

INTRODUCTION TO HEALTH CARE ANALYTICS AND OPERATIONS MANAGEMENT

In today's highly complicated, technological, and competitive health care arena, the public's outcry is for administrators, physicians, and other health care professionals to provide high-quality care at a lower cost. While an aging population, an increase in chronic conditions, and more insurance coverage create higher demand, mass access to social media and other mobile technologies bring higher expectations for care outcomes from patients and their families. Health care managers must therefore find ways to get excellent results from more limited resources. To cater to these new demands and adapt the technologies, health care managers must use a strategic asset called big data. Big data may come from electronic medical records, social media, public health records, and so on. Hence, only those managers who can seek, organize, and analyze big data will thrive as successful managers.

The goal of this book is to introduce aspiring health care managers to analytic and decision support models that allow decision-makers to sort out complex issues and to make the best possible use of available resources. Such models are used, for example, to forecast patient demand and to guide capital acquisition and capacity decisions, facility planning, personnel and patient scheduling, supply chain management, and quality control. They use mathematical and statistical techniques: multivariate statistical analysis, decision analysis, linear programming, project evaluation and review technique, queuing analysis, and simulation. This book presents all these techniques from the perspective of health care organizations' delivery of care, rather than their traditional manufacturing

LEARNING OBJECTIVES

- **Recognize analytical techniques that can be applied in health care operational decision-making.**
- **Describe the historical background and development of decision techniques.**
- **Describe the health care manager's role and responsibilities in decision-making and operations management.**
- **Review the scope of health services and follow recent trends in health care.**
- **Describe health services management and distinct characteristics of health services.**
- **Describe the data flow in health care organizations and how to organize data for analytics.**

Healthcare Analytics and Operations Management: History, Diagnosis, and Empirical Foundations, Fourth Edition. Hillary A. Linhart and Yasar A. Ozcan.

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applications. This chapter covers a brief historical background of decision techniques and explains the importance of health care managers using these techniques. Finally, the scope, distinctive characteristics, and current trends of health services are emphasized. After reading this chapter, you should have a fair understanding of how important quantitative techniques are for decisions about delivering high-quality health care.

Historical Background and the Development of Decision Techniques

Beginning in the 1880s, the scientific management era brought about widespread changes in the management of the factories that had been created at an explosive rate during the Industrial Revolution. The movement was spearheaded by an efficiency engineer and inventor, Frederick Winslow Taylor, who is regarded as the father of modern scientific management. Taylor proposed a “science of management” based on observation, measurement, analysis, and improvement of work methods, along with economic incentives. He also believed that management’s tasks are to plan, carefully select and train workers, find the best way to perform each job, achieve cooperation between management and workers, and separate management activities from work activities. Taylor’s work was based on his idea that conflicts between labor and management occur because management has no idea how long jobs actually take. He therefore focused on time studies that evaluated work methods in great detail to identify the best way to do each job. Taylor’s classic 1911 book, *The Principles of Scientific Management*, explained these guiding principles: (1) development of science for each element of work, (2) scientific selection and training of workers, (3) cooperation between management and employees, and (4) responsibility shared equally between workers and management (Taylor, 1911). Other early contributors to scientific methods of management were Frank and Lillian Gilbreth, who worked on standardization, and Henry Gantt, who emphasized the psychological effects that work conditions have on employees—he developed a time-based display chart to schedule work. Quantitative inventory management was developed by F. W. Harris in 1915. In the 1930s, W. Shewhart and associates developed statistical sampling techniques for quality control (Stevenson, 2015, pp. 23–24). World War II prompted the growth of operations research methods and development of project management techniques, and linear programming and queuing methods followed in the 1950s. After the 1970s, the development and wider use of computers and management information systems reshaped all these techniques because large amounts of data could be analyzed for decision-making in organizations. Tools for quality improvement such as total quality management and continuous quality improvement became very popular in the 1980s and 1990s, and then came supply chain management and productivity improvement techniques, in particular reengineering and lean management.

The Health Care Manager and Decision-Making

A health care manager can be a chief executive officer (CEO) or chief operating officer (COO), or a middle-level manager to whom the duties are delegated. At the top management level, a health care manager's responsibilities include planning for capacity, location, services to be offered, and facility layout; those responsibilities are strategic. The health care manager also is ultimately responsible for overseeing service production through supply chain management, quality monitoring and improvement, and organizing health services to be either produced or outsourced. Finally, the health care manager is responsible for patient and personnel scheduling, and for optimally staffing the facility and directing job assignments and work orders. Regardless of whether health care managers are directly involved or delegate these responsibilities, their ultimate responsibility remains. Generally, operational decisions are delegated to midlevel and lower-level decision-makers, while strategic decisions are evaluated at the organization's top levels. With integrated delivery systems (IDSs), health care organizations are becoming larger and more complex, so health care managers are in dire need of the most recent, reliable information derived from quantitative data analysis in order to make informed decisions. Information technology (IT) has become integral to management decision processes.

Importance of Health Analytics: Information Technology (IT) and Decision Support Techniques

If they are to analyze current situations and make appropriate changes to improve efficiency as well as the quality of care, health care managers need appropriate data. The data, from various sources, are collected by information technology (IT) embedded in systems either internal or external to the health care organization. For example, decisions about the location of a new health facility will require analysis of data on the communities under consideration (such as census, epidemiological data, and so on). Decisions about nurse staffing will require internal data on patient admissions and acuity that are collected routinely by the hospital. Later in this chapter, this book identifies sources of data for various decision-making techniques. It also discusses how data flows between information systems to the health care manager for use in informed decision-making. Furthermore, a supplemental data example using Excel pivot tables is presented at the end of the chapter.

The Scope of Health Care Services and Recent Trends

According to the Organization for Economic Cooperation and Development (OECD) countries, their members' total expenditures on health services constituted 4.2–16.7 percent of gross domestic product (GDP) in 2023, making health services a very significant sector from a public

Table 1.1 Total Expenditures on Health as Percentage of GDP for OECD Countries.

