mccwdta
Massachusetts Community Colleges
& Workforce Development
Transformation Agenda

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Contextualized Curriculum

for Adult Learners in Math and Literacy

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Weighty Matters

Print:

How data analysis is used by nurses to review patient data and ensure that health decisions meet specific guidelines.

Industry Sector: Healthcare
Content Area: Mathematics
Core Topic: Data analysis

Expand All | Collapse All

Common Core State Standards

Mathematical Practices:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.

S-ID: Interpreting Categorical and Quantitative Data

S-ID.1: Represent data with plots on the real number line (dot plots, histograms, and box plots).

S-ID.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S-IC: Making Inferences and Justifying Conclusions

S-IC.5: Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

S-IC.6: Evaluate reports based on data.

Adult Basic Education Standards

Statistics and Probability

Standard S-1. Collect, organize and represent data

- **1.3** Represent information so that it makes sense to others.

Standard S-2. Read and interpret data representations

- **2.4** Extract simple information from a list or table

Standard S-3. Describe data using numerical descriptions, statistics and trend terminology, Population vs. sample, outlier, data distribution, mean of distribution, median/mean, standard deviation, normal distribution

Standard S-4. Make and evaluate arguments or statements by applying knowledge of data analysis, bias factors, graph distortions and context

- **4.3** Visually identify "who has more," and use some numbers to compare quantities.
- **4.4** Support simple statements with data.
- **4.5** Use "most of" statements to support arguments.

Industry Overview

Healthcare in America

From neonatal nurses to radiology technologists, medical coders to medical office assistants, health educators to home care aides, the healthcare industry provides a vast and diverse array of services to individuals at every stage of life. Providing nearly 17 million jobs and accounting for an estimated $18 million of the U.S. GDP in 2009, healthcare is the nation's largest industry. In Massachusetts, in particular, healthcare accounts for more than 15% of employment (compared with 12% nationally), accounting for approximately one in six jobs. With an aging baby boomer population that is living longer, there is greater demand for more and higher quality preventative and long-term healthcare across the United States. With eight of the 30 fastest growing occupations, healthcare is predicted to be one of the fastest growing industries both nationwide and in Massachusetts between now and 2020.

Careers in Healthcare

The healthcare industry includes a vast array of jobs related to planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development. This industry includes five career pathways:

- therapeutic services, which includes professionals who work directly with patients to improve their health by providing direct care and treatment for patients (for example, a nurse or a physical therapist assistant);
- diagnostic services, which includes professionals who plan and conduct tests to detect and diagnose diseases and injuries, and use test results to plan treatment (for example, a radiologic technologist or a sonographer, who perform diagnostic imaging examinations, such as X-rays or ultrasounds);
- health informatics, which includes professionals who compile and manage health information and records (for example, a medical records and health information technician, who organizes and manages patient databases; higher-level positions, such as administrators of healthcare facilities or departments, are also included in this pathway);
- support services, which includes professionals who provide assistance to other medical professionals, allowing them to do their jobs in diagnosing and treating patients or supporting therapies (for example, food service workers and nutritionists ensure that patients' meals are healthy and meet dietary guidelines); and
- biotechnology research and development, which include careers that involve bioscience research; while many of these professions require doctoral or medical degrees, some entry-level opportunities in the field require only an associate degree (for example, food and agricultural science technicians).

Mathematics and Communication Skills Needed in Healthcare

The growing complexity of the healthcare industry, including changing technologies, requires workers to continuously upgrade their skills. In addition to technical skills specific to their job, mathematics and literacy skills are crucial for success in all occupations across the healthcare industry.

Communication: First and foremost, no matter the job, good healthcare practitioners are committed to giving patients the best care available and keeping abreast of health research and developments in the field. All workers need to be able to read medical journals and understand medical terminology and vocabulary, as well as read and write literate emails to co-workers/supervisors. Many healthcare jobs also require the ability to read and interpret charts and access and interpret electronic medical records in order to provide quality care.

Many health careers, especially—but not exclusively—those in therapeutic services—involve interacting with patients and their families, in some cases working with people who may be sick, disabled, or dying. Even support staff in a medical office or hospital require effective oral communication skills as well as compassionate interpersonal skills such as the ability to listen and talk to patients to assess needs. Effective communication with colleagues as well as patients is crucial. Healthcare is increasingly a group activity, in which a patient's recovery depends on how well all members of a healthcare team perform specific function, and how well they communicate and collaborate with one another.

