Math Medic Unit 1: Collecting Data

Lesson	Learning Targets
1.1 Introduction to Statistics	• Understand the four components of the statistical investigative process.
1.2 Sampling Methods	• Understand how convenience samples and voluntary response samples can lead to bias. • Understand how a random sample allows generalizations to a larger population.
1.3 Avoiding Bias	• Understand how undercoverage and nonresponse can lead to bias. • Identify the conditions that can lead to response bias.
1.4 Observational Studies vs. Experiments	• Explain why a confounding variable can make it difficult to conclude a cause-and-effect relationship between two variables. • Understand the difference between an observational study and an experiment.
1.5 Setting Up a Good Experiment	• Understand the four principles of good experimental design. • Understand how random assignment allows for cause-and-effect conclusions.
1.6 Making Conclusions	• Explain the purpose of selecting a random sample. • Explain the purpose of using random assignment in an experiment.
1.7 Statistical Significance	• Understand what it means for results to be statistically significant. • Use simulations to determine if the results from an experiment are statistically significant.

Math Medic Unit 2: Visualizing Data for One Variable

Lesson	Learning Targets
2.1 Graphs for Categorical Data	• Use bar graphs and pie charts to analyze data for one categorical variable. • Be aware of misleading graphs.
2.2 Dotplots for Quantitative Data	• Use dotplots to analyze quantitative data. • Describe the distribution of a quantitative variable (shape, outliers, center, variability).
2.3 Histograms for Quantitative Data	• Use histograms to analyze quantitative data. • Compare two or more distributions of a quantitative variable (shape, outliers, center, variability).
2.4 Measures of Center	• Calculate and interpret the median and mean for a distribution of quantitative data. • Choose the most appropriate measure of center based on the shape of a distribution.
2.5 Measures of Variability	• Calculate and interpret the interquartile range and standard deviation for a distribution of quantitative data. • Choose the most appropriate measure of variability based on the shape of a distribution.
2.6 Outliers for Quantitative Data	• Identify outliers in a quantitative data set. • Use boxplots to analyze quantitative data.

Math Medic Unit 3: Analyzing Data for One Variable

Lesson	Learning Targets
3.1 Standardizing with z-scores	• Calculate and interpret percentiles for quantitative data. • Calculate and interpret z-scores for quantitative data.
3.2 Transforming Data	• Determine what happens to a distribution of quantitative data when adding/subtracting a constant. • Determine what happens to a distribution of quantitative data when multiplying/dividing by a constant. • Identify the mean and standard deviation of a distribution of *z*-scores.
3.3 Introducing the Normal Distribution	• Model distributions of quantitative data using a density curve, including a normal distribution. • Use the shape of a density curve to compare the mean and median of the distribution.
3.4 Using the Empirical Rule	• Construct a normal distribution for a data set using its mean and standard deviation. • Use the empirical rule (68-95-99.7) for normal distributions to estimate the percentage of values in an interval. • Use a simulation of many random samples to estimate margin of error.
3.5 Finding Area Under a Normal Distribution	• Find the percent of a population above, below, or between values using a normal distribution. • Use a standard normal distribution to find population percentages.
3.6 Finding Boundary Values in a Normal Distribution	• For a normal distribution, find the value corresponding to a given percentile. • Find the mean or standard deviation of a normal distribution given the value of a percentile.

Math Medic Unit 4: Exploring Data for Two Variables

Lesson	Learning Targets
4.1 Two-Way Tables	• Use a two-way table to analyze data for two categorical variables. • Calculate and interpret joint, marginal, and conditional relative frequencies.
4.2 Exploring Two Categorical Variables	• Construct and interpret segmented bar graphs to analyze two categorical variables. • Determine if there is an association between two categorical variables.
4.3 Exploring Two Quantitative Variables	• Use a scatterplot to represent the relationship between two quantitative variables. • Describe the relationship between two quantitative variables (direction, unusual features, form, strength).
4.4 Correlation	• Estimate and interpret the correlation (r) for two quantitative variables. • Understand that correlation does not imply causation.
4.5 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.
4.6 Choosing a Good Model	• Make predictions using linear and exponential models. • Use a residual plot to determine if a regression model is appropriate.
4.7 Multiple Regression	• Understand multiple regression to model a response variable using more than one explanatory variable. • Use a multiple regression model with several explanatory variables to predict a value of the response variable.
Texas: Finding a Line of Best Fit	• Transform a linear parent function to determine a line of best fit • Compare different linear models for the same set of data to determine best fit, including discussions about error. • Compare different methods for determining best fit, including median-median and absolute value.

Math Medic Unit 5: Understanding Probability

Lesson	Learning Targets
5.1 What is Probability?	• Interpret probability as a long-run relative frequency. • Understand how the Law of Large Numbers relates to the idea of probability.
5.2 Rules for Probability	• Use a sample space of equally likely outcomes to find probabilities. • Use notation and basic rules for probability.
5.3 General 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.
5.4 Conditional Probability	• Calculate and interpret conditional probabilities. • Determine if two events are independent using conditional probabilities.
5.5 Independent Events	• Calculate probabilities of joint independent events. • Determine if two events are independent using the multiplication rule for independent events.
5.6 General Multiplication Rule	• Use the general multiplication rule to calculate P(A and B) for events that are dependent. • Use tree diagrams as a strategy to calculate probabilities.
5.7 Probability Using Permutations	• Use the multiplication counting principle to calculate permutations. • Use permutations to compute probabilities.
5.8 Probability Using Combinations	• Understand the difference between permutations and combinations. • Use combinations to compute probabilities.