	2015	2016	2017	2018	2019	2020	2021	2022	2023
Average	8.7	8.8	8.7	8.7	8.8	9.6	9.7	9.2	9.1
Minimum	4.1	4.3	4.2	4.1	4.4	4.6	4.6	3.7	4.2
Maximum	16.4	16.7	16.6	16.5	16.6	18.6	17.3	16.5	16.7

Source: Adapted from OECD Health Data (2024).

policy perspective. Moreover, the statistics in Table 1.1 show a relatively stable trend in health care expenditures through 2019, averaging 8.7–8.8 percent of GDP. However, with the onset of and national responses to the Coronavirus (COVID-19) pandemic in 2020, the countries spending an average of 8.7 percent of their budgets on health care in the 2010s are now spending over 10 percent. This percentage has since fallen slightly to 9.1 percent, reflecting in part, a reduction in spending on pandemic-related health services. The United States is the country spending the highest percentage of GDP on health care both pre- and post-pandemic, peaking at 18.3 percent in 2020 and beginning to stabilize near its pre-pandemic level of 16.7 percent in 2023.

Health care, especially in the United States, is a labor-intensive industry with more than 14 million jobs in 2022 (accounting for nearly 10 percent of all employment) and growing (Bureau of Labor Statistics, 2023). The aging population—as well as the proliferation of medical technology and new treatments—contributes to this growth.

The health care industry seeks to match varying medical needs in the population. Its over half a million establishments vary in size, complexity, and organizational structure, ranging from small-town, private practice physicians with one medical assistant to urban hospitals that employ thousands of diverse health care professionals. Less than about 2 percent of health care establishments are hospitals, but they employ over one-third of all health care workers.

Advances in medical technologies, new procedures and methods of diagnosis and treatment, less invasive surgical techniques, gene therapy—all of this increase longevity and improve the quality of life. Similarly, advances in information technology can improve patient care. For example, handheld order-entry systems such as personal digital assistants, radio frequency identification (RFID), and bar code scanners at bedside make health workers more efficient and minimize errors, thus improving quality of care.

As advances usually add to costs, cost containment is a major goal in the health care industry. To accomplish it, the health care industry has shifted the care of patients from hospital care to outpatient, ambulatory, and home health care. At the same time, managed care programs have stressed preventive care to reduce the eventual costs of undiagnosed, untreated medical conditions. Enrollment has grown in prepaid managed care programs: health maintenance organizations, preferred provider organizations, and point-of-service programs.

The health care industry has turned to restructuring to improve financial and cost performance. Restructuring is accomplished by achieving an IDS. An IDS merges the segments of health care delivery, both vertically and horizontally, to increase efficiency by streamlining financial, managerial, and delivery functions.

The Patient Protection and Affordable Care Act, commonly referred to as the Affordable Care Act (ACA), brought significant reform to the health care industry, introducing various programs aimed at improving quality and controlling the rising costs of health care. Many of these programs offer financial incentives for providers to meet certain quality and efficiency benchmarks. The ACA also introduced accountable care organizations (ACOs) as a tool to control costs through improved coordination of care and increased emphasis on preventive care, continuing the shift toward rewarding providers for better outcomes rather than volume.

The onset of the COVID-19 pandemic sent shockwaves through the health care industry, highlighting the importance of health care manager's decision-making role. The pandemic prompted the need for new supply chain management strategies, changes in employee and patient scheduling, new technologies, and more. For example, health care organizations had to solve supply shortages of essential items like personal protective equipment and other raw materials. When elective surgeries and procedures were put on hold to focus on critical patients, health care managers had to quickly adapt their staffing models and patient scheduling methodologies. Many health care organizations also had to suddenly find robust virtual solutions to tasks such as appointment making and patient monitoring, as well as increase their telehealth presence.

It is fair to conclude that the changes in the health care industry will continue and will affect the delivery of health services in terms of cost and efficiency as well as the quality of care. Changes will also require health care managers to be responsive and flexible in their decision-making.

Health Care Services Management

Given such complexity in both the nature and the environment of health care, managers of such establishments face challenging day-to-day decisions as well as long-term and strategic ones. Their discipline, the management, and improvement of the systems and processes that provide health care must rely on decision tools—namely, the specific methods that can help managers analyze, design, and implement organizational changes to achieve efficiency as well as high quality of care (effectiveness) for patients.

Clearly, then, management of health care establishments requires reasoned inquiry and judgment. Therefore, health care managers must use proven scientific methods drawn from such disciplines as industrial engineering, statistics, operations research, and management science. However, it must be remembered that such quantitative tools do not, alone, shape the final decision, which may have to include other, qualitative factors to arrive at the right course of action.

Future health care managers, whether in top administration or in administrative or clinical operations, will be heavy consumers of analytics, making informed decisions using state-of-the-art decision-making techniques incorporating the latest information from health information systems. To use those techniques successfully, however, they must also understand the distinctive characteristics of health care services.

Distinctive Characteristics of Health Care Services

Health care operations have five major distinctive characteristics: (1) patient participation in the service process, (2) simultaneity, (3) perishability, (4) intangibility, and (5) heterogeneity (Fitzsimmons and Fitzsimmons, 2004, pp. 21–25). Let us examine each of these characteristics to better understand the decision platforms in health care.

Patient Participation

In health care, as in any service industry, to evaluate performance (efficiency and effectiveness) a distinction must be made between inputs and outputs. Patients (or their health conditions) who receive care are among the inputs into the service process. After diagnosis and treatment, the patient's condition constitutes the effectiveness of the health care organization—that is, output. Hence, the health care organization and the patient interact throughout the delivery of care—a profound distinction of health care as compared to manufacturing industries.

Simultaneous Production and Consumption

As a service industry, health care is produced and “consumed” simultaneously. This point reflects the fact that health is not a product to be created, stored, and sold later. (Will science achieve that via gene therapy?) One of the drawbacks of that simultaneity of “production” and “consumption” is the challenge it presents for quality control—that is, ensuring the effectiveness of the service. In manufacturing, a product can be inspected and, if found defective, not be offered for sale; meanwhile, the process that is producing bad outputs is corrected. However, in health care, due to simultaneity, an instance of poor-quality care cannot be “recalled,” even though the process resulting in poor care can be corrected for future patients.