Mathematics: From reading charts to interpreting data to measuring and administering correct medicine, basic mathematics skills are essential for providing quality care across most healthcare occupations. Nurses, for example, use mathematics for calculations in all areas of their duties. They use mathematics to calculate dosages, caloric requirements for individual patients, calibrate equipment, and interpret lab results. Charts and patient data are often presented as decimals or percentages, and a nurse must be able to convert between the two, thus requiring competency in understanding and using ratios, proportions and percentages.

Much of modern medicine is based on statistics, and all workers in the industry should have a basic understanding of how statistics are used to influence medical trends. Nurses, for example, need to be aware of the statistics behind prescribing medications and possible side effects or complications. They might use statistics to counsel patients on diagnoses or prognoses, or in gathering patient histories.

Career Opportunities in Healthcare with Education from Community Colleges

Massachusetts Community Colleges play a crucial role in preparing students for careers in health sciences across all sectors of the industry—therapeutic services, diagnostic services, informatics, and support services. All 15 community colleges offer pathways to nursing careers, the largest occupation in the healthcare industry. Additionally, Massachusetts Community Colleges offers associate degree and certificate programs that prepare students to enter occupations across all sectors of the industry, for example:

- *Therapeutic services:* registered nurse, practical nurse, nursing assistant, certified nurse's aide, massage therapist, fitness trainer and instructor, dental hygienist, dental assistant, pharmacy technician, physical therapist assistant, occupation therapy assistant, respiratory assistant, medical assistant
- *Diagnostic services:* radiologic technologist and technician, radiographer, surgical technologist, sonographer, phlebotomist, paramedic, polysomnographic technologist and technician, medical and clinical laboratory technician, magnetic resonance imaging technologist, nuclear medicine technologist, veterinary technologist
- *Informatics:* Medical record and health information technician, medical coder, medical interpreter, medical biller, medical transcriptionist, health educator

Recent Career Opportunities in Massachusetts

The following is a sample of healthcare job listings in Massachusetts that require an associate's degree or certificate:

- Registered Nurse (RN), AmeriCare At Home, Boston, MA [show]
- Medical Technologist, Emerson Hospital, Concord, MA [show]
- Ultrasound Technologist, Brockton, MA [show]

- Licensed Practical Nurse, Hologic, East Watertown, MA [show]

Employment Outlook for Healthcare

America's aging population is now nearing or entering retirement (opening new jobs), and will continue to require more services and the increased use of innovative medical technology for diagnosis and treatment. As a result, healthcare is one of the fastest growing industries both nationwide and in Massachusetts, where growth is even higher than nationally. For example, in 2010, Baystate Health of Springfield, which employs more than 10,000 across its Western Massachusetts system, said that it would likely need to hire about 15,000 people between 2010 and 2020 to replace retiring workers and meet increased demand.

One important factor in the healthcare industry is the financial pressure on hospitals to focus on efficiency and profitability, which results in discharging patients as soon as possible. These financial pressures, along with increased healthcare coverage under federal law, will likely result in a growth in out-patient services in the healthcare industry, such as rehabilitation clinics, long-term care facilities, and home care programs. As a result, occupations experiencing the largest growth include home care aides, physical and occupation therapist assistants, dental hygienists, and medical assistants.

