Instructor Resources Sample

This is a sample of the instructor materials for *Healthcare Operations Management*, Fourth Edition, by Daniel B. McLaughlin, John R. Olson, and Luv Sharma.

The complete instructor materials include the following:

- Test bank
- PowerPoint slides
- Cases
- Supporting Materials
- Teaching Notes
- Videos
- Transition guide to the new edition

This sample includes the materials for chapter 8.

If you adopt this text, you will be given access to the complete materials. To obtain access, e-mail your request to hapbooks@ache.org and include the following information in your message:

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- Your name and institution name
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- Course level (graduate, undergraduate, or continuing education) and expected enrollment
- The use of the text (primary, supplemental, or recommended reading)
- A contact name and phone number/e-mail address we can use to verify your employment as an instructor

You will receive an e-mail containing access information after we have verified your instructor status. Thank you for your interest in this text and the accompanying instructor resources.

Digital and Alternative Formats

Individual chapters of this book are available for instructors to create customized textbooks or course packs at XanEdu/AcademicPub. For more information about pricing and availability, please visit one of these preferred partners or contact Health Administration Press at hapbooks@ache.org.

Chapter 8
Healthcare Analytics

Healthcare Analytics

- What is analytics in healthcare?
- Introduction to data analytics
- Prescriptive analytics
- Data visualization
- Data mining for discovery

Reasons for Increasing Popularity of Analytics in Healthcare

- More data generated and available—adoption of electronic health records (EHRs)
- Required reporting of thousands of measures
- Increased pressure to improve clinical, operational, and financial results
- Crucial to shaping effective population health initiatives
- Increasingly sophisticated technology allows for analysis of data on a massive scale

More Data

- Technology advances
  - Cloud storage
  - Smartphones
- American Recovery and Reinvestment Act (2009)
  - Installation of EHR systems
- EHR systems allow for data collection from patients, which offer insights and the ability to improve decision making

Population Health

- “The health outcomes of a group of individuals, including the distribution of such outcomes within the group”
- EHRs give ability to understand costs and clinical trends
- Use of predictive models

Seven Ways Predictive Analytics Can Improve Healthcare

1. Improves diagnosis
2. Helps with preventive medicine and public health efforts
3. Provides answers to physicians for the treatment of individual patients
4. Provides employers and hospitals tools to predict insurance product costs
5. Allows smaller test cases to be used to prove models
6. Helps pharmaceutical companies meet the needs of the public for medication
7. Potentially helps improve outcomes

Data Analytics

- Goal: to obtain actionable insights that result in smarter decisions and better business outcomes
- Build a data framework
  - Gathering data
  - Building information
  - Gaining actionable insights
- Statistical thinking and the three phases of analytics
  - Descriptive analytics
  - Predictive analytics
  - Prescriptive analytics

Descriptive Analytics

- Condense large data sets into more meaningful and useful information
- Examine past performance and summarize data to discern trends and patterns to explain behavior
- Necessary because raw data alone is not typically usable to managers
- Examples
  - Business intelligence reports
  - Key performance indicators (KPIs)
  - Descriptive statistics
  - Traditional data visualization techniques

