DATA Nugget

Lizards, Iguanas, and Snakes! Oh My!

Featured scientists: Heather Bateman & Mélanie Banville from Arizona State University

Research Background:

Scientist Mélanie searching for reptiles in the Central Arizona-Phoenix LTER.

Throughout history people have settled mainly along rivers and streams. Easy access to water provides resources to support many people living in one area. In the United States today, people have settled along 70% of rivers.

Today, rivers are very different from what they were like before people settled near them. The land surrounding these rivers, called **riparian habitats**, has been transformed into land for farming, businesses, or housing for people. This **urbanization** has caused the loss of green spaces that provide valuable services, such as water filtration, species diversity, and a connection to nature for people living in cities. Today, people are trying to restore green spaces along the river to bring back these services. Restoration of disturbed riparian habitats will hopefully bring back native species and all the other benefits these habitats provide.

Scientists Heather and Mélanie are researchers with the Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER) project. They want to know how restoration will affect animals living near rivers. They are particularly interested in reptiles, such as lizards. Reptiles play important roles in riparian habitats. Reptiles help energy flow and nutrient cycling. This means that if reptiles live in restored riparian habitats, they could increase the long-term health of those habitats. Reptiles can also offer clues about the condition of an ecosystem. Areas where reptiles are found are usually in better condition than areas where reptiles do not live.

Heather and Mélanie wanted to look at how disturbances in riparian habitats affected reptiles. They wanted to know if reptile **abundance** (number of individuals) and **diversity** (number of species) would be different in areas that were more developed. Some reptile species may be sensitive to urbanization, but if these habitats are restored their diversity and abundance might increase or return to pre-urbanization levels. The scientists collected data along the Salt River in Arizona. They had three sites: 1) a non-urban site, 2) an urban disturbed site, and 3) an urban rehabilitated site. They counted reptiles that they saw during a survey. At each site, they

searched 21 plots that were 10 meters wide and 20 meters long. The sites were located along 7 transects, or paths measured out to collect data. Transects were laid out along the riparian habitat of the stream and there were 3 plots per transect. Each plot was surveyed 5 times. They searched for animals on the ground, under rocks, and in trees and shrubs.

Scientific Question: How do urbanization and riparian rehabilitation impact reptile diversity and abundance?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

What do you predict? Given the hypothesis, what are your predictions for lizard abundance and diversity at the three sites?

They predicted that the urban site without rehabilitation would have the lowest abundance and diversity of lizards. The non-urban site would have the highest abundance and diversity of lizards, while the urban rehabilitated site would have an intermediate level of lizard diversity and abundances.

Scientific Data:

Use the data below to answer the scientific question:

Reptiles	Non-Urban	Urban Rehabilitated	Urban
Tiger Whiptail Lizard	9	12	0
Common Side-blotched Lizard	8	15	4
Zebra-tailed Lizard	4	2	2
Desert Spiny Lizard	10	0	0
Ornate Tree Lizard	5	7	0
Desert Iguana	2	0	0
Long-tailed Brush Lizard	3	0	0
Western Diamond-backed Rattlesnake	1	0	0
Reptile Diversity	8	4	2
Reptile Abundance	42	36	6

