

Data Management

I was brought up to believe that the only thing worth doing was to add to the sum of accurate information in the world.

—Margaret Mead

Data and technical standards are critical to the advancement of the national health information technology (HIT) agenda and to achieving many of the agenda's intended health goals and outcomes. Well-defined standards are the foundation for interoperability among systems and for systems that can fulfill the promise of electronically enabled health and care. By harmonizing standards, different information systems, networks, and software applications can “speak the same language” and work together technically to manage and use consistent, accurate, and practical health information for providers and consumers (U.S. Department of Health and Human Services, 2006a).

Nurse case managers are well positioned to move the country's information technology (IT) agenda forward. They possess firsthand knowledge of how data management can impact patients and the providers who care for them. They work in all areas of the healthcare arena and assume a variety of roles, all of which give them unique insight into the good, the bad, and the ugly sides of our healthcare system. They understand what data are needed to manage the care of patients and the importance of being able to access and communicate those data. They sit at many important stakeholder tables, having input into the process of defining standards, and contribute to the design of interoperable IT systems.

The United States continues to have the highest per capita health care spending among industrialized countries. In 2009, spending is projected to reach \$2.9 trillion if the current fragmented, uninformed, and uncoordinated healthcare system does not change (U.S. Department of Health and Human Services, 2006b). Of course, changing demographics such as the aging population, longer life expectancy, a growing number of people living with

disabilities, and rampant low literacy, as well as medical inflation and medical errors, all contribute to increasing costs. HIT is the critical tool that can significantly reduce medical errors, engage consumers and patients in their own health and care, provide information in a coordinated fashion, and reduce costs. This is accomplished through systems and products that electronically create, store, transmit, and present personal health information for multiple purposes, most notably for patient care.

In this fragmented system, nurse case managers are often referred to as the glue that keeps the system together. They are the advocates, consultants, coordinators, collaborators, educators, facilitators, liaisons, negotiators, researchers, risk managers, brokers, and mentors. All of these roles are enhanced and made easier and more effective when good data management processes and systems are in place, allowing for the collection, analysis, evaluation, reporting, and application of data. This chapter explains these processes and gives some practical examples. Understood throughout this data management discussion is the importance of data security, the need for information standardization, and the mandate to adhere to privacy and confidentiality legislation such as the Health Insurance Portability and Accountability Act (HIPAA), which is discussed in detail in Chapter 6.

INDIVIDUAL AND AGGREGATE DATA

Data need to be complete, accurate, and timely. The word *data* is the plural of the Latin *datum*. It refers to a collection of organized information. Data may consist of numbers, words, or images, particularly as measurements or observations of a set of variables (Wikipedia, 2008). The terms *data*, *information*, and *knowledge* are frequently used interchangeably. The concepts overlap.

Today, most businesses acknowledge that data (not “love” as the song of old spoke of) make the world go round. Therefore, data management is crucial to the success of any business. Health care is no exception. Data management provides the case manager with the processes and structures to create, capture, analyze, and act on information. IT is critical to facilitate data sharing and is seen as an effective vehicle for getting the right data to the right person for the right task at the right time. Good data management helps the nurse case manager:

- identify patients who would benefit from case management services
- stratify patients according to their risk levels;
- make better, more-informed decisions;
- coordinate quality care in a more cost-effective manner;
- contribute to the intellectual capital of an organization;
- gain insight and innovation produced by the free flow of ideas;
- eliminate redundant processes and streamline operations;
- improve customer service and efficiency; and
- be more productive

Nurse case managers work with two types of data: individual and aggregate.

Individual Data

Personal health information and demographic data are considered individual data. Patients cannot receive appropriate and efficient care unless clinical information about them is available at the point of care. When a patient's health information is not accessible to providers as he/she transitions through the continuum of care, clinical decisions often are made without full knowledge of the patient's history and health status. The absence of needed clinical information can lead to duplication of tests, which not only increases the costs of health care, but also subjects the patient to unneeded clinical interventions that always carry a degree of risk. Similarly, the absence of needed information could lead to incorrect decisions or medical errors that might result in adverse clinical outcomes. Over time, more advanced electronic health records (EHRs) will have integrated clinical decision support with the latest scientific evidence guiding clinical interventions at the point of care. These EHRs will also contain environmental data that should influence many treatment decisions. Increasing the adoption of interoperable EHRs will decrease the risks to both the efficiency and efficacy of care.

Case in Practice: *A patient is brought into the emergency room, complaining of severe abdominal pain. The patient fails to tell the provider that she was admitted to another area hospital with similar symptoms last week, where a whole battery of tests were ordered and found negative. The patient also fails to tell the treating ER provider that she suffers from depression. The provider, guided by his best judgment, orders the same battery of tests, only to discover the same results.*

Imagine for a moment this scenario if all the hospitals in the area were using systems that were interoperable. That same ER provider would enter the patient's demographic information (name, address, date of birth, Social Security number, insurance identification number, etc.) into the IT system and up would pop this patient's medical history and last ER visit information, even though the visit was at another hospital. The provider could pull up the results of all the lab work, x-rays, and imaging tests and review them. He could see what medications the patient was on or was prescribed. Just think of how valuable this information would be to the provider as he conducted his assessment of the patient and diagnosed what was wrong. More than likely, many of these tests and scans would not need to be repeated, the provider could conclude a diagnosis faster, and the patient could receive the appropriate treatment. In this instance, the patient benefits, the provider benefits, and the healthcare system in general benefits.

