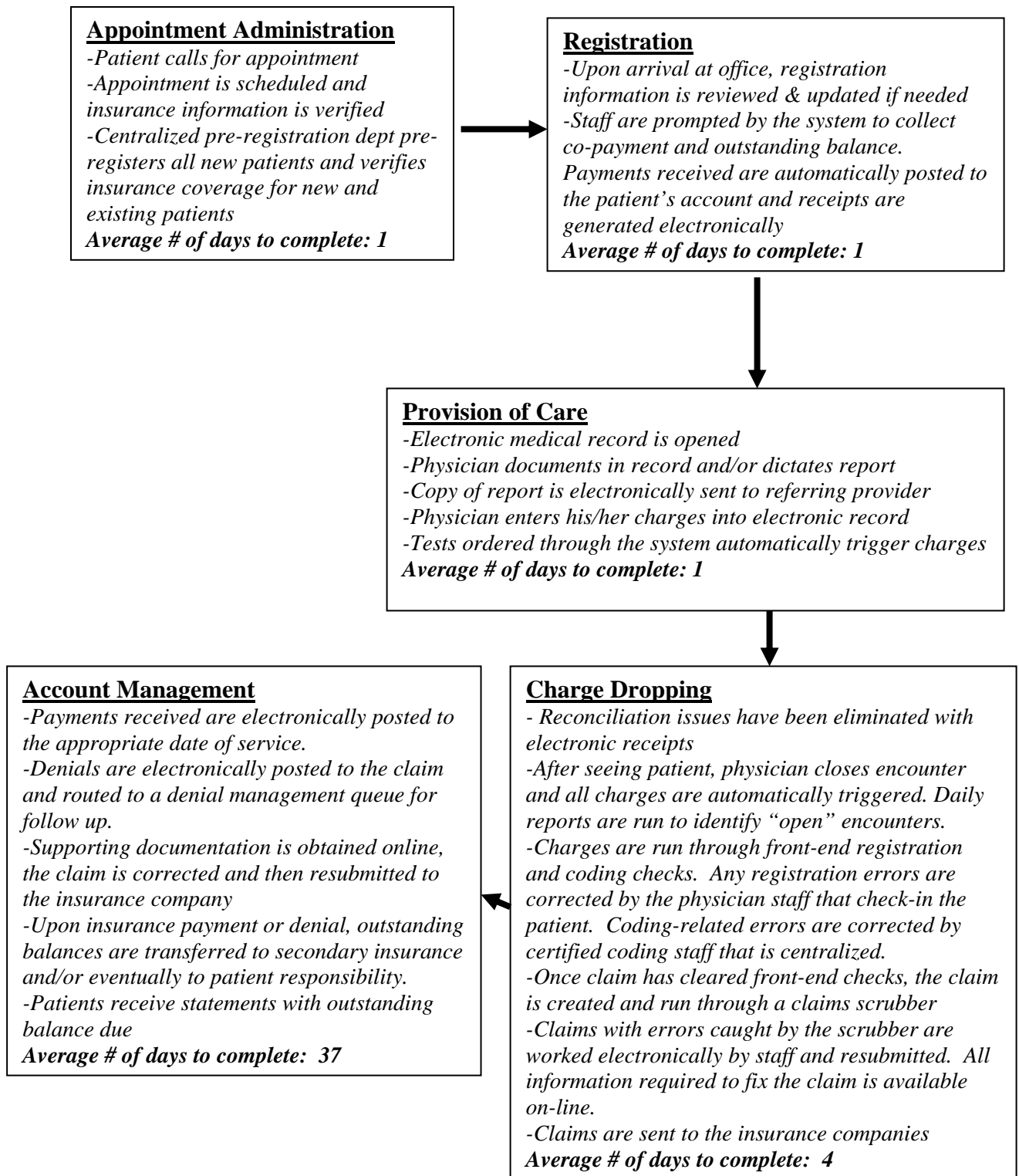


Figure 2: The out-patient billing cycle at ENHMG after re-engineering.

The main goal of re-engineering the process was to lower the cycle time between the date of a service and the date the charge is posted, as well as to lower the time a bill remains in accounts receivable. Additional goals included increasing charge capture and collection rates and improving quality and loyalty throughout the process.

