The Importance of Statistics in Health Care

67th AAMA Annual Conference
Orlando, Florida
Friday September 22, 2023
10:15 AM – 12:15 PM

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Today’s Agenda
Statistics provide evidence for health care decision-makers through numerical data collected from measurements or observation that describe the characteristics of specific population samples. Medical professionals need basic knowledge of statistics to effectively predict and summarize the utility, efficacy, and costs of medical goods and services; justify budgets’ expenditures; and measure their performance outcomes. Discover the importance of statistics in the allocation of scarce medical resources and production efficiency. Learn about the basics of statistics, including how to gather data and how to review, analyze, and draw conclusions from data that can be used in the workplace.

Misuses of Statistics Icebreaker

Facts, Numbers and Data Sometimes Skewed & Misrepresented on Charts, Graphs and More
#1
WHAT IS YOUR FAVORITE SEASON? @CNNMIKE

- Fall: 53%
- Summer: 17%
- Winter: 17%
- Spring: 13%

#2
CNN | CNN : 1m
Their cookie sales are entering the digital realm. Are the @girlscouts losing out?
cnn.it/3Jy8Mv

Top selling Girl Scout cookies nationally:

- Thin Mints: 20%
- Samoas: 13%
- Tagalongs: 13%
- Do-Si-Dos: 10%
- Trefoils: 9%

Other varieties 25%

#3

#4
UNEMPLOYMENT RATE UNDER PRESIDENT OBAMA

- 2011
- Source: Bureau of Labor Statistics
- Fox News
- War and a troop withdrawal at the end of 2011: $2.95 Trillion
#4 Continued

[Graph showing unemployment rate under President Obama]

Source: Bureau of Labor Statistics

War and troop withdrawal at the end of 2011

2011

#5

Question of the Day

What should cost less: a gallon of gas or a gallon of milk?

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>43%</td>
<td>57%</td>
</tr>
</tbody>
</table>

Yesterday's results:

73% No
28% Yes

Vote at winnipegsun.com

#6

Poll of Polls

Should Scotland be independent?

<table>
<thead>
<tr>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>52%</td>
<td>58%</td>
</tr>
</tbody>
</table>

CNN Live

Has killed more than 2,600 in West Africa. World Health Organization.

#7

2012 Presidential Run

GOP Candidates

<table>
<thead>
<tr>
<th>BACK PALIN</th>
<th>BACK HUCKABEE</th>
<th>BACK ROMNEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>70%</td>
<td>63%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Source: Opinions Dynamic
#12

If Bush Tax Cuts Expire

- Current: 35%
- Jan 1, 2013: 39.6%

#13

4 out of 5 PEDIATRICIANS RECOMMEND Gerber.

#14

9 out of 10 DENTISTS RECOMMEND SENSODYNE® TOOTHPASTE

#15

Stock A and Stock B price graphs.
Statistics in the Context of Medical Assisting

- Statistics in medical assisting involves gathering, organizing, summarizing, and interpreting patient and operational information to make informed healthcare decisions and provide solutions to medical questions.
- Data refers to factual information that can be used to formulate conclusions or inform decisions. These data points may encompass various patient characteristics, from vital signs to medical history.
- On a day-to-day basis, medical assistants work with a diverse range of data:
  - Clinically: Vital signs, lab results, patient histories, and medication lists.
  - Administratively: Appointment schedules, billing information, budgeting and inventory levels.
- Understanding statistics not only helps in diagnosing and treating patients more effectively but also in streamlining administrative procedures for better healthcare delivery.

Variability in Statistics

- Data variability is a given in healthcare; no two patients have the same vital signs, just as no two people are exactly alike.
- Within individual patients, variability exists too; for example, a single patient's weight or blood cholesterol can fluctuate over time.
- Medical assistants frequently engage with this variability by recording a range of patient data, such as temperature, blood samples, and electronic health records.
- On the administrative side, medical assistants also encounter variability in scheduling, insurance claims, and patient compliance with payment plans.
- Understanding this variability is crucial for more accurate diagnoses, tailored treatments, and efficient resource management.
- Where else do you see variability in medical assisting?
Types of Data/Measurement Levels in Medical Assisting

**Nominal**
- Categories without natural order.
- Clinical Example: Blood types (A, B, AB, O).
- Administrative Example: Insurance providers (BlueCross, Aetna, Medicaid).

**Ordinal**
- Categories with specific order/ranking.
- Clinical Example: Pain scale (1-10), Cancer Stages (I, II, III, IV).
- Administrative Example: Urgency of appointments (Routine, Urgent, Emergency).

**Interval**
- Numerical values where the difference between points is meaningful. 0 doesn’t mean absence.
- Clinical Example: Temperature (normal body temperature vs. fever temperature).
- Administrative Example: Time elapsed since the last appointment.