Aggregate Data

Aggregate data, on the other hand, are used to look at populations defined by a common variable or variables, such as disease state or demographic information. "Aggregate data" describes data combined from several measurements or a multitude or combination of other more individual data. For example, aggregate data can help a nurse case manager identify all patients with diabetes, all patients who are female, or all patients living within a certain zip code. This type of information can usually help a case manager better manage his or her resources and target his or her interventions.

Case in Practice: *A nurse case manager was asked by administration to join a work group that is looking at patient incentives. This group wants to come up with an incentive program that will*

encourage adolescents to go to their primary care providers (PCPs) for well visits. To do this, the case manager must first understand who the target population is. In this case, it is adolescents between the ages of 12 and 21 who have not received well-child visits in the past 12 months.

Thanks to the company's well-designed database, this information is easily accessible. The case manager asks for a report listing all of the members within the age range who have not had a well-child visit in the past 12 months and the names and contact information for both the member and the assigned PCP. She then sorts the report by the members' PCPs and sends copies to the providers, asking them to reach out to these members or to the guardians of patients under 18, as reminders of the importance of well visits. At the same time, the nurse case manager reaches out to these members directly with a letter offering them an incentive—a free subscription to a popular teen magazine—if they see their PCPs for a well visit before December 31.

This is an example of reaching out to an aggregate population. Of course, the case manager could decide to reach out to an individual adolescent on this list in an effort to encourage the member to see his or her provider, and the case manager could obtain individual personal health information as well.

Whether looking at individual or aggregate data, the steps in data management are the same for both: collection, analysis, evaluation, reporting, and application. However, the tools used for each process often differ.

DATA COLLECTION

Case managers collect data from a variety of sources: from the patients themselves through a one-to-one encounter either in person or telephonically, from providers and other members of the care team, from the family, or through IT systems such as pharmacy, lab and radiology databases or enrollment and claims payment systems. The data are analyzed and the case manager develops a plan of care for the patient. Outcome data are then evaluated and reported, and the information learned is applied to other patients with similar profiles or used to make adjustments to the plan of care.

Whether data are collected on an individual or in the aggregate, or collected for personal use or a formal study, they must be collected in an organized fashion in order to be managed effectively. They must be complete, accurate, and timely. The data collected must be good, meaning they must be reliable (results are repeated with subsequent measurements), unbiased (the data contain no systematic errors that either add to or subtract from the true values), and valid (the data measure what they're supposed to measure).

Before data collection begins, everyone should agree on why the data are being collected, what data are to be collected (all the elements and criteria), how they are to be collected, and over what period of time. Once these questions are decided, data collection tools are identified. The case manager may choose a standardized tool or set of tools that have been validated or develop tools in-house. When doing the latter, it is important to include the end users in the process. Their participation will lead to a more user-friendly and effective tool, with a faster rate of

adoption by the end user. It's important that the purpose of the data collection is clearly defined and disseminated before the process begins. Nurse case managers today work in a variety of care settings including acute, episodic, post-acute, sub-acute, rehabilitation, community- and home health-based care, and insurance and managed care arenas. These settings and the target population usually determine whether the data the nurse case manager needs to manage are individual or aggregate.

Individual Data Collection

Many case managers today collect data on individual patients using some version of an electronic case management system, electronic medical record (EMR), EHR, or registry. Some case managers, however, use Excel™ spreadsheets or Access™ databases, while still others use paper to manage the care of their patients.

EMRs and EHRs are promising tools to improve quality and efficiency in the healthcare system. They allow providers to keep all individual patient records electronically. However, the literature shows a slow rate of adoption for these tools. “Through 2005, approximately 23.9% of physicians used EHRs in the ambulatory setting, while 5% of hospitals used computerized order entry” (Jha et al., 2006). E-prescribing and registries have made greater strides in the electronic healthcare arena, with a slightly higher rate of adoption. E-prescribing is an electronic prescribing system that allows the provider to write a prescription on a computerized system and have it electronically transmitted to the pharmacy. Some models of e-prescribing also alert the provider to adverse drug interactions, generic alternatives, whether the patient's health plan has the drug on formulary, and, in some instances, whether the drug requires preauthorization by the insurer.

Registries are systems used to collect and track individual patient information, but also aggregate data pertaining to patient populations with particular chronic diseases. “While some EMRs include registry functions, not all do. What's more, EMRs are expensive and sometimes difficult to implement. Because EMRs are slow to gain acceptance, registries used as testing grounds for electronic recordkeeping have demonstrated their benefits through vastly improved health outcomes. A well-designed registry can

- sort patients based on specific measures of their health status, such as blood pressure or HbA1c levels;
- generate lists of patients needing care;
- assess health among defined populations;
- provide key information for patients and physicians at point of care;
- provide follow-up care reminders;
- help analyze a medical practice's successes or lapses; and
- facilitate interaction between patients and health professionals in support of patient self-management” (Hudson Center for Health Equity & Quality, 2005)

Aggregate Data Collection

Many nurse case managers working in disease management programs, the public health arena, epidemiology, on research projects, etc., use aggregate data. This collection usually involves

voluminous amounts of data. Therefore, IT operation systems are used along with software packages and applications to handle the vast amounts of data. These systems are bountiful in the marketplace today and are used by case managers to manage data.

An application, or application program, is a software program that runs on a computer. EMRs, EHRs, case management systems, registries, Web browsers, e-mail programs, word processors, games, and utilities are all examples of applications. The word *application* is used because each program has a specific application for the user. For example, a case management system can help a case manager track his or her patients and their progress, while a video game can prevent that same case manager from getting the tracking done.

In contrast, system software consists of programs that run in the background, enabling applications to run. These programs include assemblers, compilers, file management tools, and the operating system itself. Applications are said to run on top of the system software, since the system software is made up of “low-level” programs. Although system software is automatically installed with the operating system, users can choose which applications they want to install and run on their computers (TechEncyclopedia, 2008).