Perishable Capacity

Health care organizations design their services to serve with certain capacity over a given time. If the designed capacity is not used during that period, the opportunity to generate revenue from that capacity is lost. For example, consider a hospital with fifteen operating rooms that are staffed and open for twelve hours each day. If the surgeries are not scheduled appropriately to fill the open slots, or if a large amount of time is wasted by the turnover of the cases, a portion of the available capacity, and thus of potential revenues for that day, perishes. Similarly, consider

a physician's office with an available ten hour schedule for patient visits. If the office does not receive appointments to fill all those time blocks, the practice's capacity for that day will be reduced, as will the revenues.

The Intangible Nature of Health Care Outputs

The output in health care does not comprise a tangible product on hand like food bought from your favorite fast-food restaurant, where you can judge the quality of the food as much as the promptness of service. In health care, it is not so obvious what the patient has paid for. Since a healing process takes time, the opinions of patients about the service quality of their care are formed over time. Moreover, health care is not something that can be tested or handled before deciding on it. Although health care monitoring groups, as well as health care facilities in their marketing, may provide information about the quality of an organization's services, one patient's experience may not equal that of another receiving the same service. Patients' conditions and perceptions are never identical.

The High Levels of Judgment Called Upon, and the Heterogeneous Nature of Health Care

Although some routine health care tasks can be automated (recording patient history via IT), there remain a wide range of tasks that require a high level of judgment, personal interaction, and individual adaptations, even in a given service category. For example, a surgeon and an anesthesiologist must make specific decisions before operating to plan the surgery for the particular condition of the patient. The heterogeneity of patients' conditions often mandates considerable specialization in the delivery of care.

Even with these distinctive characteristics of health care, managers work together with clinicians to standardize health organizations' operations for both efficiency and effectiveness. Examples of such standardization are diagnostic and treatment protocols developed for the care of various diseases.

Big Data and Data Flow in Health Care Organizations

Health care analytics and decision support often rely on big data, which typically flow through multiple systems before they are in a usable format for health care managers. An example data flow in a health care organization is depicted in Figure 1.1. The cornerstone system of health care organizations is typically the electronic health record (EHR) system. EHR systems such as Epic and Cerner integrate data from multiple sources including ancillary systems such as radiology and pharmacology, manual data entry, genomic data, and telemetry. Comprehensive EHR data are then integrated into an enterprise data warehouse (EDW), along with data from various billing and administrative systems (sometimes the data are integrated within the EHR system). This

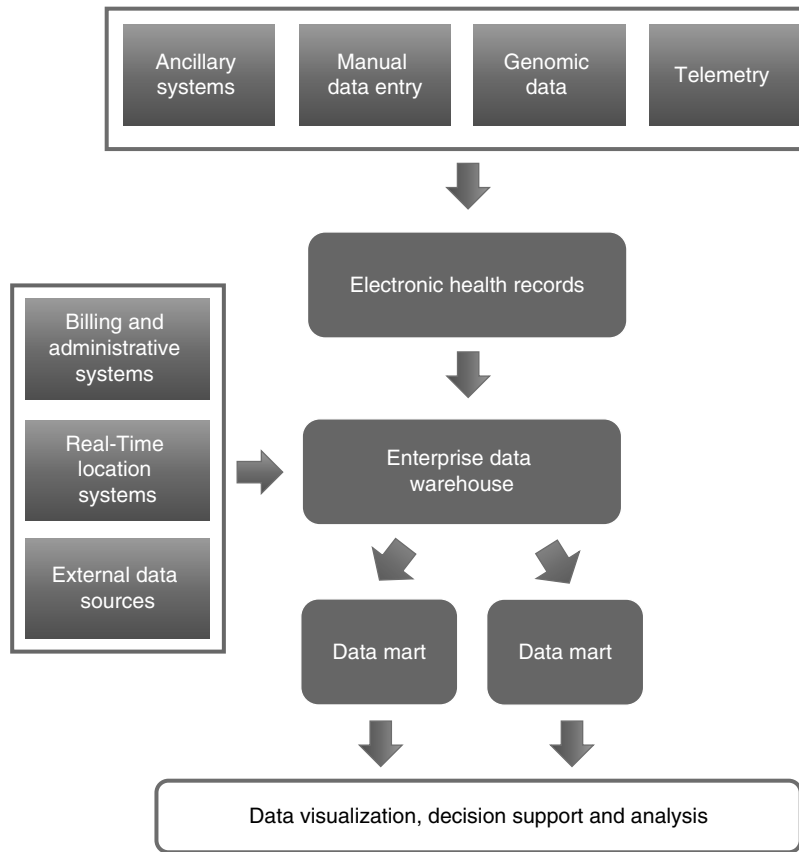


Figure 1.1 Data Flow in Health Care Organizations.

includes scheduling, human resources/payroll, and facility information. Real-time location systems, which are used to track medical equipment, supplies, and patients using RFID technology, also feed into the EDW. Another key input into the EDW is external data sources, such as the Social Security Death Index. Other examples of external data sources are provided in Table 1.2. Such sources are often leveraged for strategic reasons such as quality improvement, site planning, and market analysis.

The EDW ultimately feeds multiple data marts, which serve as small, centralized data repositories that support specific business needs or areas. For example, a patient experience data mart would include nurse staffing, provider scheduling, facility, patient, and discharge information, as well as external sources such as the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Patient Satisfaction Survey, all of which would be analyzed to identify opportunities for improvement. Once in a data mart, data are imported through various means (queries, extracts, etc.) into data analysis and visualization tools such as Microsoft Excel and Tableau. Often when data are imported into a data analysis tool from a data mart, they

Table 1.2 Examples of External Data Sources.