Math Medic Unit 6: Analyzing Random Variables

Lesson	Learning Targets
6.1 Discrete Random Variables	• Analyze and interpret the probability distribution for a discrete random variable. • Use a formula to calculate the mean of a discrete random variable.
6.2 Expected Value	• Use technology to find and interpret the mean and standard deviation of a discrete random variable. • Compare expected values to make a decision.
6.3 Binomial Distributions	• Check conditions to determine if a random variable is binomial. • Use the binomial formula to calculate probabilities.
6.4 Analyzing Binomial Distributions	• Use technology to calculate probabilities for a binomial distribution. • Calculate and interpret the expected value and standard deviation of a binomial random variable.
6.5 Normal Approximation for Binomial Distributions	• Check the Large Counts condition when using a normal approximation for a binomial distribution. • Use the normal approximation to estimate binomial probabilities.
Florida: Geometric Distributions	• Check conditions to determine if a random variable is geometric. • Solve real-world problems involving geometric distributions.
Florida: Poisson Distributions	• Check conditions to determine if a random variable is Poisson. • Solve real-world problems involving Poisson distributions.

Math Medic Unit 7: Sampling Distributions

Lesson	Learning Targets
7.1 Introduction to Sampling Distributions	• Distinguish between a sample statistic and a population parameter and use appropriate notation for each. • Understand the concept of a sampling distribution.
7.2 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.
7.3 Sample Proportions	• Describe the shape, center, and variability of the sampling distribution of $\hat{p}$. • Find and interpret probabilities involving the sampling distribution of $\hat{p}$.
7.4 Sample Means	• Describe the shape, center, and variability of the sampling distribution of $\bar{x}$. • Find and interpret probabilities involving the sampling distribution of $\bar{x}$.
7.5 Central Limit Theorem	• Understand how the shape of the population distribution and the sample size impact the sampling distribution of $\bar{x}$. • Use the Central Limit Theorem to find and interpret probabilities involving the sampling distribution of $\bar{x}$.

Math Medic Unit 8: Making Inference for a Proportion

Lesson	Learning Targets
8.1 Introduction to Confidence Intervals	• Use a point estimate and a margin of error to construct a confidence interval. • Interpret a confidence interval in context.
8.2 Margin of Error	• Interpret a confidence level in context. • Understand how the margin of error is affected by the confidence level and sample size.
8.3 Setting Up a Confidence Interval for a Proportion	• Check conditions for constructing a confidence interval for the population proportion, p. • Calculate and interpret a confidence interval for p.
8.4 Confidence Intervals for a Proportion	• Use technology to construct and interpret a confidence interval for the population proportion, p.
8.5 Introduction to Significance Tests	• Write hypotheses for a significance test for the population proportion, p. • Interpret a *p*-value and make a conclusion for a significance test for p.
8.6 Setting Up a Significance Test for a Proportion	• Check conditions for a significance test for a population proportion. • Calculate a test statistic and p-value for a significance test for a population proportion.
8.7 Significance Tests for a Proportion	• Perform a significance test for p.
8.8 Type I and Type II Errors	• Describe a Type I and Type II error in context and explain the possible consequences of each.

Math Medic Unit 9: Making Inference for a Mean

Lesson	Learning Targets
9.1 Setting Up a Confidence Interval for a Mean	• Check conditions for calculating a confidence interval for the population mean, μ. • Calculate and interpret a confidence interval for μ.
9.2 Confidence Intervals for a Mean	• Use technology to construct and interpret a confidence interval for μ.
9.3 Setting Up a Significance Test for a Mean	• Write hypotheses for a significance test for a population mean, μ. • Interpret a *p*-value and make a conclusion for a significance test for μ.
9.4 Significance Tests for a Mean	• Use technology to perform a significance test for μ. • Understand the connection between significance tests and confidence intervals.
9.5 Confidence Intervals for Paired Data	• Analyze the distribution of differences for a set of paired data using a graph and summary statistics. • Use technology to construct and interpret a confidence interval for the mean difference, μ_{diff}.
9.6 Significance Tests for Paired Data	• Use technology to perform a significance test for a mean difference, μ_{diff}.

Math Medic Unit 10: Making Inference for Two Populations

Lesson	Learning Targets
10.1 Inference for Two Proportions	• Visualize the sampling distribution of $\hat{p}_1 - \hat{p}_2$. • Check conditions for inference for the difference in population proportions, $p_1 - p_2$.
10.2 Confidence Intervals for Two Proportions	• Use technology to construct and interpret a confidence interval for a difference in proportions, $p_1 - p_2$.
10.3 Significance Tests for Two Proportions	• Write hypotheses for a significance test for the difference in population proportions, $p_1 - p_2$. • Use technology to perform a significance test for $p_1 - p_2$.
10.4 Inference for Two Means	• Visualize the sampling distribution of $\bar{x}_1 - \bar{x}_2$. • Check conditions for inference for a difference in population means, $\mu_1 - \mu_2$.
10.5 Confidence Intervals for Two Means	• Use technology to construct and interpret a confidence interval for a difference in means, $\mu_1 - \mu_2$.
10.6 Significance Tests for Two Means	• Write hypotheses for a significance test for a difference in population means, $\mu_1 - \mu_2$. • Use technology to perform a significance test for $\mu_1 - \mu_2$

Math Medic Unit 11: Investigating a Statistical Question

Lesson	Learning Targets
11.1 What is a Statistical Question?	• Distinguish between statistical and non-statistical questions.
Intro Stats Final Project	• Formulate statistical investigative questions that clearly identify variables and populations, and anticipate variability. • Design and evaluate methods of data collection including random sampling and experiments, accounting for bias and limitations. • Represent and summarize data using graphical displays and numerical measures to describe distributions. • Generalize from samples to populations, recognizing the impact of study design and variability on the scope of conclusions.