Each organization has different needs that require unique software applications. It is important to remember that it is not necessary to understand how each application works; rather, it is important that there is a clinical knowledge base to ensure that information reported is logical to the healthcare process. Knowledge is the fuel that allows software applications to work. Commercial applications that are available are programs such as Excel and Access. These programs allow information to be collected and incorporated into charts or databases to analyze and present information in an organized manner.

Some organizations prefer to customize their own programs rather than buy ready-made systems. Some have IT departments that develop applications to meet the needs of the organization. If this is not available, an alternative is for the organization to contract with consultants who specialize in software development. Understanding and communicating what the needs are and what the organization wishes to accomplish are critically important to the overall success of the process. Accordingly, case managers must take an active role in defining and communicating their unique needs when making application or system decisions.

Data collected using these tools are stored in a data warehouse. A data warehouse is a repository of an organization’s computer-generated data that is set up in a way to facilitate fast retrieval of correct data without slowing down the operational systems of the organization. Having all data stored in a system that utilizes standard programming language and logic to define an organization’s business rules is essential if the organization is going to operate from one single point of truth for data.

DATA ANALYSIS

An important step in data management is data analysis. After the data are collected, organized, and summarized, they are put through the process called analysis. Analysis is the means of

looking at data with the intent to extract useful information and develop conclusions. When discussing aggregate data, the term *data mining* may also be used. Data mining tends to focus on larger data sets, with less emphasis on making inference, and often uses data that were originally collected for a different purpose. Today, the demand for data is tremendous, and in some areas we have more data than we know what to do with. Therefore, data must be analyzed to be useful.

The marketplace is demanding that healthcare providers and payers develop and provide data to improve care, support and define costs, and demonstrate outcomes. To do this, analysis of pertinent data generated every day by all involved in the healthcare system is necessary. IT systems allow organizations to obtain information and generate reports on a variety of topics from the data collected.

If a quality management team wants to evaluate the effectiveness of a particular treatment guideline or critical pathway, data generated from those using the pathway are analyzed to determine variances in care and outcomes that may have occurred. Information gathered from analysis of these areas allows the healthcare team to determine whether the guideline or pathway is being applied effectively and meeting the desired goals. Data can also demonstrate whether changes in treatment patterns by providers and ancillary professionals have occurred since the guideline or pathway was implemented. Similarly, if an issue is uncovered or an opportunity for change or improvement is identified, a *root cause analysis* is conducted. This is a process used by healthcare providers and administrators to identify the cause of, or causal factors contributing to, variation in performance and outcomes. This process became even more popular after the Institute of Medicine (IOM) Committee on Quality of Health Care in America released its two reports, *To Err is Human: Building a Safer Health System* and *Crossing the Quality Chasm: A New Health System for the 21st Century*. These reports shocked the healthcare world when they said, “Health care today harms too frequently and routinely fails to deliver its potential benefits,” and “Quality problems are everywhere, affecting many patients. Between the health care we have and the care we could have lies not just a gap, but a chasm” (Institute of Medicine, 2001).

The choice of analysis is just as important as any other aspect of data management. A proper analysis should be planned in advance, during the design phase of the case manager’s project. Nurse case managers need to ask themselves, “After the data are analyzed, will I be able to answer the question that I set out to answer?”

The basic types of statistical analyses include confidence intervals (used when trying to estimate a population value or the difference between two population values), hypothesis tests (used when testing a claim, such as whether one drug is more effective than another), and correlation and regression analysis (used to show if and/or how one variable can predict or cause changes in another variable; Rumsey, 2003).

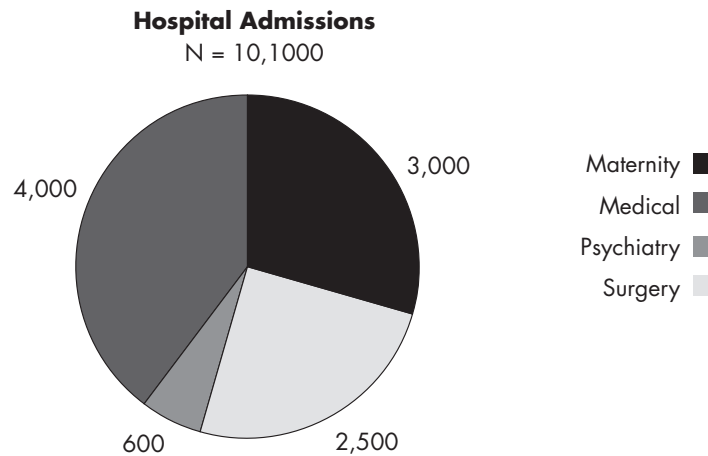
When analyzing data, it is helpful to display the data. The main purpose of the display is to make a certain point clearly and effectively. The most common types of data displays are pie charts, bar graphs, histograms, tables, and time charts.

Pie charts display data in a circle or pie and divide the data into slices. They are easy to read and can quickly make a point. A pie chart takes categorical data and breaks them down by

group, showing the percentage falling into each group. The sum of all the slices of the pie should equal 100% (see Figure 3–1).