**Ratio**
- Numerical values with a true zero point.
- Clinical Example: Patient weight (Body Mass Index - underweight, normal weight, overweight, obesity).
- Administrative Example: Number of missed appointments.

Why Data Matters in Medical Assisting

- **Why knowing data type matters**
  - Tailoring treatment plans.
  - Prioritizing administrative tasks.

- **Uses in record-keeping**
  - Accurate medical history.
  - Efficient appointment scheduling.

- **Uses in patient communication**
  - Clarifying treatment options.
  - Discussing payment plans.

- **Comparing types of data: What works when**
  - Knowing when to use ordinal vs. ratio data in clinical assessments.
  - Understanding when nominal data is sufficient for administrative tasks.

Simple Random Sampling

- Every individual has an equal chance of being selected.
- Clinical Example: A medical assistant randomly picks 50 patient records from a list of 1,000 to audit the accuracy of recorded vital signs.
- Administrative Example: A medical assistant randomly chooses 20 invoices from a pool of 500 to check for billing errors.
Stratified Sampling
• The population is divided into subgroups, and samples are randomly selected from each.
• Clinical Example: A medical assistant categorizes patient records by age groups and selects 10 records from each to study medication patterns.
• Administrative Example: A medical assistant stratifies patients by their insurance type and randomly picks 5 from each group to audit billing practices.

Systematic Sampling
• Every nth individual in a list is selected.
• Clinical Example: The medical assistant picks every 10th patient who walks into the clinic to measure patient satisfaction with clinical care.
• Administrative Example: The assistant selects every 5th online appointment to assess the new scheduling system’s effectiveness.

Cluster Sampling
• Clusters are randomly selected, and individuals within those clusters are sampled.
• Clinical Example: A manager randomly picks 3 departments in a hospital and surveys all medical assistants in those departments about their clinical tasks.
• Administrative Example: The assistant selects 2 locations of a healthcare chain and surveys all patients visiting on a particular day about administrative experiences like wait times and staff responsiveness.

Measures of Central Tendency
• Mean: The sum of the data divided by the number of pieces of data.
• Median: The value in the middle of a set of ranked data. The data must be put in order before you find the median.
• Mode: Value that occurs most often in a series of numbers. You may have one mode, no mode, or multiple modes.
Example #1: Mean, Median and Mode
Patient Wait Times: In a busy medical clinic, wait times can be a significant issue affecting patient satisfaction. A medical assistant records the wait times (in minutes) for 7 patients on a given day as follows: 15, 20, 20, 25, 30, 35, 40 (minutes)

• **Mean:** \[\frac{15 + 20 + 20 + 25 + 30 + 35 + 40}{7} = \frac{185}{7} = 26.43 \text{ minutes}\]

• **Median:** 15, 20, 20, 25, 30, 35, 40; 25 minutes

• **Mode:** 20 minutes

You Try – Example #2: Mean, Median and Mode
Number of Syringes Used for Vaccinations in 6 Days: A medical assistant is tracking the number of syringes used for vaccinations each day over a 6-day period to assist with resource allocation. Syringes used: 60, 65, 65, 70, 80, 120

• **Mean:**

• **Median:**

• **Mode:**

Outliers
• In the last example, we saw that 120 syringes was an outlier.
• An outlier in a data set is a value that is much higher or much lower than almost all others.
• An outlier may be correct, incorrect, a typo, or even misplaced in the data set.
• A data point that significantly deviates from the other data points in a dataset.
• Outliers can skew results and lead to inaccurate conclusions.

Clinical Examples of Outliers in Medical Assisting
• **High Blood Pressure Reading:** One patient in a study on hypertension has a reading of 250/160 mm Hg, while most fall in the range of 130-150/80-90 mm Hg.
  - Impacts: Critical/urgent medical care needed. May distort the average blood pressure in your study.
• **Unusually Long Wait Times:** On a day with a computer system failure, the patient wait time spikes to 2 hours compared to a typical 15-30 minute wait.
  - Impact: Can distort average wait time calculations, affecting staffing decisions.
**Administrative Examples of Outliers in Medical Assisting**

- **Inventory Spikes**: An emergency situation necessitates the use of 500 syringes in one day, while a typical day uses around 70-80.
  - Impact: Could affect future supply orders if not accounted for.
- **Budget Surge**: An expensive piece of medical equipment needs unexpected urgent repair, significantly exceeding the monthly maintenance budget.
  - Impact: May throw off budget analyses and future budget planning.

**Inventory Management**

- Duties may include inventory and ordering of clerical/business supplies, clinic supplies, medication orders, etc.
- Careful monitoring is vital.
- Maintain minimum (threshold) amount of supplies.
- Many factors to consider: coordinate activities with the provider, etc.

**Discussion: Inventory Management**

- How do you manage optimal inventory at your workplace?
- What were some supplies/items with variable prices during COVID-19?
- What measures do you take so that you have sufficient supplies?
- What numbers/data do you use to make these decisions?