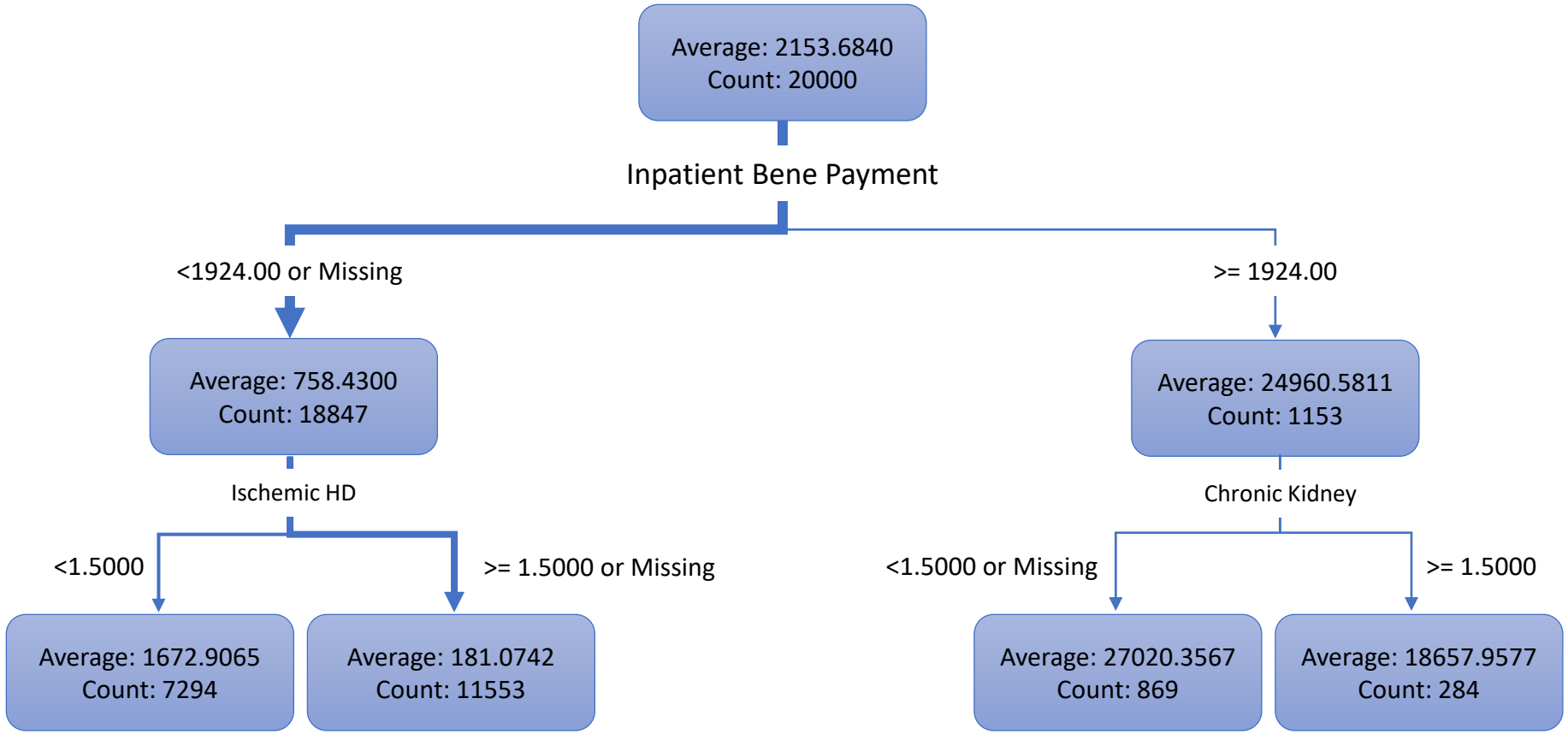
Predictive Analytics

- Builds models with data that can help forecast the future in terms of probabilities
- Popular in disease management and population health
  - Examination of early indicators of diabetes to help with prevention and cost management
  - More than 75 percent of total healthcare spending is related to chronic disease
- Hennepin County Medical Center
  - Analysts discovered HIV patients also suffered from poor nutrition
  - Predictive model showed positive impact of improved nutrition
  - Now distributes healthy food with HIV medication, lowering overall costs

Predictive Tools

- Regressions
- Decision trees
  - Useful for explaining prediction to nonanalysts
- Neural networks
  - Attempt to mimic the human brain
  - Can be used to predict outputs on basis of new inputs
  - Sensitive to initial data and are difficult to diagnose errors