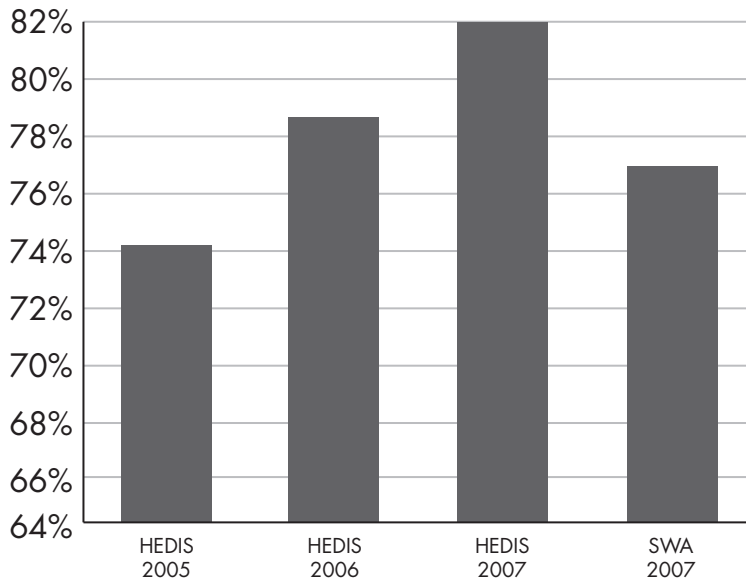
Case in Practice: A hospital administrator is given a yearly report that tells him how many admissions the hospital had in a given year. Realizing that these are important data, the administrator wants to analyze them to see what types of admissions the hospital has so that he can determine his budget for the different units, and identify any opportunities for improvement. The report tells him that there were 3,000 admissions for maternity, 4,000 for medical, 600 for psychiatry, and 2,500 for surgery. A clearer, more effective way to display these data is a pie chart.

Figure 3–1. Sample Pie Chart: Hospital Admissions Broken Down by Type



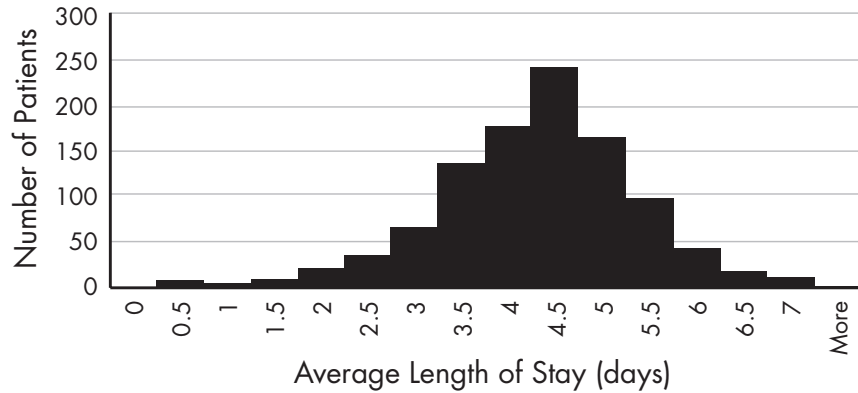
Bar graphs are also popular data displays. They, too, use categorical data and break them down by groups to show how many (numeric) or what percentage are in a group by the length of the bar (see Figure 3–2).

Case in Practice: An organization working hard to educate both its providers and members about the importance of lead testing for children under 2 years old implemented several outreach strategies complete with incentives for the providers and the children. To determine if the outreach project was effective, the plan collected and recorded data on each 2-year-old as to whether they were screened for lead poisoning. A look at 3 years of data showed that in year 1, the plan's Healthcare Effectiveness Data and Information Set (HEDIS) scores were 70; in year 2 the score was 79; and in year 3, it was 81. The plan compared these scores to the statewide average (SWA) for this measure, 75. An easier, clear, and effective way to analyze these data is to put them in a bar graph.

Figure 3-2. Sample Bar Graph: HEDIS Scores by Year

Histograms are bar graphs used to display numerical data (see Figure 3-3). The categories are ordered from smallest to largest. Bars on a histogram touch each other in order to capture each number. Histograms look at frequency (number of patients in each group) and relative frequency (percentage of patients in each group). When histograms are used, they reveal the so-called shape of the data, such as bell shaped. Do the data look like a mound with tails trailing off to each side? This usually tells the case manager that most of the patients in the sample fall somewhere in the middle of the numbers. For example, if a case manager graphed the average number of days patients stayed in the hospital over a period of a year and the peak of the mound was between 3 and 5 days, with the tail to the left at less than 1 day and the tail to the right at greater than 15 days, then it would be visually clear that the two “tails” represented outliers in the patient population.

Figure 3–3. Sample Histogram: Average Length of Stay



Tables are used to display summary information from a data set. Their column and row formats are clear and easy to read. Unlike a pie chart or graph, a table can show several data points at once (see Table 3–1).

Case in Practice: *If a workers’ compensation vendor wanted to understand where it stood financially, it might look to develop a report that told a number of variables: (1) the source of the information (which data system or data warehouse the information was pulled from; (2) the year the claims were billed and paid; (3) the claim type, institutional (inst) or professional (prof); (4) the number of claims of each type for each year; (5) the amount billed for the service; (6) the amount paid; and (7) the totals for each category.*

In this instance, the most effective way to display a report with this many data points is a table. It is clear and easy to understand and tells the reader immediately what he/she wants to know.