Data Source	Description	How to Access
Healthcare Cost and Utilization Project (HCUP)	Publicly available family of all-payer inpatient health care databases, which provides encounter-level information on inpatient stays, emergency department visits, and ambulatory surgery in U.S. hospitals.	Certain HCUP data is available for free via HCUPnet, an online query system accessible at http://hcupnet.ahrq.gov/ . Individual databases can be accessed at https://www.hcup-us.ahrq.gov/databases.jsp . However, the cost and availability of data varies state to state.
Provider Data Catalog (PDC)	Interactive platform managed by the Centers for Medicare & Medicaid Services (CMS), providing detailed demographic, quality, and performance datasets on Medicare-certified providers, including (but not limited to) hospitals, hospice care, home health, and dialysis centers. It includes datasets such as HCAHPS, Hospital Readmissions, Health Care Associated Infections, and Hospital Value-Based Purchasing Performance Scores.	PDC datasets can be downloaded for free at https://data.cms.gov/provider-data/
Medical Expenditure Panel Survey (MEPS)	National surveys of individuals and families, as well as their health care providers, providing data on health status, the use of medical services, charges, insurance coverage, and satisfaction with care.	Data files can be downloaded at http://meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp

require additional cleanup and manipulation. The PivotTable functionality in Excel is a helpful tool for transforming the data set into a workable format. It is often used in conjunction with a Data Dictionary, which typically lists the names, formats, and descriptions of data elements. Once the data are in a usable format, health care managers can perform their analyses to support various operational and strategic decisions. The end-of-chapter supplement illustrates the use of pivot tables in Excel and will provide the basis for predictive analytics examples in Chapter 2.

Summary

Contemporary health care managers must understand the distinctive characteristics of health care services and use state-of-the-art decision-making techniques with the latest information available to plan and organize their facilities for quality patient care. They must also understand the data sources and be able to organize the data in appropriate form for specific decision tools. The remaining chapters of this book will discuss and show the use of decision-making techniques and their applications in health care.

KEY TERMS

Health Analytics

Health Care Manager

Decision Support

Health Care Providers

OECD

Perishable Capacity

Pivot Tables

Big Data

CHAPTER 1 SUPPLEMENT

DATA ANALYTICS IN MS EXCEL: CREATING AND MANIPULATING PIVOT TABLES

The PivotTable functionality in Microsoft Excel is extremely useful for summarizing, grouping, and analyzing large data sets, and is often used to prepare data for use with decision-making techniques.

In this example, *MS_Excel_Pivot_Tutorial.xls* will be used. This file contains daily days of service data for a cardiology department from May 2022 through May 2025.

The Basics: Inserting a Pivot Table

1. To insert a PivotTable on the **days_of_service** worksheet, click on the **Insert** tab followed by the **PivotTable** button (the first option on the left side of the toolbar under the Tables group) (see Figure SE 1.1).

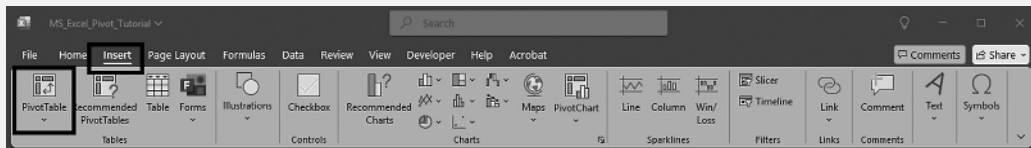


Figure SE 1.1 PivotTable Button.

A **PivotTable from table or range** window will appear (Figure SE 1.2). This provides the option to place the PivotTable on a new worksheet or on an existing worksheet within the Excel file. Click **OK** to place the PivotTable on a new worksheet.

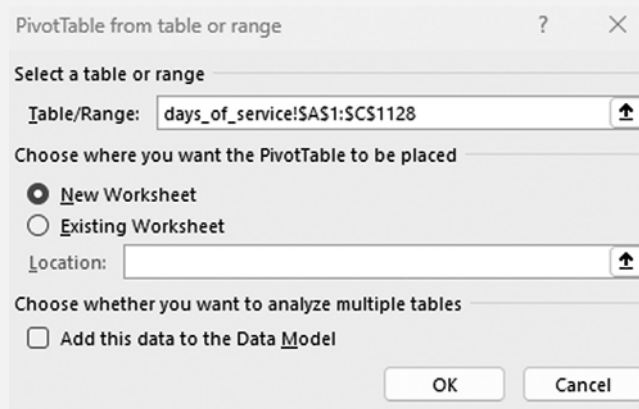


Figure SE 1.2 PivotTable from Table or Range Window.

2. Sheet1 has now been created. A **PivotTable Fields** section will be located on the right-hand side of the sheet. This contains the names of the data columns from the Days_of_Service data set. To build a PivotTable, drag and drop these data columns into the **Filters**, **Columns**, **Rows**, and **Values** sections found below the **PivotTable Fields** section (Figure SE 1.3).

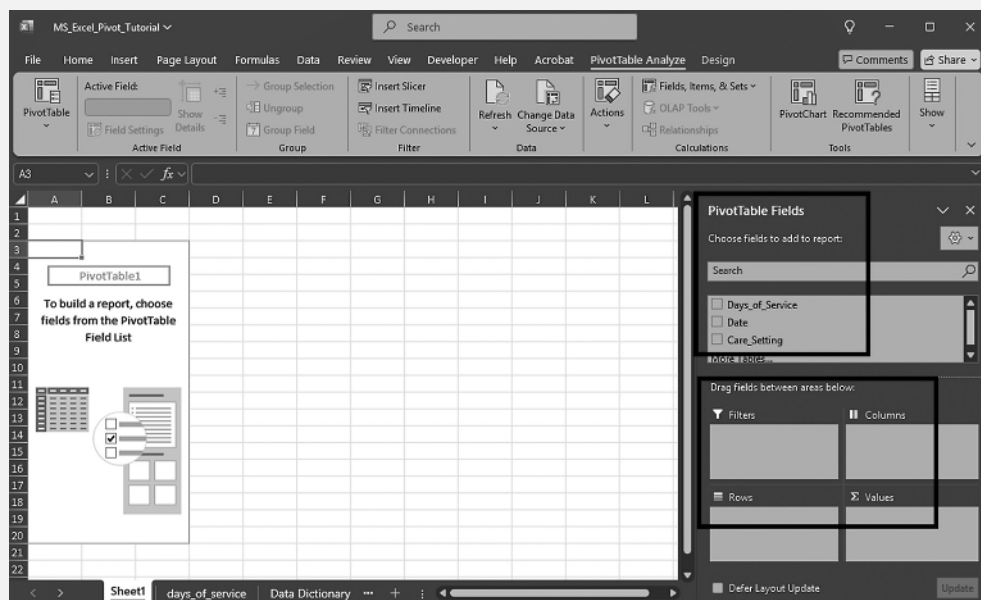


Figure SE 1.3 PivotTable Fields.