Decision Tree



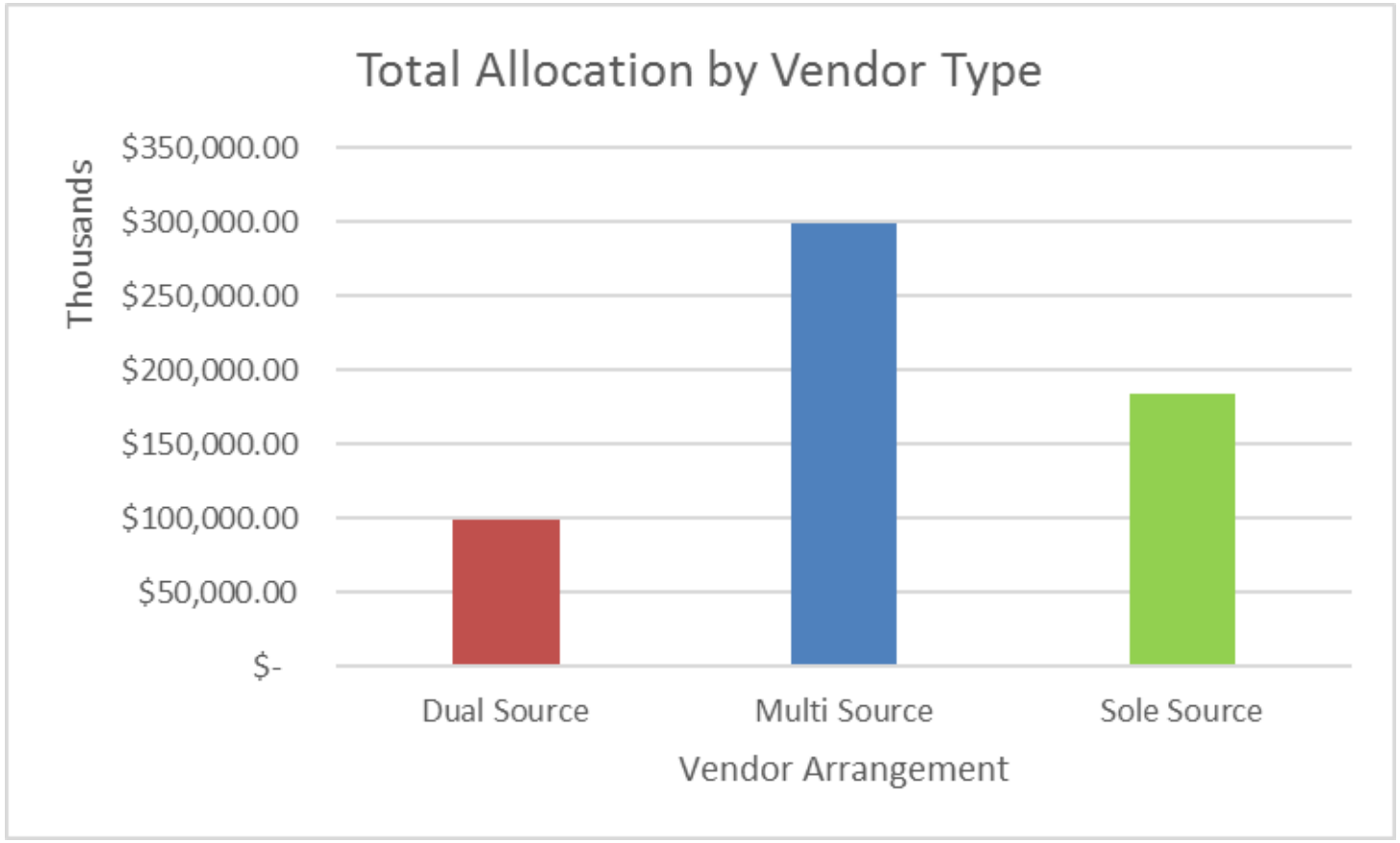
Prescriptive Analytics

- Provides models that offer recommendations
- Uses predictive models, optimization, and mathematical models
- Examples
  - Models for staffing that maximize quality and minimize costs
  - Models to maximize operating room capacity
  - Strategic models for allocation of investments
  - Risk models that minimize adverse health events
- Many assumptions must be made to create models—should be used as one piece of effective decision making

