Math Medic Unit 1: Analyzing Data

Lesson	Learning Targets
1.1 Statistical Studies	• Identify the population and sample in a statistical study. • Identify and classify the variable(s) in a study.
1.2 Analyzing Categorical Data	• Use bar charts and pie charts to analyze data for one categorical variable. • Use two-way tables and various bar graphs to analyze data for two categorical variables. • Be aware of misleading graphs.
1.3 Representing Categorical Data	• Compare distributions of categorical data using bar graphs and mosaic plots. • Determine if two categorical variables are associated.
1.4 Describing Quantitative Data	• Use dotplots, stem-and-leaf plots, and histograms to analyze quantitative data. • Describe the distribution of a quantitative variable (shape, outliers, center, variability).
1.5 Measuring Variability	• Calculate and interpret standard deviation. • Identify which summary statistics are resistant and nonresistant to outliers. • Compare the mean and median to determine the approximate shape of a distribution.
1.6 Comparing Quantitative Data	• Identify outliers in a quantitative data set. • Use a boxplot to analyze quantitative data. • Compare distributions of quantitative data.
1.7 Location in a Distribution	• Calculate and interpret percentiles for quantitative data. • Calculate and interpret z-scores for quantitative data. • Use z-scores to compare the relative location of values in different distributions.
1.8 Linear Transformations of Quantitative Data	• Determine what happens to the shape, center, and variability when adding/subtracting a constant or multiplying/dividing by a constant for quantitative data. • Determine the mean and standard deviation for a standardized (z-score) distribution.

Math Medic Unit 2: Collecting Data

Lesson	Learning Targets
2.1 Simple Random Sample	• Understand how convenience samples and voluntary response samples can lead to bias. • Explain how to select a simple random sample (SRS).
2.2 Stratified Random Samples	• Explain how to select a stratified random sample. • Understand how the sampling method can affect the bias and variability of estimates about a population.
2.3 Cluster and Systematic Samples	• Explain how to select a cluster random sample and a systematic random sample. • Understand the advantages and disadvantages of each sampling method.
2.4 Potential Problems with Sampling	• Explain how undercoverage and nonresponse can lead to bias. • Understand what conditions can lead to response bias.
2.5 Observational Studies and Experiments	• Explain why a confounding variable can make it difficult to conclude a causal relationship between two variables. • Understand the difference between an observational study and an experiment. • Identify the experimental units and treatments of an experiment.
2.6 Designing Experiments	• Explain the necessary components of a well-designed experiment. • Describe a process for random assignment in an experiment. • Explain the placebo effect and the purpose of blinding in an experiment.
2.7 Selecting an Experimental Design	• Describe a randomized block design experiment and explain the benefit. • Describe a matched pairs design experiment and explain the benefit.
2.8 Inference and Experiments	• Use simulation to determine if the results from an experiment are statistically significant.
2.9 Scope of Inference	• Explain the purpose of taking a random sample. • Explain the purpose of using random assignment in an experiment.

Math Medic Unit 3: Probability

Lesson	Learning Targets
3.1 Introducing Probability	• Interpret probability as a long-run relative frequency. • Understand how the Law of Large Numbers relates to the idea of probability.
3.2 Simulation	• Use a simulation to estimate the probability of an event. • Understand what it means for a result to be statistically significant.
3.3 Rules for Probability	• Use the sample space of equally likely outcomes to find probabilities. • Use basic rules and notation for probability.
3.4 The Addition Rule	• Use two-way tables and Venn Diagrams to find probabilities. • Use the general addition rule to calculate P(A or B) for events that are not mutually exclusive.
3.5 Conditional Probability and Independence	• Calculate and interpret conditional probabilities. • Determine if two events are independent.
3.6 Tree Diagrams	• Use the general multiplication rule to calculate P(A and B). • Use tree diagrams as a strategy to calculate probabilities.