Building a Basic PivotTable Report

3. Drag and drop the **Date** field into the **Rows** section. Next, drag and drop **Days_of_Service** into the **Values** section, as shown in Figure SE 1.4.

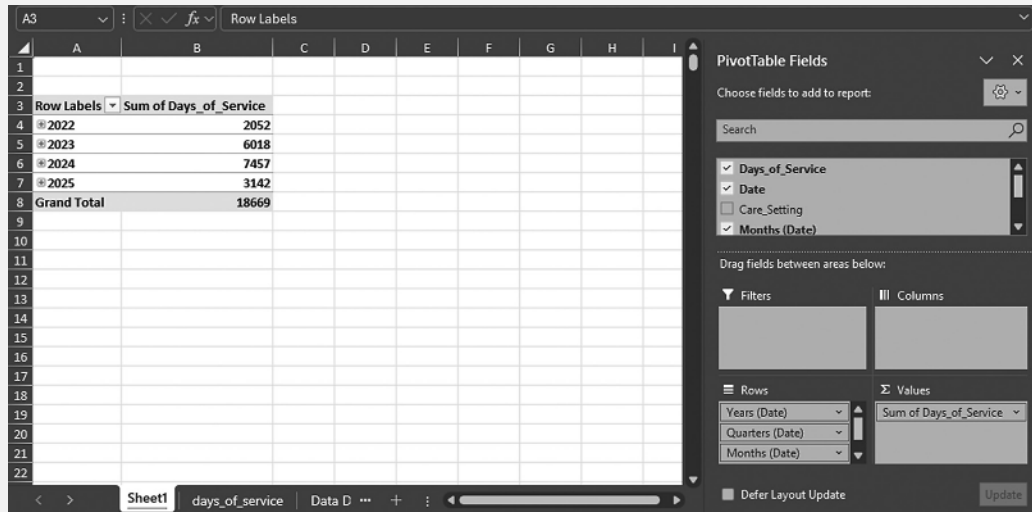


Figure SE 1.4 Rows and Values Sections.

Notice that by default, the pivot table organizes the data by year (with the option to expand to quarter and month by clicking the “+” button) and provides a *sum* of Days_of_Service by date.

4. To display the total **Days_of_Service** by year and month (Figure SE 1.5), uncheck the **Quarters(Date)** field or drag and drop it from **Rows** to the **PivotTable Fields** section. Alternatively, to display **Days_of_Service** by year and quarter, leave **Quarters(Date)** checked and uncheck **Months(Date)** or drag and drop it out of the **Rows** section.

Building an Advanced PivotTable Report: Using Columns and Filters

It is often helpful to insert additional columns into a data set. When used in conjunction with the **Columns** and **Filters** options in the PivotTable, it enables further analysis.

As an example, let us build a PivotTable that displays total Days_of_Service per weekday for each month. A filter will also be created to view this data on an annual basis.

5. Create a new column on the **Days_of_Service** worksheet entitled **Weekday**. The **TEXT** function will be used to convert the Date column values into Weekday text values. In cell D2, input the following formula, as shown in Figure SE 1.6:

= TEXT(B2, “DDDD”)

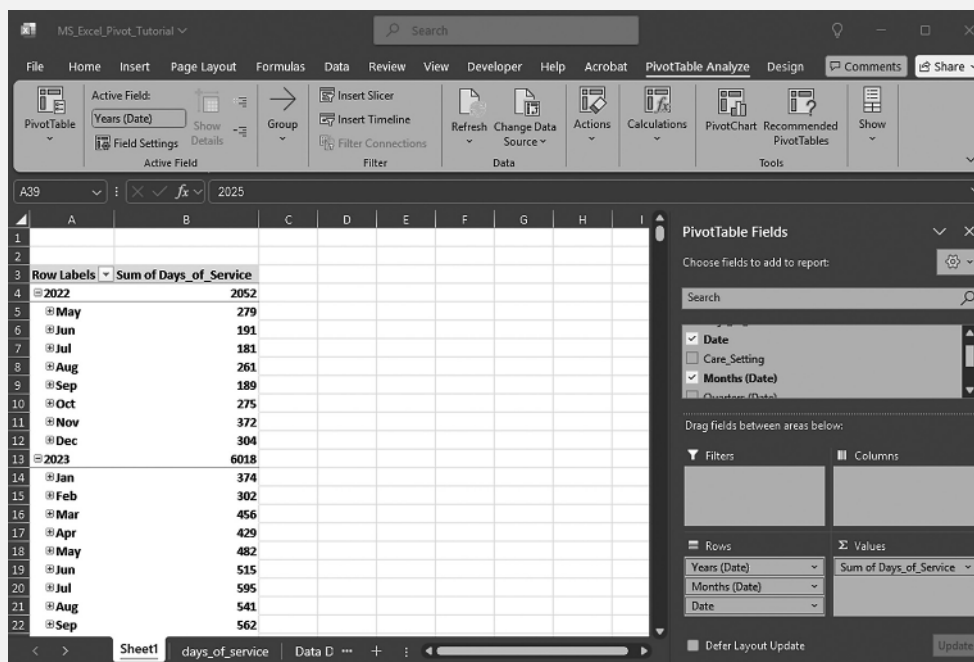


Figure SE 1.5 Days of Service by Year and Month.