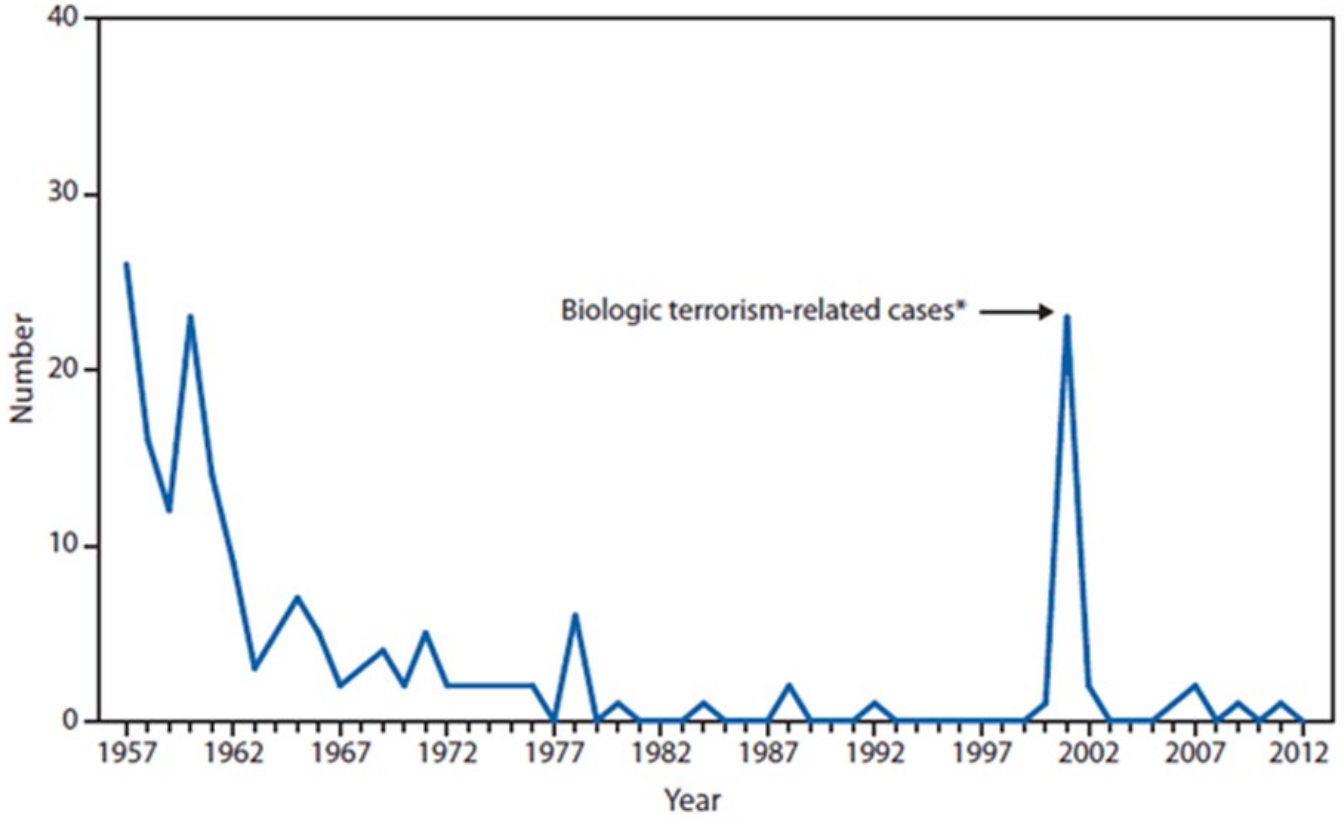
Data Visualization

- Help extract value from raw data
- Many forms of data visualization
  - Bar graph
  - Line graph
  - Histogram
  - Scatter plot
  - Dashboards
  - Scorecards
  - Reports

Bar Graph



Line Graph



Source: Adams et al. (2014).

Dashboard Components

- Metrics
  - A direct numerical measure that represents a piece of business data in relationship with one or more dimensions (e.g., gross sales by week)
  - Measuring across more than one dimension (e.g., gross sales by territory and time) is called multidimensional analyses.
  - Most dashboards do not use multidimensional analyses, although more dynamic tools that do so are available
- KPIs
  - A metric tied to a target
  - Most often, the distance of a metric is above or below target
- Grain
  - The association of a measure with a specific hierarchal level in a dimension

Scorecards, Dashboards, and Reports

- Scorecards
  - Highest, most strategic level of decision making
  - Used to help align operational execution and strategy
  - Use KPIs to monitor execution and map results back to strategy
- Dashboards
  - Less focused on strategic objective and more on operational goals
  - Used to provide actionable business information that is intuitive and insightful
- Reports
  - Simple and static
  - Allow users to analyze specific data underlying metrics and KPIs