Emerging careers in Health/Information Technology (HIT): Estimates based on data from the Bureau of Labor Statistics (BLS), Department of Education, and independent studies indicate a shortfall of approximately 51,000 qualified Health IT (HIT) workers who will be required over the next five years to meet the needs of hospitals and physicians as they move to adopting an electronic healthcare system, facilitated by the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009. The HITECH Act is a key component of healthcare reform. The Act encompasses interoperable electronic health records (EHRs) including computerized systems to order tests and medications, and support systems to aid clinical decision making and the development of a national health information network to permit the secure exchange of electronic health information among providers. The Congressional Budget Office estimates that the incentive mechanisms in the HITECH Act will increase HIT adoption rates from 45 percent to about 70 percent for hospitals and from 65 percent to approximately 90 percent for physicians. To support job growth in this emerging career field and ensure the adoption of EHRs, new types of workers are needed to facilitate information exchange across healthcare providers and public health authorities, and assist in redesigning workflows within healthcare settings to maximize the quality and efficiency benefits of EHRs, while maintaining privacy and security of health information and records. To that end, the Department of Health and Human Services has embarked on an initiative to build the HIT workforce with community colleges as the primary training ground for these new workers: (1) Practice workflow and information management redesign specialists; (2) Clinician/practitioner consultants; (3) Implementation support specialists; (4) Implementation managers; (5) Technical/software support staff; and (6) Trainers. The average hourly earnings for community college program graduates are expected to be in the target range of between $12.46/hour to $20.25/hour.

Resources:

Healthcare Employment Outlook:

- Massachusetts Career Information System: Massachusetts-specific information on careers which can be used to look at different industries, occupations within those industries, and the skills and education needed to work in these jobs
- WorkKeys Occupational Profiles
- Bureau of Labor Statistics

Healthcare Career Information:

- Top 5 Reasons to Work in the Healthcare Field, About.com
- Break Into a Healthcare Career, About.com
- Healthcare Initiatives, US Department of Labor
- Six Healthcare Careers that are Booming, Yahoo! Education
- Career Clusters in Health Sciences, National Association of State Directors of Career Technical Education Consortium
- Explore Health Careers, American Dental Education Association

Massachusetts Healthcare Job Listings:

Workplace Scenario (8th Grade Level)

This scenario is based on the work of a preoperative nurse. For more information, view this video.

You work at a major hospital in Boston. You are part of a preoperative nursing team. Your team works in the Weight Loss Surgery Center. The center specializes in gastric bypass surgery. The center also performs the newer gastric sleeve surgeries. These surgeries require patients to go through a standard program before surgery. The program includes medical and psychological education. It also covers nutritional, physical, and surgical education.

The doctors in your center strongly recommend weight loss before surgery. Specifically, they suggest that patients lose 5–10% of their weight. There are several reasons for this recommendation. First, the surgery is safer for the patient. Second, patients who lose at least 5% of their weight will likely be hospitalized for fewer days. Lastly, patients who lose weight before surgery are more likely to keep losing weight. Patients who lose 10% before surgery are twice as likely to lose 70% of excess weight one year after surgery. It takes most patients six to twelve months to complete the full program. Your nursing team works with patients to support their progression through the program.

Your specific job is to check vitals, weight, and blood sugar. You then enter the data into the electronic health record (EHR). Each time you enter data, you see a graph. It shows data from the time of the first patient visit to the present. The data you collect is important to the surgical team. It helps them decide whether a patient is ready for the surgery.

Your practice follows the National Institute for Health guidelines. Gastric bypass and gastric sleeve surgeries are not best for all patients. They are generally suggested for patients with a Body Mass Index (BMI) less than 40. Patients with a BMI over 50 are still accepted for the program. They are placed on a physician-supervised rapid weight-loss program. This helps them reach a safer weight for surgery. Patients with a BMI over 35 may qualify for gastric surgery. To do so they must have at least one obesity related illness. These include Type 2 diabetes, heart disease, or severe sleep apnea.

Workplace Scenario (High School Level)

This scenario is based on the work of a preoperative nurse. For more information, view this video.

You work at a major hospital in Boston. You are part of the preoperative nursing team for the Weight Loss Surgery Center. Your center specializes in gastric bypass surgery. More recently your center has also been performing the newer gastric sleeve surgeries. These require patients to go through a standardized preoperative program. The program includes medical, psychological, nutritional, physical, as well as surgical education. The surgeons in your center strongly recommend that patients lose 5–10% of their weight before surgery for several reasons: 1) the surgery is safer for the patient 2) patients who lose at least 5% of their weight before surgery are more likely to have a shorter stay in the hospital and 3) patients who lose 10% of the weight before surgery are twice as likely to lose 70% of excess weight one year after the surgery. It takes most patients six months to a year to complete the full program before their surgeries. Your nursing team works collaboratively to facilitate patients' progression through the program.