Table 3–1. Sample Table: Workers’ Compensation Report

Claim Source	Year	Claim	No. of Claims	Billed	Paid
Diamond	2006	INST	13,625	\$25,025,382	\$11,655,827
Diamond	2006	PROF	585,947	\$67,890,071	\$22,589,359
Diamond	2007	INST	17,671	\$39,548,883	\$17,620,208
Diamond	2007	PROF	803,422	\$105,927,684	\$33,292,617
Diamond	2008	INST	18,917	\$53,128,150	\$20,515,106
Diamond	2008	PROF	964,476	\$134,500,481	\$42,124,815
Grand Total			2,404,058	\$426,020,631	\$147,797,932

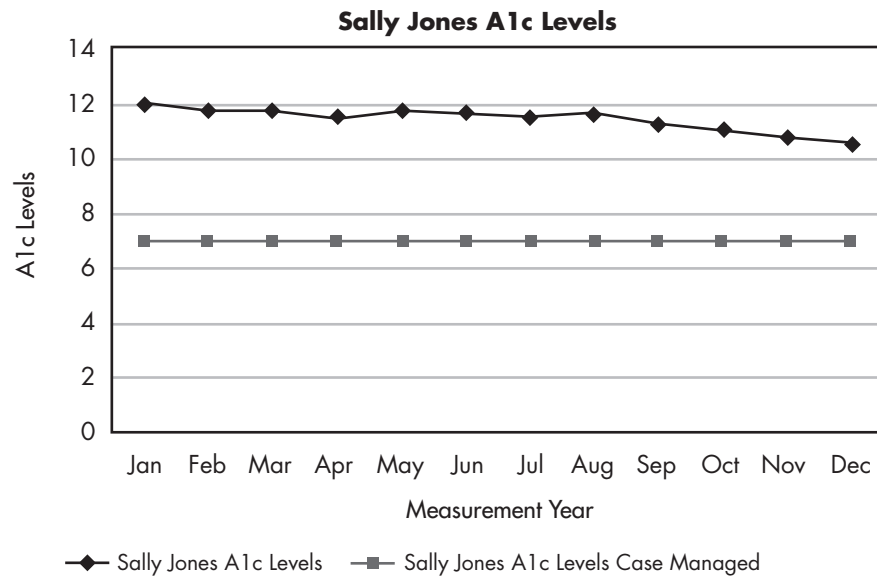
Time charts display data over a period of time and use a quantity (vertical) axis and a time (horizontal) axis (see Figure 3–4).

Individual data analysis is used by case managers to stratify the acuity level of patients and prioritize caseloads. Stratification is used to determine a member's level of need and is categorized to direct a member to the appropriate level of case management services, including frequency of contact. An effective case management program should have a stratification process in place that has the following key characteristics:

- uses methods to map level of needs to case management services and reasonably clear descriptions of the levels to allow all case managers to accurately distinguish levels and apply them consistently;
- factors into assignment of caseload with complexity of coordination, intensity of services, and frequency of contact
- leads to the intensity of health services coordinated by the case manager in the care plan; and
- demonstrates fluidity during the duration of case management (Gesten, Leonard, & Schettein, 2006)

Individual data are also used to assess how a patient is progressing and to determine whether or not he/she is responding or adhering to a plan of care. For example, if a nurse case manager has been collecting data on a patient over time, he/she may plot those data on a graph or in a chart to see how that patient is responding to treatments and interventions. The patient, too, can see how he/she is doing. It is said that a picture is worth a thousand words. When data are plotted on a graph, they are easily interpreted and analyzed, especially if the chart has a reference point on it as well.

Case in Practice: *A nurse case manager is working with a patient with diabetes and her provider to control the patient's A1c levels. The patient is responsive to the case manager and has been watching her diet and taking her medications as prescribed. Although the patient admits to falling off both regimes occasionally, she goes regularly for her blood lab work and receives routine reports from her provider. The problem is that the patient rarely remembers exactly what her last report said. Therefore, she is never quite sure how she is doing. She does remember that her A1c level was 12 in the beginning of the year and that it has fluctuated each subsequent month. That is as much as she can recall. It has become very difficult for the patient to keep track of how she is doing. But once the nurse case manager gives the patient a report that plots these numbers on a line graph, everyone can easily see that the patient's A1c level is headed in the right direction—down. What makes the report even more valuable is that the case manager has added a benchmark line at 7 on the chart (A1c level recommended in the American Diabetes Association guidelines) to show the patient which direction the A1c level should be going and how her levels compare to the national benchmark. It is important to note that the benchmark in this instance should come from a reliable source, standard, or clinical guideline before comparing data to it. These tools and processes are discussed in detail in Chapter 5.*

Figure 3-4. Sample Time Chart: Patient's A1c Levels

Cost-Benefit Analysis

Cost-benefit analysis is used to demonstrate the ratio dollars spent to savings achieved. In case management, documentation of savings achieved as a result of case management intervention, or as a result of implementation of a service or use of a product, is an important outcome that the case manager can use to demonstrate his or her value to the healthcare system.

Components that are included in the cost-benefit analysis are

- identifying information regarding the patient,
- overview of the case management intervention,
- summary of the intervention,
- costs associated with the case management intervention, and
- any savings achieved; these can include
 - avoided charges,
 - discounts or negotiated rates,
 - reduction in equipment and services,
 - gross savings (potential minus actual charges),
 - net savings (gross savings minus case management fees),
 - status of case (open or closed), and
- review of pertinent aspects of the case, including
 - clinical,
 - social-situational,
 - educational, and
 - wellness

The summary of the cost–benefit analysis should outline the case manager’s specific intervention in the case. Issues included are the patient’s compliance, enhancement of quality of care, outcomes achieved, prevention of greater illness or injury, and better/more appropriate use of resources (Llewellyn & Moreo, 1998).