Scorecards

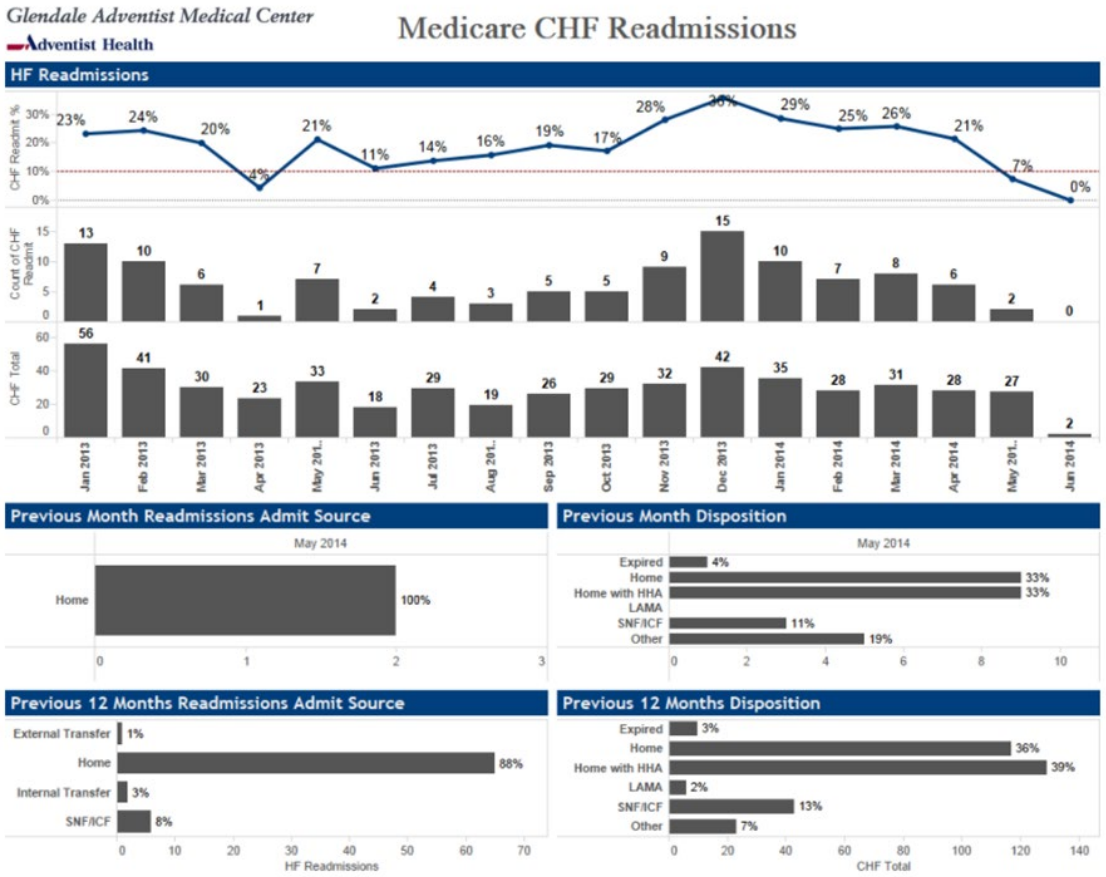
Sample Hospital Scorecard

Goal	Target	Owner	Review Frequency	Aug-16	Sep-16	Oct-16	YTD 2016
Finance							
Patient Information Accuracy Rate	99%	Paul	Monthly	99%	100%	97%	100%
Denials and Write-offs as % of Overall Charges	4%	Sarah	Monthly	5%	4%	3%	5%
Number of Days Charged in A/R	5	Sarah	Monthly	2	6	1	4
People							
Absenteeism Hours	30	Joseph	Monthly	15	20	30	22
Acceptable Overtime Hours	7%	Joseph	Monthly	8%	4%	5%	6%
Staffing: Open Positions	3	Jennifer	Monthly	2	1	1	1
Clinical							
Hospital-Wide 30 Day Readmissions	10.0%	Mark	Monthly	13.0%	11.0%	9.8%	12.2%
Heart Failure Mortality	13.2%	Mark	Monthly	12.7%	11.0%	9.0%	10.7%
Inpatient LOS (Days)	3	Catherine	Monthly	2.7%	2.3%	2.6%	2.5%

Creating a Dashboard

- Top-down approach to collecting metrics and KPIs
  - Start with business decisions that must be made
  - End with data needed to support those decisions
- Must involve those who will be using the dashboards in the creation process