Your specific job is to monitor preoperative vitals, weight, and blood sugar. You then enter the data into the electronic health record (EHR). Each time you enter data into the EHR, you see a graph of the data from the time of the first patient visit to the present. The data you collect helps the surgical team determine readiness for the surgery.

Your practice follows the guidelines of the National Institute for Health. Gastric bypass and gastric sleeve surgeries are generally recommended only for those patients with a Body Mass Index (BMI) less than 40. Patients with a BMI over 50 are accepted for the program. They are placed on a physician-supervised rapid weight-loss program to help them reach a safer weight for surgery.

Patients with a BMI over 35 may qualify for gastric surgery if they have at least one obesity related illness. These include Type 2 diabetes, heart disease, or severe sleep apnea.

Core instructional context

Data analysis can help us to make better decisions in both our daily lives and in our work. Students may be used to reading information in charts and graphs, making sense of the data, and then making decisions based on that data—decisions about their finances, what type of automobile to purchase, whether and where to buy a house, or about where to send their children to school. In the workplace, data analysis can be crucial—in many industries, there is a strong emphasis on ensuring that the quality of a product or service remains stable (and high) by constantly analyzing data about the process and making improvements.

Nurses chart and analyze trends in data continuously. When patients are in the hospital—whether they are recovering from surgery, illness, or an injury or undergoing treatment for cancer or other diseases —nurses take their vital signs (temperature, heart rate, and blood pressure) every four hours and then look at the trends over the course of the day.

This analysis helps nurses to determine a baseline of each vital sign for each patient and note if they deviate from their norm, which can indicate a serious problem—for example, an increased heart rate and decreased blood pressure over the course of a few hours can indicate sepsis. In addition, nurses closely monitor patients' fluid balance (that is, how much intravenous fluid, blood products and IV medications patients receive in comparison to how much fluid they are putting out via urine, vomiting, or any kind of drains they may have). Nurses then note if the fluid balance is positive or negative, which have different clinical meanings (for example, if a child received 700 cc of fluid in the past 6 hours but only put out 200 cc of urine, she has a positive fluid balance which can indicate sepsis, renal problems, cause respiratory problems or just indicate that the patient had been dehydrated and needed some extra fluid). Nurses routinely report information about patients, including trends in vital signs and fluid balance to doctors and nurse practitioners, who make decisions about how to treat patients. It is essential that the data and analysis are accurate and clear, as lives can depend on it.

Worked Example

For the past month, your practice has been testing two different protein drinks, Energize and Metabolize, as meal replacements for patients who are on an all-liquid diet in the 2 weeks before surgery. The doctors leading the study ask you to gather and analyze five patients' BMI data at three points: 14 days prior to surgery, on the day of the surgery, and 90 days after the surgery. Using the EHR software, you generate the following graph:

You analyze the data using the following questions.

    a. Which patient had the greatest change in BMI over the course of the study?

        Patient A: 41 − 32 = 9
        Patient B: 39 − 31 = 8
        Patient C: 45 − 35 = 10
        Patient D: 42 − 37 = 5
        Patient E: 37 − 30 = 7

        Patient C had the largest change in BMI.

    b. What was the mean change in BMI from 14 days prior to surgery to the day of the surgery?
      First we must calculate each patient's BMI change during the period before the surgery:

        Patient A: 41 − 39 = 2
        Patient B: 39 − 38 = 1
        Patient C: 45 − 42 = 3
        Patient D: 42 − 40 = 2
        Patient E: 37 − 35 = 2

To calculate the mean, you add up all of the results and divide by the number of results:
Mean = (2 + 1 + 3 + 2 + 2) / 5 = 2

c. What was the mean change in BMI from the day of the surgery to 90 days after the surgery?
First we must calculate each patient's BMI change during the period after the surgery:

Patient A: 39 – 32 = 7
Patient B: 38 – 31 = 7
Patient C: 42 – 35 = 7
Patient D: 40 – 37 = 3
Patient E: 35 – 30 = 5

To calculate the mean, you add up all of the results and divide by the number of results:
Mean = (7 + 7 + 7 + 3 + 5) / 5 = 5.8

d. What's the ratio of mean change in BMI from the period after surgery to the mean change in BMI from the period before the surgery? Explain what this means in words.