To reach these objectives, we applied the fundamental lean principles of eliminating waste, reducing batch size, building quality at the source, building service inventory for frequently performed activities, and improving visibility of open encounters and accounts to drive continuous improvement. At ENHMG, these principles translated as

- Do it right the first time
- Eliminate re-work and duplication
- Ensure that the person who has the information completes that part of the process
- Create experts for difficult processes and centralize those functions
- Make the new billing system work for us
- Identify and correct errors as early in the process as possible
- Challenge the status quo – no existing process is sacred

The following are key performance metrics from before and after the redesign of the revenue collection process:

	<u>Before redesign</u>	<u>After redesign</u>
Charge dropping cycle time	13 days	4 days
Co-pay collection rate	50 -60 %	93 %
% of charges hitting claim scrubber edits	25%	3%
Days in Accounts Receivables	110 days	37 days
Denial rate	25-28%	11%

Table 1: Revenue Cycle Performance Before and After Redesign

In addition to the efficiency improvement across the process, the redesign allowed ENHMG to reduce its physician office staff by 23 positions and its business office staff by 135 positions.

To illustrate how the redesigned process is conducive to leaner operations, consider a patient with a scheduled appointment. A call is placed to the patient a few days prior to the consultation to remind the patient of the appointment, ask for the specific reasons for the appointment, ensure that all the personal and insurance information is up to date, and remind the patient of any outstanding charge on the account. During the consultation, the physician may identify medical conditions, order tests and lab work, and prescribe medication. After the physician updates the patient's charts, she now directly enters the diagnoses and services performed into the system. The charges for the visit and any tests or lab orders are automatically triggered to the billing system once the physician closes the encounter. The triggered charges are then run

through front-end edits, and any records exhibiting discrepancies or errors are flagged. Registration errors are sent to a work queue for physician staff, and other errors are sent to a work queue for business staff to review and correct before releasing the claims and billing the appropriate health insurance plan.

Two and a half years after redesigning the process, the performance of the ENH Medical Group's revenue cycle had improved significantly, as documented in Table 1. Although remnants of the old billing system still remained, patients generally were much more satisfied with the billing process. Physicians who previously disparaged the billing office and its inability to provide reports had become staunch supporters. By 2006, ENHMG was continuing to refine its workflow processes and system functionality to enhance its revenue cycle performance. Some of these changes included electronic eligibility verification, more robust front-end coding edits (based on the most frequent insurance denials) and imaging of health plan "explanation of benefits" forms.

## **Service Design Principles**

In this section, we identify lean operations design principles that have been used by ENHMG to improve its revenue cycle. These principles have often been articulated in manufacturing (see Monden 1998) and in some instances for service settings (see Swank 2003). These principles can be used to improve any service process and are summarized as follows:

1. Eliminate Waste
2. Reduce batch size

3. Build quality at the source
4. Build service inventory of frequently performed activities
5. Build resource flexibility and pool resources
6. Increase visibility of queues for continuous improvement

We discuss each principle in detail and illustrate how it has been used by ENHMG to improve its revenue cycle.

## **Eliminate Waste**

*Waste* is any activity, time, or resource that is not adding value to the customer. Waste is eliminated by avoiding duplicate work and ensuring that no resource works on defective jobs. In services, an important aspect of waste elimination is to ensure that all data is captured once and not entered repeatedly. Data can then be stored centrally and made accessible to every step of the process. This ensures data accuracy and saves resources used to reenter the data. Eliminating rework and duplicate work helped ENHMG reduce a significant amount of waste.

For example, by collecting co-payments at the time of service, the need to spend an additional \$7 per bill to collect \$10 was eliminated. In the new system, charges are scrubbed prior to creating a claim by checking for frequent errors that lead to denial by insurance companies. Any identified errors are corrected by office staff that has the knowledge and experience to fix them. In addition, account management staff has online access to view insurance cards and documentation, which eliminates the need to request information from physician offices and then wait for the data to be copied and faxed. All these activities have saved resources and reduced time.



Another example of waste reduction is the fact that every patient encounter no longer requires a paper form from the physician that is reentered by the staff. This change has improved accuracy of information, eliminated duplicate work, and hastened the process to drop charges.

## **Reduce batch size**

Batch size is the number of units that a resource either works on at one time or transfers from one stage to another. For example, when the billing-related information for each patient is entered into the system in batches, a delay in the data entry and collection process is created. Filing the financial claim as soon as each patient is seen reduces the batch size to one unit and decreases the time to collection.

A good example of batch size reduction at ENHMG is in radiology, where the use of digital images has allowed transfer to radiologists one at a time. In the past, several film images were physically transferred to the radiologist in a batch. The result was a high waiting time for each image to be processed. Reducing the transfer batch size to one unit has significantly reduced the waiting time and thus the turnaround time for each image. In many service examples, the use of information technology to replace paper has allowed transfer batches to be reduced to one unit, which has improved overall efficiency.