Case in Practice: *An independent case manager is called to work with a 68-year-old woman with peripheral vascular disease who has had four acute care admissions in the past 2 months due to cellulitis. The assigned managed care case manager feels that an on-site case manager is needed to find out what factors may be causing the need for frequent admissions. Her supervisor authorizes the contracting of an independent case manager to perform a consultation.*

After receiving the referral from the managed care case manager, the independent case manager calls the patient and makes an appointment to see the woman in her home. The patient is found at home, sitting on a recliner with her leg elevated. The case manager notices that the leg is swollen and has an old dressing, which is falling off, that is partially covering a large, oozing wound. Several things may be contributing to the poor wound healing and exacerbation of the cellulitis. The case manager observes that the patient lives alone in a small third-floor apartment, is unable to drive to the store to get the prescribed supplies for her wound care, and, although she has a few supplies from when she left the hospital, cannot remember how to use them as demonstrated by the hospital nurse. The patient states that she does not want to bother her family since they are all very busy, and admits that she is a heavy smoker, which could be contributing to poor circulation. The patient states that she assured her doctor she would stop smoking, but she needs help.

Upon returning to her office, the case manager calls the treating physician to discuss the case. He states that he thinks the patient should be readmitted so that the social worker can find a skilled care facility for her to stay in until her wound heals. Otherwise, he does not know what to do for her anymore. The case manager recommends to the doctor that a course of outpatient physical therapy may be a solution. She states that in her review of the records, the patient’s wounds began to heal each time she received whirlpool therapy in the hospital. She suggests arranging for a series of outpatient whirlpool treatments. The case manager also states that the therapy visits will allow professionals to clean and redress the wound while increasing the woman’s circulation stemming from activity. She assures the physician that she will keep him informed of progress and notify him if the wound is not healing effectively so that admission can be arranged.

The doctor agrees to the plan and states, he will provide a prescription for whirlpool therapy three times a week, with dressing changes. The case manager uses this opportunity to inform the physician that transportation is a problem too and that she anticipates the woman will be compliant with therapy only if she receives dependable third-party transportation, since it is highly unlikely she will contact her family for assistance. The case manager also uses the opportunity to address the patient’s smoking. She inquires whether the patient is a candidate for a nicotine patch to help her decrease the number of cigarettes she smokes. The doctor agrees to write a prescription for nicotine patches and third-party transportation for therapy.

The case manager calls the managed care case manager and informs her of the progress, gaining approval to proceed with coordination of the outpatient therapy. Expectedly, the nicotine patch and transportation are denied as uncovered benefits. Anticipating this denial, the independent case manager informs the managed care case manager that she has prepared a brief cost–benefit analysis demonstrating the expected ongoing costs if the patient does not quit smoking and cannot get to

therapy. The independent case manager informs the managed care case manager of the patient's history of refusing to seek assistance from her family, coupled with the other reasons for her repeated hospitalizations. She states that the third-party transportation and the nicotine patches are very small expenditures compared to even one additional hospitalization, which the physician is planning as an alternative treatment.

The managed care case manager delivers the estimated cost–benefit analysis to her company's medical director, who approves the out-of-benefit items. The independent case manager contacts an outpatient rehabilitation center in the managed care network that is close to the woman's apartment and that is equipped to provide the prescribed therapy. The case manager inquires about any wellness programs provided by the rehab center and learns that it provides smoking cessation classes. The case manager speaks with the physical therapist, who agrees to plan the therapy to coincide with these smoking cessation classes. The center also provides transportation for its patients.

The case manager speaks to the patient regarding her findings, and the patient is agreeable and thankful for the help. Therapy is scheduled to begin. The case manager follows the patient's progress over the next few weeks. In speaking with the physical therapist, she learns that the patient's wounds are showing signs of healing. The therapist informs her that the patient is attending the smoking cessation classes, in addition to using the patch, and has decreased from smoking two packs a day to less than a pack a week. The therapist states that she is going to recommend to the doctor in her report that the wound care treatments continue but decrease to twice a week. The case manager speaks with the patient, who says she is doing much better. She states that this is the first month she is not in the hospital in a long time, and she is very proud that she is able to cut down on her smoking. In addition, the patient is getting around the house more and should start driving soon.

The treating physician is pleased that the patient is finally making progress. After another month, all treatments are completed, the wound has healed, and the patient is back to her normal activities. The case manager speaks with the managed care case manager and suggests case closure. As part of her final report, the case manager includes a detailed cost–benefit analysis. The report demonstrates that prior to case management involvement, the patient had 4 admissions, each lasting about 5 days. The average cost for each admission was \$1,800 per day, for a total of \$36,000 in a short treatment period, excluding all intermittent physician visits. Care and costs implemented as a result of the case manager's intervention included outpatient physical therapy 3 days a week for 3 weeks, then 2 days a week for 1 month. The cost of therapy was \$125 per treatment. The total cost for the outpatient therapy amounted to \$2,125. There was no charge for the smoking cessation program or the transportation. The cost of the nicotine patches totaled \$145. The independent case manager charged \$75 an hour. She included 10 hours of intervention in the cost–benefit analysis, for a total of \$750. To recap, the following charges were included in the cost–benefit analysis:

Expenses:

- Cost of physical therapy: \$2,125
- Cost of nicotine patches: \$145
- Cost of case management services: \$750
- Total Expenses: \$3,020

Savings Achieved:

- Avoidance of additional 5 days of hospitalization: \$9,000
- Direct savings for the case: \$5,980

Return on investment (ROI) is one of the latest buzzwords across the healthcare system, with policy makers, payers, and consumers demanding greater value for dollars spent on health care. Government officials, legislators, health plans, and other stakeholders are increasingly being challenged to identify programs with the potential to improve quality of care and control healthcare costs.

ROI is a measure of a company's ability to use its assets to generate additional value for patients and providers. It is calculated as net profit divided by net cost and expressed as a percentage.