This is simply the ratio of the answer for part c to the answer to part b:
5.8 : 2 or 2.9 : 1

This means that, on average, the patients lost 2.9 times as much weight in the 90 days after the surgery than they did in the 14 days prior to it.

The doctors want a larger sample size for this part of the study. They ask you to generate two histograms representing patient weight loss in the period before the surgery and the period after for a much larger set of patients. Using the EHR software, you generate the following two graphs:

e. Approximate the mean of the change in BMI for each of the data sets. Interpret their meanings in the context of the study.

The center of the distribution on the histogram should allow you to approximate the mean. For the samples from before the surgery, the mean is between 3 and 4. For the samples from after the surgery, the mean is between 6 and 7.

f. Qualitatively compare the standard deviations of the two histograms. Interpret their meanings in the context of the study.

The standard deviation of a data set is a measure of spread. A distribution with a large spread has a large standard deviation. The data set for after the surgery has a much larger spread—the data points along a greater range from the mean.This means that the amount of BMI change post-surgery can vary a lot more, whereas most patients drop close to 3.5 in BMI prior to surgery.

Contextualized learning activities

1. Pre-Reading Activities

Write the term "gastric bypass surgery" on the board and ask students: "What facts do you know or think you know about weight loss surgery?" Record key phrases or ideas as students brainstorm, without commenting or discussing them. (For example: "for obese adults, the surgery makes the stomach smaller and reduces the amount of food you can eat, has high rates of success, has some risks and/or side effects, is expensive, number of surgeries is on the rise.") (If students have difficulty with the brainstorming, you might have them explore one of the websites on this topic listed in the Resources to determine key phrases and ideas.) Highlight one fact they identified, such as "high rates

of success" or "has some risks and side effects," and ask them how they know or could find out if this fact is true. Use this discussion to introduce research, data analysis, and statistics, and the role that statistics plays in all sectors of life in helping people interpret information and make sound decisions.

Have students work with a partner to brainstorm a health-related decision they or a family member made recently. (It could be very minor, such as deciding to ice their knee after hurting it or giving their child chicken soup to combat a cold, or it could be a more major decision such as electing to have an invasive procedure or operation.) Ask pairs to "find the math" behind their decisions (i.e. identify the statistics that helped them make the decision or the kind of data they would collect to help them make a more informed decision in the future; for example, what percentage of people experience side effects to that medicine/procedure, do women or men experience more side effects, etc.).

2. Unpacking the Scenario

Have students read the scenario, circling or highlighting the math-related phases and concepts. Draw students' attention to the recommendation in the scenario for patients to lose 5-10% of their body weight prior to the surgery and ask students what they think the rationale for that recommendation is. Present students with the following scenario:

You are meeting with three patients today to discuss when to schedule their surgeries. Your practice requires that patients lose 5–10% of their body weight before surgery for both better surgical outcomes and better long-term weight loss success. Your EHR is down, so you realize you'll have to calculate their weight loss percentage by yourself. Which of the patients has lost the necessary weight to begin scheduling surgery?

Patient	Today's Weight	Total Weight Lost to Date
Thomas	323 lbs	14 lbs
Gabrielle	245 lbs	18 lbs
Anthony	440 lbs	21 lbs

> **Answer:** Gabrielle

3. Contextualized Problems

Before having students complete the following problems, you might have them work in pairs on the worked example in "Core Instructional Context" and share their answers.

a. For the past month, your practice has been testing two different protein drinks, Energize and Metabolize, as meal replacements for patients who are on an all-liquid diet in the 2 weeks before surgery. You want to compare if there is any difference between the drinks, so you go to the EHR and export the patient data as a spreadsheet to see if one drink is better than the other at helping patients lose weight.

   1. What percentage of the patients in this study are female and what percentage are male?

      Answer: 59.26% female and 41.74% male

   2. What is the range of starting BMI for all participants?

      Answer: Starting BMI data range from 36 to 54, so the range is 18

   3. What is the range of BMI on Day 14 for all participants?

      Answer: Day 14 BMI data range from 26 to 52.5, so the range is 26.5

   4. What is the range of BMI change for all participants in the study?

      Answer: BMI change data range from -1.20 to 20, so the range is 21.20

5. Create a scatterplot graph of the BMI changes for participants in the study.

   Answer: Students' graphs should look like this graph.