Name____________________

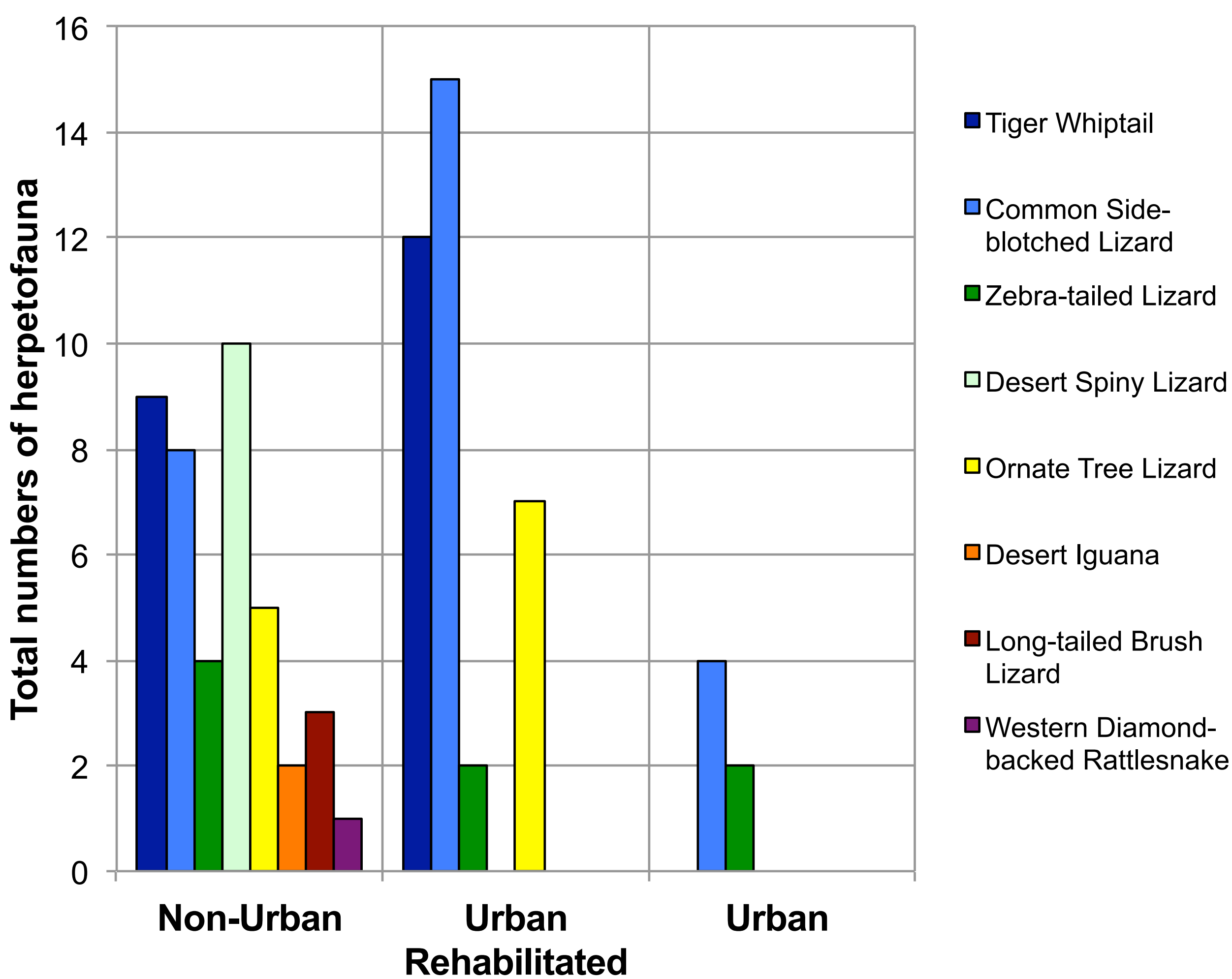
What data will you graph to answer the question?

Independent variable: Site type (non-urban, urban, urban rehabilitated)

Dependent variables: Reptile diversity (number of species at each site) and abundance (total number of individuals per site)

The Common Side-blotched Lizard

Draw your graph below:



Interpret the data:

Make a claim that answers the scientific question.

Urbanization negatively impacts reptile abundance and diversity, leading to fewer reptile individuals and species at a site. Rehabilitation of these urban areas is able to partially restore abundance and diversity, but the composition of the reptile community differs from non-urban undisturbed sites.

Support your claim using data as evidence. Describe the relationship between the dependent and independent variables. Refer to specific parts of the table or graph.

Reptiles were most diverse at the non-urban site (8 species present), followed by the urban rehabilitated site (4 species present), with the least diversity at the urban site (only 2 species present).

As well as having the lowest diversity, the urban disturbed site had the smallest abundance of reptiles (only 6 individuals were recorded). The non-urban and urban rehabilitated sites had similar numbers of reptile individuals present (42 at the non-urban and 36 at the urban rehabilitated).