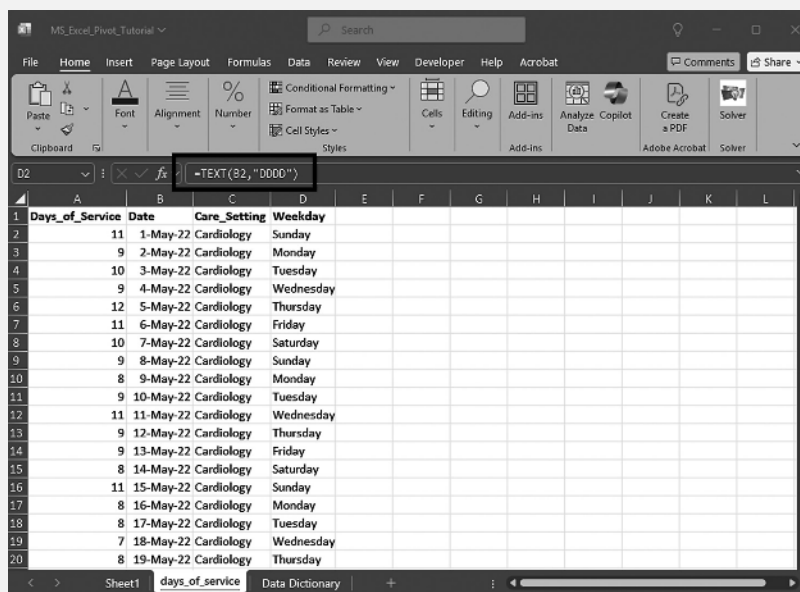


Figure SE 1.6 Weekday Column and Formula.

This takes the date in cell B2 (May 1, 2022) and returns the day of the week. To quickly copy this formula down to all rows, highlight cell D2 then double-click on the small square in the bottom right-hand corner of the cell.

6. Now that the Weekday field has been created, return to **Sheet1** and reset the pivot table by removing **Days_of_Service** and **Date** from the **Rows** and **Values** areas.
7. Notice that the Weekday column does not appear under the PivotTable Fields. To add Weekday as a field, select the **PivotTable Analyze** tab. Click the **Change Data Source** button, found in the **Data** section (see Figure SE 1.7).

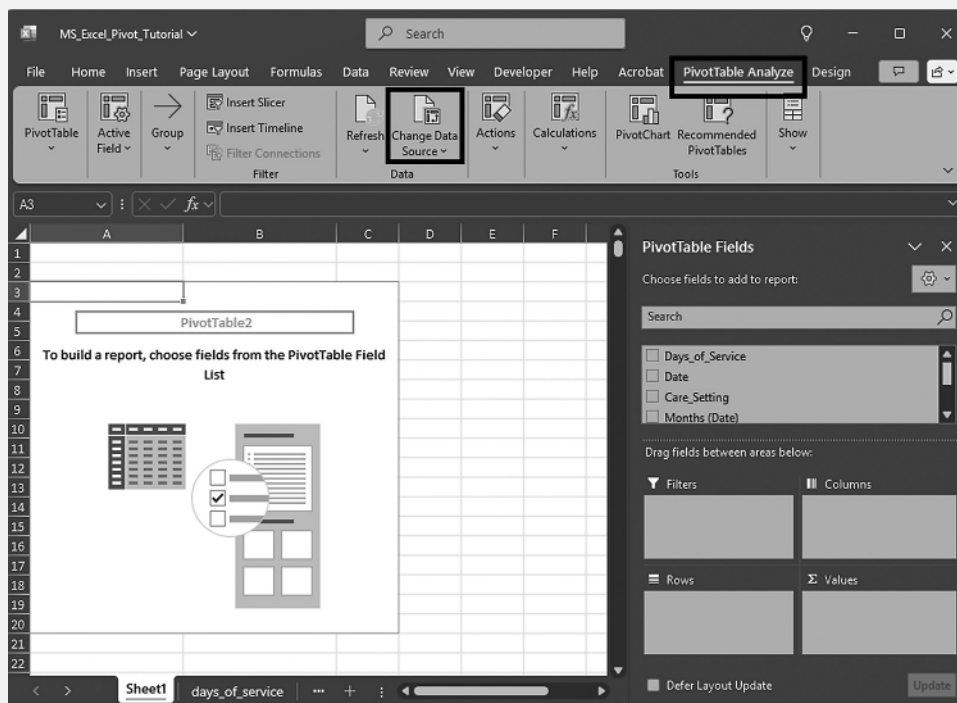


Figure SE 1.7 Change Data Source.

8. A **Change PivotTable Data Source** window will appear (Figure SE 1.8). Update the **Table/Range** to include the Weekday column, and then click **OK**. The **PivotTable Fields** now include the **Weekday** column.

Tip: Simply press the **Shift** key and tap the → once to extend the range.

9. Drag and drop the **Days_of_Service** field into the **Values** section.

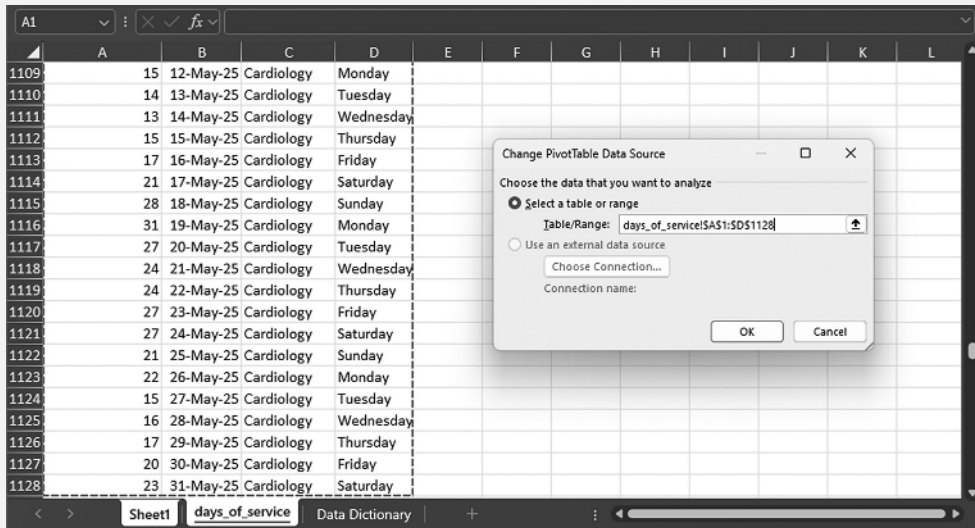


Figure SE 1.8 Change PivotTable Data Source.