6. Looking at both the range of BMI change and the scatterplot you created, does any of the data stand out to you as possible outliers? How do you think you should handle outliers?

   Answer: The high number (20) is a clear outlier—it is impossible to lose 20 BMI points in 14 days. It is most likely a data entry error. If you include the outlier for some analyses (such as the arithmetic mean), it can skew the results, so it is best to exclude that data point from the data set.

7. You notice two negative numbers in the BMI Change column. What do you think these numbers indicate and should those patients be included in your analysis?

   Answer: The two negative numbers indicate a slight increase in BMI. This weight gain is unlikely to occur on an all liquid diet, so it is possible that these patients did not follow the diet. However, since you do not know for sure what the cause of this increase is, you should include these data when conducting your analyses.

8. Calculate the mean BMI change for this group of patients.

   Answer: The average, or mean, BMI change (including the outlier) is 1.9. If you eliminate the outlier 20, the mean change is 1.2.

9. What is the median BMI change for this group of patients?

   Answer: The median is 1.2 (whether calculated with or without the outlier)

10. What might account for any discrepancies between the median and the mean? Which one do you think is a better indicator of the average change for this study?

    Answer: When you use mean to calculate average, any outliers can skew the results. In this case, median is a better indicator. Or you can eliminate the outlier and calculate mean.

11. What does the mode tell you? What is the BMI change mode for this cohort of patients? Is mode a useful indicator for this study? Why or why not?

    Answer: The mode is the most commonly occurring number in a set of data. In this study, the BMI change mode is 1.2, which happens to be the same as the median and mean (when calculated without the outlier). In a study with lots of very specific data, you may need to do some rounding for the mode to be a useful measure. (For example, if you had rounded to the nearest hundredth in this study, thus specifying whether the BMI changes were 1.23 or 1.19, then mode would not be a very useful measure, since it tells you the specific value that occurs most frequently.)

12. What is the average change in BMI for each drink? Choose which measure of central tendency you use and whether you will include the outlier(s) in your analysis.

    Answer: The average BMI changes for the Energize drink are 1.2, regardless of whether mean, median, or mode is used.

    The average BMI changes for Metabolize are:
    Mean: 2.65 (when the outlier, 20, is included in the data analysis)
    Mean:1.21 (when the outlier, 20 is excluded from the data analysis)
    Median:1.1 (regardless of whether the outlier is included)
    Mode:1.1 (regardless of whether the outlier is included)

13. What is the average change in BMI for men? For women?

Answer:
Males:
Mean (including the outlier): 3.10
Mean (excluding the outlier): 1.51
Median: 1.5
Mode: 1.5

Females:
Mean: 1.01
Median : 1.1
Mode: 1.2

14. What is the average change in BMI with each drink, by gender?

Answer:
Energize for males:
Mean: 1.3
Median: 1.4
Mode: 1.5

Metabolize for males:
Mean: 5.66 (Excluding the outlier, the mean change is 2.08)
Median: 2.1 (Excluding the outlier, the median change is 2.05
Mode: None (There are no values that repeat. Given that there are only five males who drank Metabolize, mode is not a very useful measure of central tendency here.)

Energize for females:
Mean: 1.25
Median: 1.2
Mode: 1.2

Metabolize for females:
Mean: 0.77
Median: 0.95
Mode: 1.1

15. Based on the data your team has reviewed, which drink is better at helping patients lose the most amount of <u>weight</u> before surgery?

Answer: If you exclude the outlier, the differences overall are minimal. However, Energize is slightly more effective than Metabolize is for females. For males, the opposite is true. Even if the outlier is excluded from analyses, Metabolize is more effective for <u>weight</u> loss for men than Energize is.

b. Using the EHR records, you find several patients who had a BMI of 40 when they underwent surgery. You graph these patients' <u>weight</u> loss on a graph of BMI vs.Time (in months).

You also make a table of data points.

Show Data Table

1. Does patient BMI increase or decrease over time after the surgery?

Answer: Decrease

2. What type of relationship (i.e. exponential, quadratic, linear, etc) is there between months after surgery and BMI?

Answer: Linear

3. Use a [statistical tool](#) to calculate a linear regression of the data. Find the line of best fit.

   Answer: BMI = 39.962 - 0.978 * Months

4. Find r2, the coefficient of determination, for your line of best fit. What does this value mean about your linear model?