**Calculating the Value of Ending Inventory Using Average Cost**

**Step 1**: Calculate the average cost per unit by using the following formula.

\[
\text{Average Cost Per Unit} = \frac{\text{Cost of Goods}}{\text{Total Units}}
\]

**Step 2**: Calculate the value of ending inventory by multiplying the number of units in ending inventory by the average cost per unit.

\[
\text{Ending inventory} = \text{Units in ending inventory} \times \text{Average cost/unit}
\]
Average Cost Method Example

Using the average cost method of inventory pricing for a medical supply, what is the dollar value of ending inventory if 167 units were on hand on December 31?

Average Cost Per Unit = \( \frac{86,320}{60} = \$143.72 \)

Ending inventory = 167 x $143.72 = $24,001.24

Probability

• The **probability** of an event is a numeric measure of the likelihood that the event will occur.
• The probability of an event, P(E), can be determined by the following formula:
  \[ P(E) = \frac{\text{number of times it can occur}}{\text{total number of possible outcomes}} \]
• If an event is impossible and will never occur, the probability is 0.
• If an event is absolutely certain to occur, the probability is 1.
• Otherwise, the value of a probability is between 0 and 1.

Probability Examples

• **Probability of Late Payments**
  Out of 100 patient bills sent out, 10 were paid late.
  \[ \frac{10}{100} = 0.1 = 10\% \]

• **Probability of Medical Software Crashes During a Shift**
  In 100 shifts, the medical software crashed 8 times.
  \[ \frac{8}{100} = 0.08 = 8\% \]

• **Probability of Patient No-Show for Evening Appointments**
  Out of 30 evening appointments, 5 resulted in no-shows.
  \[ \frac{5}{30} = 0.167 = 16.7\% \]

Correlation

• The **response variable** is the variable whose value can be explained by the value of the **explanatory** or **predictor variable**.
• A **scatter diagram** is a graph that shows the relationship between two quantitative variables measured on the same individual.
• A **correlation** exists between two variables when the values of one are somehow associated with the values of the other in some way.
• The **linear correlation coefficient** \( r \) measures the strength of the linear relationship between the paired quantitative \( x \)- and \( y \)-values in a sample.
Scatter Diagrams and Correlation

Notice the difference between Figure (a) and Figure (b). The data follow a linear pattern that slants upward to the right in Figure (a) and downward to the right in Figure (b). Figures (c) and (d) show nonlinear relations. In Figure (e), there is no relation between the explanatory and response variables.

Clinical Examples of Correlation

- **Blood Pressure and Age**: There might be a positive correlation between age and blood pressure, meaning as age increases, it's likely that blood pressure also rises.
  - **Importance**: Helps in risk stratification and early intervention strategies for hypertension.
- **Cholesterol Levels and Cardiovascular Issues**: High cholesterol levels might have a positive correlation with cardiovascular diseases.
  - **Importance**: Assists in identifying patients who are at risk of developing cardiovascular problems.
- **Medication Dosage and Recovery Time**: For some conditions, there may be a negative correlation between the dosage of a certain medication and the time it takes for a patient to recover.
  - **Importance**: Helps to optimize medication dosage for quicker recovery.

Administrative Examples of Correlation

- **Budget Allocation and Equipment Failure Rates**: There might be a negative correlation between how much is spent on equipment maintenance and the frequency of equipment failures.
  - **Importance**: Helps in making budget decisions related to equipment maintenance.
- **Patient Satisfaction Scores and Return Visits**: There could be a positive correlation between high patient satisfaction scores and the likelihood of return visits.
  - **Importance**: Useful for assessing the quality of service and for future planning.
- **Online Reviews and New Patient Registration**: A positive correlation might exist between good online reviews and the rate of new patient sign-ups.
  - **Importance**: Signifies the impact of online reputation on attracting new patients.
Correlation: Patient Wait Times & Average Satisfaction

Which physician’s office had a greater decrease in revenue in July?

Correlation: Medical supply costs hit new highs amid supply chain disruptions

It’s the exact same graph! 😊
Final Thoughts (Slide 1 of 2)
• **Importance of Statistics in Healthcare**
  - Statistics inform evidence-based practice, enhancing the quality of patient care in clinical settings.
  - Administratively, statistics help in resource allocation and budget planning.
• **Why It Matters: Improved Outcomes, Reduced Costs**
  - Data-driven approaches can lead to more accurate diagnoses and treatments, while also optimizing resources and reducing costs.

Final Thoughts (Slide 2 of 2)
• **Statistics may or may not provide an accurate picture!**
• **Ethical Considerations: Always Remain Vigilant**
  - Data integrity and patient confidentiality must always be maintained, both in clinical and administrative settings.
• **The Ever-Increasing Role of Data**
  - With advancements in technology, data analytics is becoming more integral in both clinical and administrative tasks.

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