10. Drag and drop the **Months(Date)** field into the **Rows** section.
11. Drag and drop the **Weekday** field into the **Columns** section. As shown in Figure SE 1.9, the PivotTable now displays the total days of service for each weekday by month across the entire data set (May 2022 to May 2025).

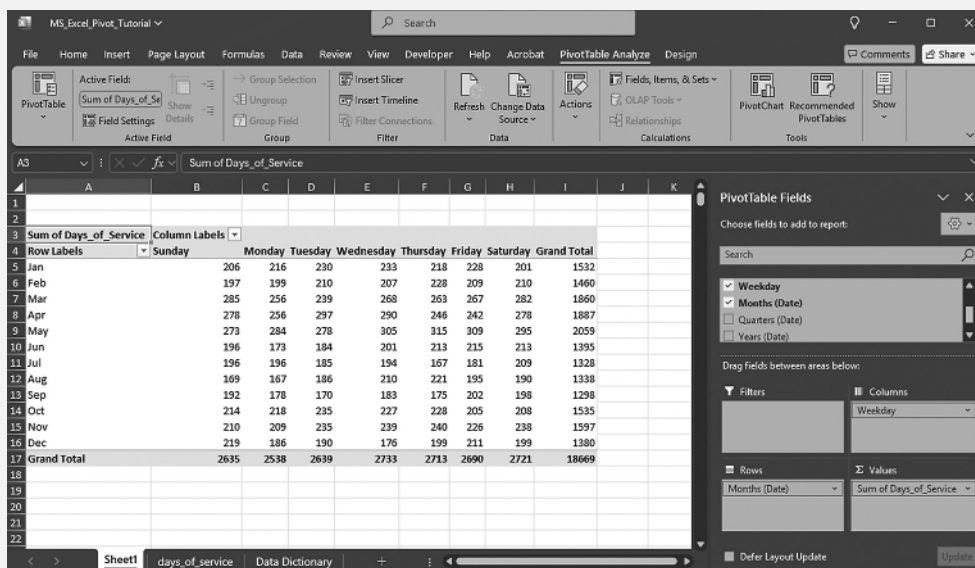


Figure SE 1.9 Total Days of Service by Day and Month.

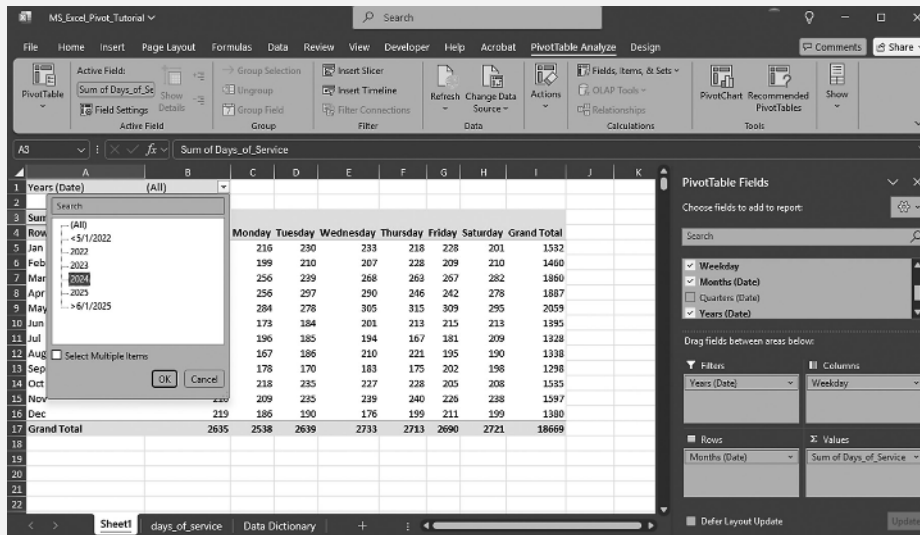


Figure SE 1.10 Filter by Year.

12. To filter by year, drag and drop the **Years(Date)** field into the **Filters** section. A **Years (Date)** filter will then appear in the first row. Figure SE 1.9). Select the down arrow next to **(All)** to filter down to a specific year. Select **2024**, and then click **OK** (Figure SE 1.10). **Note:** Multiple years can be viewed at once by checking the **Select Multiple Items** check box.
13. The PivotTable is now constructed (Figure SE 1.11), displaying total days of service per weekday for each month in 2024.

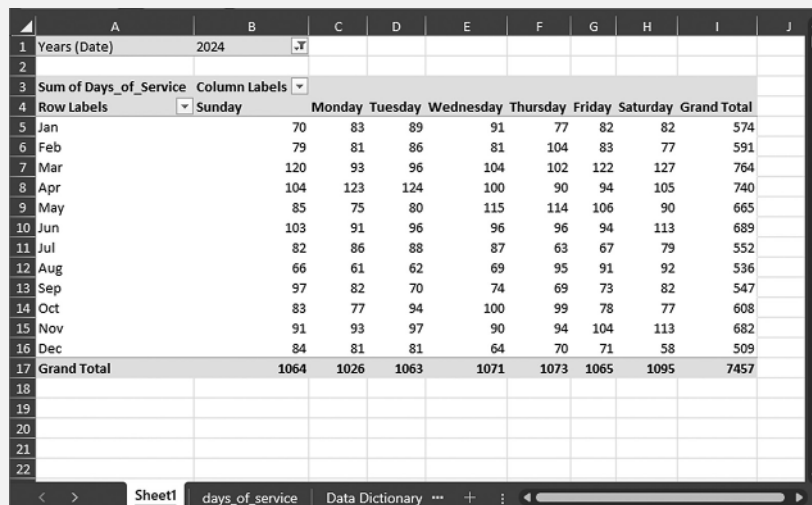


Figure SE 1.11 Total Days of Service by Day/Month in 2024.