Dashboard Example

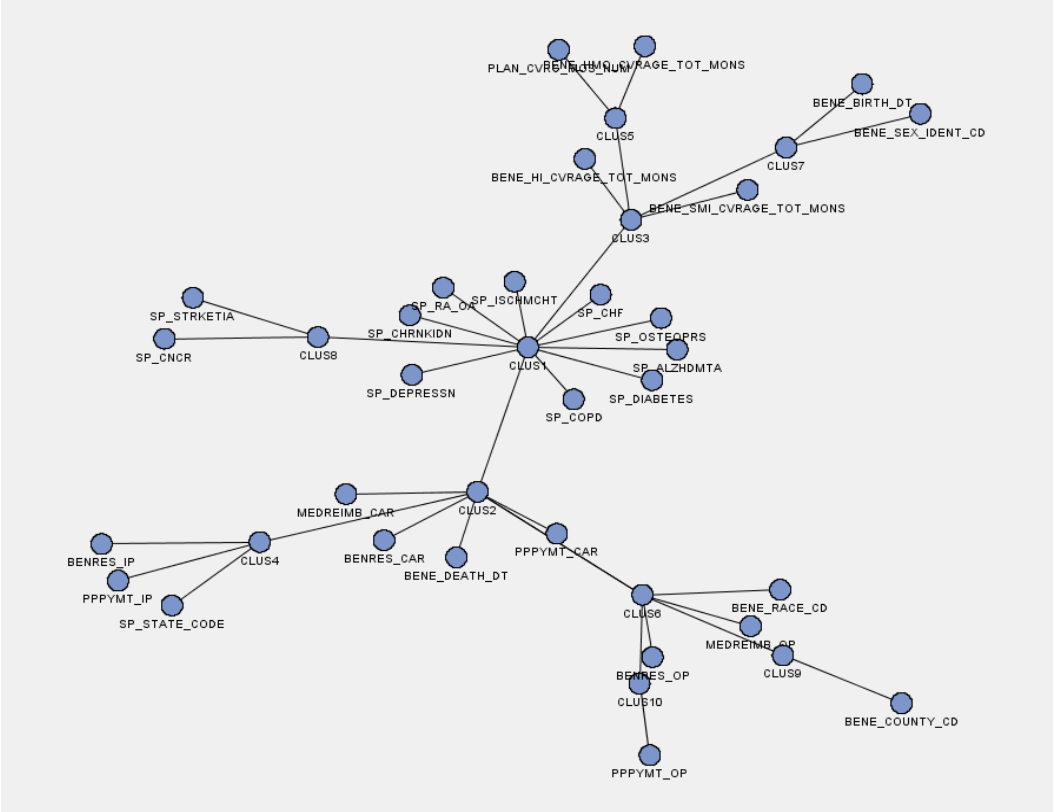


Data Mining for Discovery

- Data explored without a specific hypothesis being established
- Relies on general sense that data may reveal insights
- Data mining tools
  - Clustering
  - Text mining
  - Cognitive computing

Clustering

- Placing objects into groups suggested by nature of the data
- Perform cluster analysis through Euclidean distances
- Characteristics of clusters is examined graphically with software



Text Mining

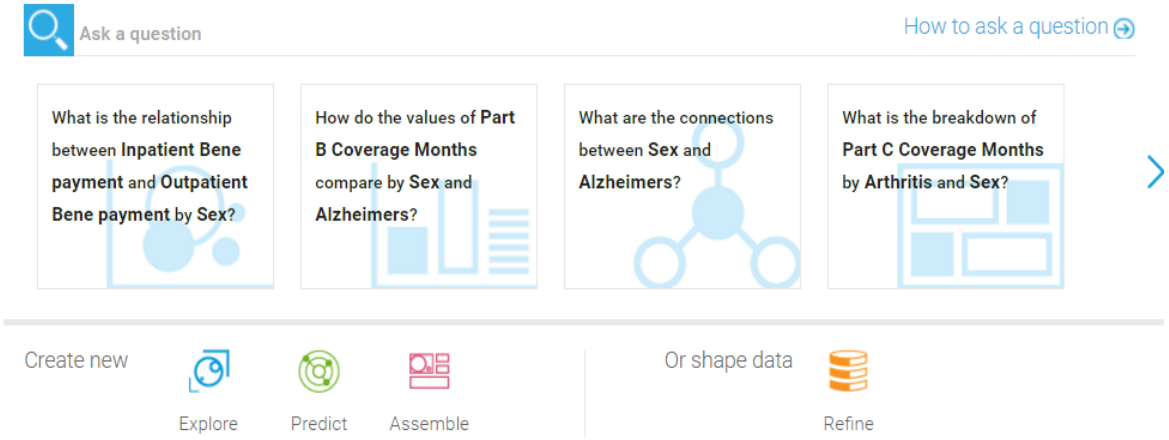
- Gathering of text data from EHRs, doctors' and nurses' notes
- Minnesota State Fair example
  - Set up booth providing multiple services (e.g., flu shots, blood pressure readings, eye and ear exams)
  - Asked participants, "Why did you choose to get health screening at the state fair?"
  - Prediction—low cost or convenience
  - Results—used text miner and found the word "fun" appeared frequently
  - Insight—fairgoers felt empowered and engaged in the screening, as they were in control and traditional barriers to healthcare were gone