The new system at ENHMG allows every doctor to initiate collection by documenting and entering the diagnosis and required tests directly into an electronic record. Physician charges, as well as charges for tests ordered through the system, are automatically triggered when the physician closes his or her encounter. This ensures a

batch size of one unit, unlike the old system, when patient forms from doctors were often batched before data was entered into the billing system. As a result, the process of generating a bill starts as soon as a patient is seen rather than when a batch is processed.

## **Build Quality at the Source**

When a resource spends time on a defective job, work is being wasted. Working on defectives decreases the effective throughput and increases the time spent by each job in process. It is thus important for every process to minimize the number of defectives and ensure that any defectives are detected and eliminated at the source itself. The goal is to ensure that every defect is caught as soon as it is introduced so it does not proceed to the next stage.

For example, a major source of delays and double work at ENHMG was the fact that incorrect information regarding patient insurance was on file. The new process of double-checking patient information at registration reduces the number of defectives that move forward. The fact that every step of the process accesses the same central registration record ensures that additional errors are not created by multiple entry of registration data. Each record is run through front-end edits for possible registration errors. Any identified errors are corrected by the office staff that initially checked in the patient and reviewed his or her registration and insurance information.

Errors have also gone down due to the single-point entry of registration and consultation information. Previously, the physician completed a paper form by ticking boxes associated with her patient's condition, labs, and other tests, and then by writing in

a summary or diagnosis. The form was then processed by staffers who coded the information into charts and billing systems. The process now relies on the physician to enter the summary of the encounter into the system. This clearly improves the overall quality of the data, since the physician is coding it herself immediately after the consultation. The information is fresh and need not cycle through an additional and now-redundant activity. The presence of a set of online edits and checks that prevents the submission of erroneous information further ensures quality at the source.

Upon submission of an encounter, the data in the electronic form is automatically verified against a set of consistency checks. These checks are based on the most frequent reasons for rejection by insurance companies and thus ensure quality at the source. Charges that have errors found by the scrubber are routed to work queues directed to the staff with the knowledge to correct and resubmit. Registration-related errors are routed to registration staff; coding-related errors are routed to certified coders. As a result of quality at source, denial rates have declined from around 25 percent to around 11 percent.

### **Build service inventory of frequently performed activities**

For a product, inventory is often viewed as finished goods that are produced before the customer requests them. For a service, inventory can be viewed as process steps that are completed prior to the arrival of the customer (see Chopra and Lariviere, 2005). This may include steps as simple as pulling a patient's file before the patient arrives to steps as complex as an airline creating and coding check-in kiosks that have several process steps pre-built. The creation of service inventory speeds up customer flow by reducing the amount of work to be done after the customer arrives. Examples of

service inventory in the health care setting include having all patient information online so that the doctor can access it during the patient's visit, pre-populated forms and form letters that doctors can tailor to a specific patient, and consistency checks based on frequent reasons for denial. The existence of service inventory reduces the work that a doctor and other resources perform after the patient is seen.

There are several good examples of service inventory at ENHMG. In the new process, service inventory is collected a few days before the patient sees her physician, when the office calls the patient to request verification of registration information, remind her of the appointment, and discuss any outstanding charges. During the office visit/physician consultation, the physician has all the inventory on hand (patient's history, prescriptions and other medication, research advances, and so on) to perform tests, produce diagnoses, and order additional services (labs, scripts, etc.). Once the physician submits the form with this information, the encounter is verified using service inventory in the form of a list of scrubbing rules (data checks to ensure that the new information in the file is consistent with the history). The charges are then processed and billed to the health insurance plan.

It should be noted that there are tradeoffs when creating service inventory. On one hand, resources are required to create service inventory. On the other hand, service inventory reduces the amount of work to be done after patient arrival. Thus, the creation of service inventory is very powerful if the inventory will be used repeatedly. The key is to identify activities that are performed repeatedly and create service inventory for them. A doctor is much more likely to create a form letter for a "typical" patient. There is little use in creating a form letter for a unique type of patient. Similarly, service inventory in

the form of automatic routines that analyze each bill for errors make more sense for errors that are more frequent. Rarer errors may be better processed manually, because it is not worth the investment in creating the service inventory. This is the precise structure followed at ENHMG.

## **Build Resource Flexibility and Pool Resources**

The goal in any service is to minimize the resource capacity used to provide an appropriate level of service. With a high-enough resource capacity, any level of service can be achieved. The trick is to structure the resource capacity in a manner that minimizes the amount required but provides the customer with responsive service.