Exercises

- 1.1 Access the `Days_of_Service_Surgical.xlsx` dataset containing days of service data for a surgical department over a sixteen-month period. Using the Chapter 1 Supplement as a guide, reorganize the data set using Excel's PivotTable functionality so that the *average* days of service per weekday per month over this sixteen-month period are displayed. (Hint: You will need to change the Field Settings from "Sum" to "Average.")
- 1.2 Access the `Visits.xlsx` dataset containing daily visit data for an urgent care clinic over a twenty-four-month period. The clinic manager would like to determine the average number of visits per week during this time frame.
Create a new column entitled "Week." In the first cell of this column, type the formula `=WEEKNUM(B2)`. This will take the date in cell B2 and return the week number (e.g., "1" for the first week of January and "52" for the last week of December). Copy this formula down to all rows.
Use Excel's PivotTable functionality to reorganize the data set so that the average number of clinic visits per weekday per week over this time period is displayed. Include a filter for year.
- 1.3 Access the `Admissions.xlsx` dataset containing daily patient admissions data for an intensive care unit over a thirty-six-month period. Use Excel's PivotTable functionality to reorganize the data set so that the average number of admissions per weekday per quarter is displayed. Include a filter for year.
- 1.4 A director of outpatient services is developing a presentation discussing the growth of outpatient visits in hospital settings. Access the `Hospital.xlsx` data set containing hospital data over a five-year period. Use Excel's PivotTable functionality to create an insert for the director's presentation that displays the average number of outpatient visits for each of the five years.
- 1.5 A health care executive is interested in whether readmission rates for heart attack, heart failure, and pneumonia differ across small, medium, and large hospitals. Assume that the researcher defines small hospitals as those with fewer than 50 beds, medium hospitals as those with 50 to 99 beds, and large hospitals as those with 100 or more beds.
 - a. Access the `Hospital.xlsx` data set containing hospital data over a five-year period.
 - b. Insert a new column next to the `ipbeds_5` column entitled "Hospital Size." In the first cell of this new column, input the following formula (known as a nested IF statement) and copy down to the remaining cells:

`= IF(B2 < 50, "small", IF(B2 < 100, "medium", "large"))`

This will classify each hospital as small, medium, or large according to its inpatient bed size in year 5.

- c. Create a PivotTable that displays the average risk-adjusted readmission rate for heart attack, heart failure, and pneumonia in year 5 by hospital size. Does there appear to be a difference in readmission rates across hospitals of different sizes?

1.6 Navigate to CMS Provider Data Catalog at <https://data.cms.gov/provider-data/>.

- a. Search for the “Hospital General Information” file. This file contains a list of all hospitals registered with Medicare and includes addresses, phone numbers, hospital type, and quality ratings.
Download the file by selecting “Download CSV” and then follow the website’s Excel download instructions.
- b. Use Excel’s PivotTable functionality to reorganize the data set to display the total count of hospitals for each type of hospital ownership (i.e., Government-Federal, Government-State, Proprietary, etc.). (Hint: You will only need to use one field—hospital ownership.)
- c. Modify the PivotTable in part (b) to further breakdown hospital ownership by hospital type (i.e., acute care, children’s, critical access, etc.).
- d. Using the PivotTable in part (c), determine the following:
 - i. The percentage of hospitals that are physician owned
 - ii. The total number of acute care hospitals owned by state governments
 - iii. The total number of private nonprofit children’s hospitals
- e. Modify the PivotTable in part (c) to obtain the total number of critical access hospitals in the United States. (Note: A simple modification eliminates the need to add up columns or rows.)

1.7 A health care manager is interested in determining the number of ACOs with 25,000 or more assigned beneficiaries.

- a. Navigate to <https://data.cms.gov/>. Search for the “Shared Savings Program Performance Year Financial and Quality Results” dataset. Download the latest dataset and accompanying resources. Open the “Performance_Year_Financial_and_Quality_Results” file in MS Excel.
- b. Insert a new column entitled “Beneficiary Grouping” to the right of the “N_AB” column which contains the total assigned beneficiaries for each ACO. In the first cell of this new column, input the following formula:

= IF(J2 < 25,000, “< 25,000”, “25,000 + ”)

This will assign a value of “<25,000” for all ACOs with fewer than 25,000 beneficiaries and “25,000+” to ACOs with 25,000 or more assigned beneficiaries. Copy the formula down to all rows.

(Note: Reference the Data Dictionary downloaded with the dataset to verify the column containing the total assigned beneficiaries. This may change year by year. If total assigned beneficiaries is now located in column C instead of J, the formula would read =IF(C1<25,000,...).)

- c. Create a PivotTable that compares the total counts of by Beneficiary Grouping. What is the total number of ACOs with 25,000 or more assigned beneficiaries?
 - d. Suppose the manager is interested in the differences in annual inpatient expenditures per assigned beneficiary (variable “CapAnn_INP_all”) for ACOs with fewer than 25,000 beneficiaries compared to those with 25,000 or more beneficiaries. Reference the data dictionary as noted in part (b) to verify variable name.
Modify the PivotTable in part (b) to display the average total inpatient expenditures for ACOs with fewer than 25,000 beneficiaries versus those with 25,000 or more beneficiaries. Is there a difference in average annual inpatient expenditures per assigned beneficiary for the two different beneficiary groupings?
- 1.8** The director of a home health agency wants to explore the most recent results of the Home Health Care CAHPS survey.
- a. Navigate to <https://data.cms.gov/>. Search for the “Home Health Care - Patient Survey (HHCAHPS)” dataset and download the latest, most current full dataset and any accompanying resources. Open the file in MS Excel.
 - b. Create a pivot table that displays the count of home health agencies that fall within each HHCAHPS Survey Summary Star Rating. Do not include any facilities that do not have a Summary Star Rating available.
(Note: Use the “CMS Certification Number” to identify unique facilities.)
 - c. Using the PivotTable in part (b), determine the following:
 - i. The count of home health agencies with a 5-star HHCAHPS Summary Rating
 - ii. The percentage of home health agencies with at least a 3-star HHCAHPS Summary Rating
 - d. Repeat steps (a) through (c) using the previous year’s HHCAHPS Survey results. Search for and download the prior year’s dataset and create another pivot table. Compare the counts and percentages of home health agencies with a 5-star rating and home health agencies with at least a 3-star rating, respectively, for both years. What, if any, changes are observed?

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