State Fair Survey Results

	W3 - Why did you get screening here? Topic	No. of documents
1	fun,+learn,fun-check,doctor,doc's office	5
2	+screening,clinic,+check,office,health assessment	6
3	md,md's office,fair,offer,sucha	1
4	+learn,+live,fun-check,doctor,doc's office	3
5	time,fun-check,doctor,doc's office,doc	2
6	fair,information,valuable-love,access,convenient	2
7	+check,work,ndustry,+thing,health	4
8	doctor,fun-check,+visit,test,doc's office	2
9	sitting,down,cool,fan,fun-check	1
10	health assessment,keep,assessment,awareness,+build	2
11	random check,random,check,fun-check,doctor	1
12	doc's office,doc,office,+screening,work	3

Cognitive Computing Systems

- Designed to mimic human thought
- Address the issue of complicated data preparation
- Example: IBM Watson Analytics
  - Users upload data and Watson analyzes and suggests correlations
- Will continue to evolve as artificial intelligence software improves



Source: IBM Watson Analytics. Used with permission.

Conclusion

- Analytics has become increasingly prevalent in healthcare
- Used to gain insight into strategic, operational, and clinical issues
- Analytics and big data are increasing in complexity and usability
- Data -> Actionable Insights -> Enhanced decision making

End of Chapter 8

Chapter 8 Case Study

Tasker Foothills Primary Care

Analytics and the Use of Advanced IT

Vincent Valley Hospital and Health System has created an Innovation Center under the leadership of Dr. Robert Munsey, who is chief of Family Practice. One of the center's first major projects is to create a new approach to delivering primary care. A team was formed, which included Dr. Cynthia Andreson, medical leader of Tasker Foothills primary care clinic; Sameer Inanpudi, director of business intelligence; and Jim Hanson, special projects manager. The charter for the project states that the new primary care model should consider utilizing leading-edge technologies (big data, cognitive computing, data visualization, text mining, wearable technology, mobile computing, Internet of Things, etc.).

A data set was available from the federal Bureau of Labor Statistics that showed household time use in the Tasker Hill area. A sample of this data is included as Work and Leisure Time Survey.xls

The current primary care process can be seen as a series of steps that are initiated as an acute episode (e.g., athletic injury) or chronic disease management (e.g., follow-up visit to manage high blood pressure). The steps in the process include:

1. Patient calls clinic to make appointment.
2. Patient drives to clinic, parks, and walks to clinic waiting area.
3. Patient checks in at desk (name, conditions, insurance changes).
4. Patient completes current medications and history form.
5. Patient enters exam room.
6. Nurse collects data (blood pressure, weight, etc.) and current issues and history.
7. Physician enters and conducts examination.
8. Physician completes treatment plan, advises patient, orders drugs as needed, and completes documentation in electronic health record.
9. Patient is provided with printed visit summary and plan and exits.

Concerns about this current process include the following:

- Much of patient time is spent in non-value-added activities.
- There is no direct system for follow-up between clinic visits.
- There is no system to collect useful clinical data between visits.
- There is no accessible opportunity for patients to monitor their own progress toward meeting clinical goals.

The team first examined the data and then created a new system for delivering primary care to patients with chronic conditions. They scheduled a meeting with Dr. Munsey to present their proposal.

What were the new process and systems used?

What were the advantages and risks?