The Center for Health Care Strategies (CHCS) developed a set of tools to help Medicaid stakeholders identify where opportunities may exist to realize both quality improvement and cost containment goals. One such tool, the ROI/Evidence Base, was developed to help policy makers assess changes in utilization patterns of healthcare costs that may be repeated as a result of specific interventions. Following is an example of a study that proves ROI. Remember that when evaluating studies, it is important to consider the generalizability of published study results to other settings and populations. When using reported outcomes of studies in the ROI/Evidence Base to estimate potential efficiencies of proposed initiatives, case managers should consider similarities and differences in these characteristics: target and sample populations, healthcare delivery environment, intervention implementation, time frames, intensity, financial arrangements, and evaluation design (Center for Health Care Strategies, 2007).

In a 12-month, randomized control trial of 937 children between the ages of 5 and 11 diagnosed with asthma receiving care in hospitals and community-based clinics enrolled to practitioners in private practice in seven inner-city areas in the United States, it was found that by making bimonthly phone calls to advise the children's caregivers on asthma triggers and medication adherence, there was a 24% decrease in the emergency room visit rate, and no significant change in unscheduled clinic visits or hospitalizations. (Kattan et al., 2006)

Aggregate Data Analysis

When analyzing aggregate data, statistics are used. A statistic is a number that summarizes some characteristic about a set of data. Every data set has a story, and if used properly, statistics do a good job of telling that story. Statistics that are improperly used can tell a different story or only part of it. Whenever data are collected and analyzed, the researcher is typically looking to prove a hypothesis (a claim or its alternative) and determine a significant result. A statistically significant result is one that would have had a very small probability of happening by chance. The p -value reflects that probability. p -values are used to weigh the strength of the data being used to evaluate the hypothesis. Many organizations do not conduct formal studies but use data analysis to assist in making decisions about how to conduct everyday business.

Case in Practice: A managed care organization (MCO) set out to answer this question: *Would hospital readmissions and ED visit rates decrease if members received outreach calls from a case manager after hospital discharge? This was the working hypothesis. However, before the organization made a decision to invest resources and make this outreach service available and ongoing to all of its members, it wanted to see if the hypothesis would prove true. Therefore, it decided to conduct a pilot study. The MCO identified the target population: all members discharged from the hospital during*

the first quarter of the year (except maternity patients because the MCO already had an intensive case management program in place that routinely made calls to mothers after they were discharged from the hospital). The methodology was also decided. Each member in the target population would receive a call from a case manager. If the case manager was unable to reach the member, a postcard encouraging the member to call the case manager was mailed. A reasonable limit was set for the number of outreach attempts; three phone calls and one postcard attempt would be made before a case was closed with a reason code "all efforts exhausted." A survey instrument was developed for the outreach calls. The survey asked questions such as, Did you receive discharge instructions before you left the hospital? Did you receive any prescriptions for medications and, if so, did you fill the prescriptions? Do you have an appointment to visit your primary care provider and, if not, may I assist you in making that appointment? The case manager's interventions were based on the responses.

The data were collected in a software application program designed in-house by the IT staff. To obtain consistent data, the data fields were designed as check-off boxes, yes (y) or no (n), or drop down boxes. This design would prevent any loss of data that can sometimes occur when using a free text unreportable field during data entry. To analyze the data collected, baseline data were run for the target population, and the number of hospitalizations and emergency department (ED) visits for the 6 months prior to the trigger event (hospitalization) and the query was rerun 6 months after the outreach intervention. When the pilot was completed, data were analyzed. The results showed a 12% reduction in hospital visits and an 8% reduction in ED visits. The results were statistically significant, and the reduced utilization translated into savings of \$450,000 for the MCO. The pilot project was adopted and implemented as a standard service for all members.

Predictive modeling: Predictive modeling is a data-driven strategy used by healthcare agencies, managed care companies, physicians, and others interested in predicting costs, utilization and even outcomes when specific variables are applied. This model looks to confirm a correlation between the identification of patients with specific conditions or diagnoses and improved outcomes resulting from targeted outreach efforts (Hodgman, 2008).

Case in Practice: *A health plan has used a predictive modeling tool to establish that its patients living with diabetes can be very costly to the plan if the diabetes is not controlled. Therefore, a patient with diabetes is targeted by a nurse case manager for outreach. She contacts the patient to assess his understanding of the diabetic diet, to determine his compliance level, to see if he has equipment to self-monitor his disease, and to find out when his next doctor's appointment is scheduled. The nurse case manager fills in the gaps identified through this assessment to implement an evidence-based diabetes disease management program with this patient. If the patient is willing to participate in this care plan, his diabetes will likely be better managed, his costs will likely decrease, and more important, his outcomes will likely improve. The intended result of healthcare cost savings should always include improved quality of life and health status for the patient targeted for intervention.*

DATA EVALUATION

The next step in the data management process is evaluation. Evaluation is the systematic determination of merit, worth, and significance of something or someone. Evaluation often is used to characterize and appraise subjects of interest in a wide range of human enterprises,

including the arts, criminal justice, foundations and nonprofit organizations, government, health care, and other human services. In nursing case management, evaluation of a care plan and a patient's status are done continually to assess and reassess a patient's response to the care plan and measure the progress, or lack thereof, toward the desired goal.

In data management, information systems enable decision makers to choose a course of action that has the highest expectation of favorable results, both in terms of clinical and financial impact. Through a careful evaluation of the data, changes, procedures, and policies are implemented so that systems improve.