   Answer: r2 = .980. An r2 value so close to 1 means that this data very closely matches a linear relationship.

Contextualized test items

1. A patient, Allan Yang, comes in for a [preoperative](#) visit, and you check his [weight](#) and [vitals](#). He weighs 301 pounds. You see that at his first visit he weighed 318 pounds. Has he lost the recommended 5–10% of his body [weight](#) to be scheduled for surgery?

   a. **Yes**
   b. No

2. The Red Diamond [Insurance](#) Company will cover [weight](#) loss surgery for patients with a BMI >40 or a BMI >35 if the patient has at least one obesity-related disease. Which of the patients below quality for surgery based on BMI?

Patient	Height	[Weight](#)	Any disease?
Shakira	5'4"	220	heart disease
Monique	5'8"	225	[sleep apnea](#)
Elisabeth	5'11"	290	
Ramon	5'10	320	[Type 2 diabetes](#)

   a. Elisabeth and Ramon only
   b. Shakira, Monique, and Ramon only
   c. **Shakira, Elisabeth, and Ramon only**
   d. All patients

3. Gina is tracking her weekly [weight](#) loss following surgery in the table below:

Date	Current [Weight](#)	[Weight](#) loss since last week	Current BMI
5-Dec	201	N/A	35.61
12-Dec	193	8	34.19
19-Dec	189.5	3.5	33.57
26-Dec	191	-1.5	33.83
2-Jan	192	-1	34.01
9-Jan	192	0	34.01
16-Jan	191	1	33.83
23-Jan	189	2	33.48
30-Jan	188	1	33.30

6-Feb	187	1	33.13

    a. Which weekly weight-loss amount appears to be an outlier when compared to the rest of her weekly weight changes?

        a. 0
        b. 1
        c. 8
        d. 2

    Answer: c

    b. Which weekly weight loss amount is the mode for the weeks Gina charted?

        a. 1
        b. 2
        c. -1.5
        d. 8

    Answer: a

    c. Find Gina's average weekly weight loss, using the measure of central tendency that you think is most useful for showing her weight loss journey. Explain which measure of central tendency you used and why.

        Possible Answers: Gina's mean weight loss per week is 1.4lbs. If you exclude the outlier (8 lb loss the first week), her mean weekly weight loss is only 0.67 lbs. Her median weight loss is 1, as is her mode (both with or without the outlier included). Students might argue that because of the outlier, the median or mode is a more accurate portrayal of her average weekly weight loss, particularly if she is using the analysis to predict and plan weight loss over a longer period of time.

Contextualized project

Team project: Your surgical weight loss center has a website with a lot of information for new and prospective patients, including a BMI Chart. Your nursing team has heard from several patients that they find it confusing because there is no explanatory text.

1. You deal quite a bit with patient data, so the web developer asks your team to write a few sentences of explanatory text and a title for the chart. What do you submit?

    Answer: Look for answers to suggest that the darker gray shows the safest BMI ranges for patients qualify for gastric bypass or gastric sleeve surgeries based on NIH recommendations.

2. Your team realizes that the chart only shows one piece of data. Work as a group to come with a new chart or graph that reflects all of the data from the NIH about which individuals qualify for bariatric surgery.

    Answer: Look for answers that show all three data points from NIH:

    BMI >35, Patients qualify for surgery only if they have one obesity related illness
    BMI >40 Patients qualify for surgery
    BMI >50 Patients qualify for surgery, but must lose weight before having it

Additional or extension activities, multimedia, readings and/or resources

Extension

Have students work in groups to identify statistics they might want to know about gastric bypass or gastric sleeve surgeries. (For example: expected weight loss, how weight loss compares with other methods, demographics of weight-loss surgery such as income level and age, complication and/or mortality rates following surgeries). Have students present their research question to the class and explain what kind of data should be collected to answer those questions. Then have them conduct Internet research to see if such studies have been conducted, and present their findings to the class.

Resources

BMI Calculator

Weight Loss Surgery, Online Journal of Issues in Nursing

Overview of Gastric Bypass Surgery

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