	Observation						
	1	2	3	4	5		
Day						Average	Range
1	44	41	80	51	25	48.2	55
2	28	32	58	42	18	35.6	40
3	54	83	59	50	46	58.4	37
4	57	53	63	15	52	48	48
5	30	50	62	68	42	50.4	38
6	42	40	50	49	73	50.8	33
7	26	17	50	47	91	46.2	74
8	54	39	39	82	28	48.4	54
9	46	62	53	64	57	56.4	18
10	49	71	34	42	43	47.8	37
11	53	64	12	35	43	41.4	52
12	75	43	43	50	64	55	32
13	74	19	52	55	59	51.8	55
14	91	40	66	15	73	57	76
15	59	32	59	49	71	54	39
16	14	44	35	32	76	40.2	62
17	52	84	55	63	15	53.8	69
18	28	20	67	76	69	52	56
19	25	23	35	21	23	25.4	14
20	46	74	24	10	47	40.2	64
21	33	54	62	40	27	43.2	35
22	64	55	62	14	72	53.4	58
23	53	49	72	49	61	56.8	23
24	15	16	18	35	78	32.4	63
25	64	9	51	47	70	48.2	61
26	36	21	51	40	57	41	36
27	24	58	19	88	16	41	72
28	75	66	34	27	71	54.6	48
29	60	42	20	59	60	48.2	40
30	52	28	85	39	67	54.2	57
					19.74502	47.8	48.2

Day	Proportion of patients who were unsatisfied
1	0.17
2	0.13
3	0.15
4	0.22
5	0.16
6	0.13
7	0.17
8	0.17
9	0.11
10	0.16
11	0.15
12	0.17
13	0.17
14	0.12
15	0.15
16	0.14
17	0.13
18	0.15
19	0.15
20	0.22
21	0.19
22	0.15
23	0.12
24	0.16
25	0.18
26	0.14
27	0.17
28	0.18
29	0.19
30	0.14
31	0.19
32	0.10
33	0.17
34	0.15
35	0.17
36	0.15
37	0.15
38	0.15
39	0.14
40	0.19

Healthcare Operations Management, **4th Edition**

Chapter 8 – Instructor Support

Analytics

Learning Objectives

Upon completing this chapter, the student should be able to understand the need for advanced analytics in healthcare and to effectively apply these tools:

- Descriptive analytics
- Predictive analytics
- Prescriptive analytics
- Data visualization
- Data mining

Teaching Resources

PowerPoint slides for chapter 8 are available.

A test bank for chapter 8 is available.

Discussion Questions – See suggested responses below.

Case study or major experiential activity – A case study is part of this chapter. Instructor support is below.

Discussion Questions

1. Identify a healthcare operating issue that could benefit from each of the analytical techniques:

a. Descriptive

Clinical variance by doctor

Payment rates by payer

Employee turnover by department

Patient satisfaction scores by clinic

b. Predictive

Readmission probability

Prescription fulfillment probability

Incidence of disease by zip code

c. Prescriptive

Predict emergency department demand and optimize staffing

Use prescriptive algorithm to model lab use based on inpatient disease state and optimize lab equipment use.

2. How could text mining be used to improve the care of patients with chronic disease?

- Identify patient issues through patient complaints
- Track use of therapies in doctor's and nurse's notes
- Track reasons for invoice rejections by payers

3. Design a dashboard for each of the following care delivery types:

(Note: Potential elements of a dashboard are included below. Students should experiment with all of the graphing options available in Excel.)

a. Inpatient intensive care unit

Patient census by shift and staffing levels by shift

Patient risk score by shift

Patient complications by day – month compared to month

b. Outpatient imaging center

Number of images per day by machine

Number of images per day by diagnosis

Map of locations of referring doctors, patient address

c. Dental office

Number of procedures per day

Average processing time by procedures

Open or failed appointments by day

d. Home health agency

Geographic location of patients

Referrals per month by referral source

Patient satisfaction by home health worker per month

Case Study – Primary Care Redesign Using Analytics and the Use of Advanced IT

This case encourages students to be creative in redesigning primary care with the use of new IT tools. In addition, it provides a data set to assist in this creative thinking. This case works best as a team project.

Students should be encouraged to take these steps:

1. Read the case and discuss primary care encounters that all of the students have experienced—pros and cons.

2. Do internet research on emerging trends in information technology (big data, cognitive computing, data visualization, text mining, wearable technology, mobile computing, Internet of Things, etc.).

3. Examine the data set: Work and Leisure Time Survey.xls. Conduct some preliminary descriptive analysis including visualization. The accompanying instructor file contains an example of this analysis: Work and Leisure Time Survey analysis.xls