Case in Practice: *A cardiac cauterization department wants to evaluate its efficiency and effectiveness compared to other cardiac cauterization programs in the region. Information that is generated from the IT system helps determine the*

- *number of procedures performed within a given month or year,*
- *type of patients selected for the procedure,*
- *outcomes of the procedure,*
- *benefit/complication rate of the procedure,*
- *cost of the procedure; and*
- *time to complete the procedure*

The results of this evaluation can serve as a benchmark to show where the hospital stands in relation to other hospitals providing similar services. The action taken depends on the results obtained. If the outcomes of the evaluation show that the cardiac cauterization program has excellent results using these variables, this information can help market the program to payers and the community. Conversely, if the outcomes demonstrate poor results, the data help determine the changes necessary to improve processes.

REPORTING

Reporting is an essential part of data management. Reports are used to inform the case manager and other decisions makers about the effectiveness of their operations. Data used in reports should be clear and concise. Reports generated by an IT system should give the user adequate, objective information to review data critically. However, the data contained in the report are only as good as the data collected. There is nothing more frustrating than receiving a report and realizing that an important piece of data being collected was not captured in the IT system. Or worse yet, the data was captured, but not in a reportable data field.

Case in Practice: *A nurse case manager has been collecting data on her patients for months. She captured the data in the case manager's notes page, which is a free text formatted field that cannot be reported through the system; the only way to report on those data is to go into each patient's record and manually extract that piece of the note containing the information. Therefore, it is not included in the automated report generated by the IT system.*

Draft test reports generated early in the process and audited for completeness and accuracy can help avoid this problem. Nurse case managers should be involved in the report development process from the beginning. The business of health care runs on reports. Hospitals have daily census reports, staffing reports, length of stay reports, acuity level reports, cost reports, operating room schedule reports, etc., by which they function. Nurse case managers may work with individual patient reports—lab reports, radiology reports, pharmacy reports, and patient status reports, for example. The healthcare industry relies on quality reports, and morbidity and mortality reports, to inform it of its status. The government enacts laws that affect the quality of health care in the country based on reports. When dealing with large populations, data may be reported per 1,000 units or persons.

Another important element in reporting is timeliness. The closer reports are to real time, the more effective they are. In general, when results of formal studies are reported, the public does not understand why the data are 2 or 3 years old or more. For example, Healthcare Effectiveness Data and Information Set (HEDIS) measures are reported annually by managed care plans. The plans submit data to the National Committee for Quality Assurance (NCQA) in 2008 that will be published in 2009 for services that were delivered in 2007. Therefore, the report released to the public in late 2009 is telling people about the quality of care delivered in 2007, which, it is hoped, has already been identified by the health plan and its providers as a problem and addressed.

In addition to accuracy, completeness, and timeliness, reports should provide information that meets the stated goals of the analysis. It is important that the report contain clinical and/or financial data to support outcomes.

Another term used when discussing reports is “actionable.” This term is often used to describe reports created to assist providers in caring for their patients. These reports allow providers to review the status of their patients and identify issues and opportunities for improvement.

Case in Practice: *A health plan serving members in an urban area with a high prevalence of asthma decided to implement a strategic plan to improve the health of its members between the ages of 5 and 64 who are living with asthma. The plan had three specific goals it hoped to achieve after the interventions: (1) increase the use of controller medications by members 5 to 64 years old with persistent asthma as defined by HEDIS, (2) reduce “bad days”—the combination of ER visits and inpatient days attributable to poor asthma control, and (3) ensure that members with asthma had at least two PCP visits per year.*

To accomplish these goals, the plan identified strategies to help the members and the providers. The primary member intervention was case management, and the primary provider intervention was education through the development of an actionable report. This report was designed to inform providers of the status of their patients and to give them information the plan extracted from its claims systems. The report was used to both congratulate providers on the good care they were delivering to their patients and to give them patient-specific information. The report contained information such as a list of all patients with a diagnosis of asthma in the age range and the date of their last inpatient stays, last ER visits, and last two primary care provider visits. It also contained information about prescriptions filled. Much of this information was data that providers usually do not capture in patient charts. The idea behind the report was to let a provider know if one of his patients was hospitalized or visited the ER and then failed to inform him of the incident or arrange a follow-up visit after the

event. It also allowed the provider to see if his patient was actually filling the prescriptions he had written. This information could inform providers and assist them in deciding what steps to take with their patients: call to remind them to come in for a visit, send in a visiting nurse to instruct patients on the importance of medications and to perhaps assist them in obtaining the medications, etc. The report was a potential tool that the provider could use to help decide what actions he should take. The report was very well received by providers. They felt that it was a valuable tool, a necessary response if providers are to review the report, adopt it, use it, and ultimately take action (Leonard & McGlone, 2008).

In all instances, if changes are made as a result of the data collected, a follow-up report is completed to evaluate those changes and to determine whether they were successful in correcting or improving the process. Organizations that establish efficient ways to collect and manage data are able to obtain valid reports to measure success.

APPLICATION

In the world of data management, the term *application* takes on new meaning. Normally, case managers consider data application to mean how the information that is derived from the data analysis and evaluation processes is used or applied to a patient's plan of care, the disease management program designed to assist an aggregate population living with a chronic disease, or a healthcare organization's business plan. Case managers also consider how data contained in reports are used to improve processes or systems. In data management, applications are software programs described earlier in this chapter.

CONCLUSION

Data management is of paramount importance to nurse case managers and the field of case management. Data are needed to inform the case manager of the status of the patients, the programs, and the community at large. The case manager must understand how to identify, collect, analyze, evaluate, and report data in order to manage, monitor, and evaluate outcomes. Data management skills are a must. Nurse case managers should also be able to identify and utilize the appropriate tools and systems required to do their job, improve the health of patients and populations, and move the nation's IT agenda forward, which they are uniquely positioned to do.

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