Math Medic Unit 4 Random Variables

Lesson	Learning Targets
4.1 Discrete Random Variables	• Analyze and interpret the probability distribution for a discrete random variable. • Describe the probability distribution for a discrete random variable (shape, center, variability).
4.2 Continuous Random Variables	• Distinguish between a discrete and a continuous random variable. • Calculate probabilities for continuous random variables.
4.3 Normal Distributions and the Empirical Rule	• Model distributions of quantitative data using a density curve, including a normal distribution curve. • Use the empirical rule (68-95-99.7 rule) for normal distributions to determine the percent of values in an interval.
4.4 Normal Distribution Calculations	• For a normal distribution, find the proportion of values in a given interval. • For a normal distribution, find the value corresponding to a given percentile.
4.5 Combining Random Variables	• Calculate the mean and standard deviation for the sum or difference of random variables. • Find probabilities for the sum or difference of normal random variables.
4.6 Introduction to the Binomial Distribution	• Check conditions for determining if a random variable is binomial. • Use the binomial formula to calculate probabilities.
4.7 Parameters for Binomial Distributions	• Use technology to find probabilities for binomial distributions. • Calculate and interpret the mean and standard deviation of a binomial distribution.
4.8 Conditions for Inference	• Check the 10% condition when sampling without replacement. • Check the Large Counts condition when using a normal approximation for a binomial distribution.

Math Medic Unit 5: Sampling Distributions

Lesson	Learning Targets
5.1 Sampling Distributions	• Distinguish between a statistic and a parameter, and use appropriate notation for statistics and parameters. • Understand the definition of a sampling distribution.
5.2 Bias and Variability	• Determine if an estimator is biased or unbiased. • Understand why increasing the sample size reduces the variability when estimating a population parameter.
5.3 Sample Proportions	• Describe the shape, center, and variability of the sampling distribution of $\hat{p}$. • Find and interpret probabilities involving the sampling distribution of $\hat{p}$.
5.4 Differences in Sample Proportions	• Describe the shape, center, and variability of the sampling distribution of $\hat{p}_1 - \hat{p}_2$. • Find and interpret probabilities involving the sampling distribution of $\hat{p}_1 - \hat{p}_2$.
5.5 Sample Means	• Describe the shape, center, and variability of the sampling distribution of $\bar{x}$. • Find and interpret probabilities involving the sampling distribution of $\bar{x}$.
5.6 The Central Limit Theorem	• Understand how the shape of the population distribution and the sample size impact the sampling distribution of $\bar{x}$. • Find and interpret probabilities involving the sampling distribution of $\bar{x}$.
5.7 Differences in Sample Means	• Describe the shape, center, and variability of the sampling distribution of $\bar{x}_1 - \bar{x}_2$. • Find and interpret probabilities involving the sampling distribution of $\bar{x}_1 - \bar{x}_2$.

Math Medic Unit 6: Confidence Intervals for Proportions

Lesson	Learning Targets
6.1 Interpreting a Confidence Interval	• Use a point estimate and a margin of error to construct a confidence interval. • Interpret a confidence interval in context.
6.2 Interpreting a Confidence Level	• Interpret a confidence level in context. • Understand how the margin of error is affected by the confidence level and sample size.
6.3 Constructing a Confidence Interval for a Proportion	• Check conditions for constructing a confidence interval for a population proportion, p. • Calculate and interpret a confidence interval for p.
6.4 Confidence Intervals for a Proportion	• Use the 5C method to construct and interpret a confidence interval for a population proportion, p. • Determine the sample size needed for a given margin of error.
6.5 Confidence Intervals for a Difference in Proportions	• Use the 5C method to construct and interpret a confidence interval for a difference in population proportions, $p_1 - p_2$. • Use a confidence interval for $p_1 - p_2$ to evaluate a claim.