A powerful approach to reducing the amount of capacity required is to pool or centralize the available capacity. Pooling of capacity can be physical, or it can involve cross-training. For example, if radiology equipment in a hospital is physically centralized, this ensures that the equipment can be used for any part of the hospital that requires it. This improves the utilization of the equipment but increases the response time for individual requests. In contrast, if each department were to have its own radiology equipment, the amount of equipment required would be significantly higher, thus raising costs. It would, however, speed up the response time for any patient because the processing capacity was nearby.

A good approach to this tradeoff is to structure resource capacity based on the utilization. Thus, departments with a steady demand for radiology services can be given their own equipment. This ensures high utilization while providing quick response. In

contrast, equipment for radiology services to other departments where the needs are lower and more sporadic can be centralized. For these departments, the response time will be slightly longer but the gain in terms of reduced resource requirements will be significant.

We illustrate the concept using some of the processes at ENHMG. A call is placed to the patient a few days prior to the consultation to remind the patient of the appointment, ask if there are specific reasons for the appointment, and ensure that all the personal and insurance information is up to date. At this stage, registration resources are centralized for better utilization. This contrasts with the previous process where registration was handled by each of the 50 physician offices. The centralization of registration resources has decreased the resource requirements and improved the quality of output, because this group is more knowledgeable about registration issues. Similarly, non-registration related errors in charges go to a common work queue and are fixed by a centralized group. Staff in this group develop the expertise to fix such errors and are centralized for better utilization.

## **Increase visibility of queues and performance to drive continuous improvement**

One of the most important principles of lean operations is to ensure that all jobs waiting in queues as well as performance measures are visible to those responsible. The visibility of queues creates a sense of urgency and allows the responsible resource an opportunity to take appropriate action. When queues are not visible, it is much more likely that a resource will focus on the task at hand, further delaying jobs in the queue.

Visible queues allow the organization to focus on areas that require further improvement and help create an environment of continuous improvement.

The new system at ENHMG has increased visibility of queues all along the process. When a physician logs into the system, she is immediately prompted with all her open encounters (waiting to be closed) and upcoming appointments. This information is also visible to ENHMG's management for patient information verification, service scheduling (appointments, follow-ups, lab tests, prescriptions, and so on), and insurance billing.

The visibility of queues benefits the organization on two fronts. First, it provides a prioritizing tool for physicians and administrators. As they log in, they are quickly able to close encounters for records that have been updated while they were away (with tests results, prescription information, or other data), effectively enabling the update of encounters whenever they access ENHMG's system.

Making the queues visible also provides administration with valuable performance metrics, which allows for targeted improvement. For example, a series of encounters may remain open because they are all awaiting lab results from one specific location. The administration may then contact the lab to inquire, something they would not have been able to do previously, when queues were not visible. Open encounters may have many causal factors, and making them visible to management allows supervisors to judiciously target efforts to improve the quality of both their in-house and contracted services.

## ***Conclusion***

Basic lean principles that have been used in manufacturing environments have significant applicability in service settings. The revenue collection process at ENHMG provides a powerful example of the practical application of these principles. These principles are universal and can be applied in a variety of service settings. Each service organization, however, has to identify the principles that are most applicable for it.



## **References**

1. Barber, Robert L. "Prompt Payment Depends on Revenue Cycle Diligence," *Healthcare Financial Management*, December 2002: 52-59.
2. Chopra, Sunil and Martin A. Lariviere. "Managing Service Inventory to Improve Performance," *Sloan Management Review*, Fall 2005: 56-63.
3. D'Eramo Michael and Lynda Umbreit. "Thinking Inside the Lockbox: Using Banking Technology to Improve the Revenue Cycle," *Healthcare Financial Management*, August 2005: 90-93.
4. Graham, Timothy. "Increasing Revenue Through A/R Recovery, Revenue Cycle Redesign," *Healthcare Financial Management*, November 2001: 60-64.
5. Laforge, Richard W. and Johnny S. Tureaud. "Revenue Cycle Redesign: Honing the Details," *Healthcare Financial Management*, January 2003: 64-71.
6. Monden, Yasuhiro. *Toyota Production System: An Integrated Approach to Just-In-Time*, 3<sup>rd</sup> edition, Engineering and Management Press, Norcross, Georgia, 1998.
7. Spear, Steven J. "Fixing Healthcare from the Inside, Today," *Harvard Business Review*, September 2005: 78-91.
8. Swank, Cynthia Karen. "The Lean Service Machine," *Harvard Business Review*, October 2003: 123-129.
9. Womack, James P. and Daniel T. Jones. "Lean Consumption," *Harvard Business Review*, March 2005: 58-68.