Math Medic Unit 7: Hypothesis Tests for Proportions

Lesson	Learning Targets
7.1 Introduction to Hypothesis Tests	• Write hypotheses for a hypothesis test for a population proportion, p. • Interpret a *p*-value and make a conclusion for a hypothesis test for p.
7.2 Conditions and *p*-value	• Check the Random, 10%, and Large Counts conditions for a hypothesis test for p. • Calculate a test statistic and *p*-value for a hypothesis test for p.
7.3 Hypothesis Tests for a Proportion	• Use the 5C method to perform a hypothesis test for p.
7.4 Introduction to Hypothesis Tests for a Difference in Proportions	• Write hypotheses for a hypothesis test for a difference in population proportions, $p_1 - p_2$. • Interpret a *p*-value and make a conclusion for a hypothesis test for $p_1 - p_2$.
7.5 Hypothesis Tests for a Difference in Proportions	• Use the 5C method to perform a hypothesis test for $p_1 - p_2$.
7.6 Type I and Type II Errors	• Describe a Type I and Type II error in context and explain the possible consequences of each.
7.7 Power of a Test	• Interpret the power of a hypothesis test. • Identify ways to increase the power of a hypothesis test.
7.8 Introduction to Chi-Square	• Calculate expected counts for two-way tables. • Calculate a test statistic and a p-value for a chi-square test for homogeneity.
7.9 Chi-Square Test for Homogeneity	• Use the 5C method to perform a chi-square test for homogeneity.
7.10 Chi-Square Test for Independence	• Use the 5C method to perform a chi-square test for independence. • Distinguish between the two different types of chi-square tests.

Math Medic Unit 8: Confidence Intervals for Means

Lesson	Learning Targets
8.1 Introduction to the t-distribution	• Explain why the t-distribution is used instead of the standard normal distribution when the population standard deviation is unknown. • Understand the specific formula for calculating a confidence interval for a mean.
8.2 Constructing a Confidence Interval for a Mean	• Check conditions for calculating a confidence interval for a population mean, μ. • Find a critical t* value for a confidence interval for μ.
8.3 Confidence Intervals for a Mean	• Use the 5C method to construct and interpret a confidence interval for μ.
8.4 Confidence Intervals for a Difference in Means	• Use the 5C method to construct and interpret a confidence interval for a difference in means, $\mu_1 - \mu_2$. • Use a confidence interval for $\mu_1 - \mu_2$ to evaluate a claim.
8.5 Confidence Intervals for a Mean Difference	• Analyze the distribution of differences using a graph and summary statistics. • Use the 5C method to construct and interpret a confidence interval for a population mean difference, μ_{diff}.

Math Medic Unit 9: Hypothesis Tests for Means

Lesson	Learning Targets
9.1 Introduction to Hypothesis Tests for a Mean	• Write hypotheses for a hypothesis test for a population mean, μ. • Interpret a *p*-value and make a conclusion for a hypothesis test for μ.
9.2 Hypothesis Tests for a Mean	• Use the 5C method to perform a hypothesis test for μ. • Understand the connection between hypothesis tests and confidence intervals.
9.3 Introduction to Hypothesis Tests for a Difference in Means	• Write hypotheses for a hypothesis test for a difference in population means, $\mu_1 - \mu_2$. • Check conditions for a hypothesis test for $\mu_1 - \mu_2$.
9.4 Hypothesis Tests for a Difference in Means	• Use the 5C method to perform a hypothesis test for $\mu_1 - \mu_2$.
9.5 Hypothesis Tests for a Mean Difference	• Use the 5C method to perform a hypothesis test for a population mean difference, μ_{diff}. • Distinguish between one-sample paired data and two-sample data.
9.6 Choosing the Correct Inference Procedure	• Identify an appropriate inference procedure for a given scenario.
9.7 The Investigative Question	• Write a valid investigative question for a statistical study.

Math Medic Unit 10: Two-Variable Data

Lesson	Learning Targets
10.1 Scatterplots	• Use a scatterplot to represent the relationship between two quantitative variables. • Describe the relationship between two quantitative variables (direction, unusual features, form, strength).
10.2 Correlation	• Estimate and interpret the correlation (r) for two quantitative variables. • Interpret the coefficient of determination (r^2). • Understand that correlation does not imply causation.
10.3 Making Predictions	• Use a linear regression model to make a prediction, being careful about extrapolation. • Calculate and interpret a residual. • Interpret the slope and y-intercept of a linear regression model.
10.4 Residual Plots	• Understand what is meant by a "least-squares" regression model. • Use a residual plot to determine if a linear regression model is appropriate.
10.5 Coefficient of Determination	• Interpret the coefficient of determination (r^2).