Describe your scientific reasoning and explain how the evidence supports your claim.

The diversity data suggest that urbanization has a negative impact on reptile diversity and although rehabilitation was not able to restore diversity back to non-urban area diversity levels, rehabilitation did increase diversity when compared to the un-rehabilitated urban area, which was more disturbed.

The abundance data suggest that though the rehabilitation of urban areas was not able to fully restore reptile diversity, it did bring the total number of individuals back up to approximately non-urban levels.

It appears that rehabilitation of riparian urban areas was successful in providing sufficient resources to support an abundant reptile community. Some species of reptile may appear to respond better to rehabilitation of urban areas than others, as shown by the high abundance of Common Side-blotched Lizard and Tiger Whiptail. Results from this study indicate that rehabilitation can both increase reptile diversity and abundance in urban areas by providing resources needed, but urbanization may be an important factor dictating which species are present.

What do the data from this study tell us about the scientist's hypothesis?

The data support the hypothesis that some reptile species are to urbanization, and that restoration can bring back abundance and diversity in some species.

<u>*Your next steps as a scientist:*</u> Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer this question?

As with any initial study, the patterns identified could be explained by alternative hypotheses. Without replication (3 or more sites for each habitat type) we cannot say what is driving the pattern of lizard abundance and diversity. For example, reptile diversity and abundance could be driven by how much vegetation is present at the site or connectivity between the urban areas and non-urban areas. Future studies could look at more urban, non-urban, and urban rehabilitated sites to see if these results hold up.

Future studies could determine what is driving the effect of rehabilitation. Perhaps it is the amount of vegetation and/or diversity of vegetation species and structure present at a site that determines reptile abundance and diversity. To test this hypothesis, scientists could measure the amounts of vegetation at different sites and relate the percent cover of vegetation per species to the abundance and diversity of reptiles. They could also compare the reptile communities between urban rehabilitated areas and non-urban areas with similar amounts of vegetation.

The scientists still have many questions about reptiles in riparian areas. For example, they would like to measure how much reptile species contribute to nutrient cycling along the Salt River. They would do this by counting lizards and measuring scat or waste production to estimate the amount of nitrogen that they add to the riparian system.

Meet the scientist! Follow the link to watch a video where scientist Heather explains her research!
https://ecologyexplorers.asu.edu/about-us/meet-scientists/#heather-bateman

Name____________________

Lizards, Iguanas, and Snakes! Oh My!

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Research Background:

Scientist Mélanie searching for reptiles in the Central Arizona-Phoenix LTER.

Throughout history people have settled mainly along rivers and streams. Easy access to water provides resources to support many people living in one area. In the United States today, people have settled along 70% of rivers.

Today, rivers are very different from what they were like before people settled near them. The land surrounding these rivers, called **riparian habitats**, has been transformed into land for farming, businesses, or housing for people. This **urbanization** has caused the loss of green spaces that provide valuable services, such as water filtration, species diversity, and a connection to nature for people living in cities. Today, people are trying to restore green spaces along the river to bring back these services. Restoration of disturbed riparian habitats will hopefully bring back native species and all the other benefits these habitats provide.

Scientists Heather and Mélanie are researchers with the Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER) project. They want to know how restoration will affect animals living near rivers. They are particularly interested in reptiles, such as lizards. Reptiles play important roles in riparian habitats. Reptiles help energy flow and nutrient cycling. This means that if reptiles live in restored riparian habitats, they could increase the long-term health of those habitats. Reptiles can also offer clues about the condition of an ecosystem. Areas where reptiles are found are usually in better condition than areas where reptiles do not live.

Heather and Mélanie wanted to look at how disturbances in riparian habitats affected reptiles. They wanted to know if reptile **abundance** (number of individuals) and **diversity** (number of species) would be different in areas that were more developed. Some reptile species may be sensitive to urbanization, but if these habitats are restored their diversity and abundance might increase or return to pre-urbanization levels. The scientists collected data along the Salt River in Arizona. They had three sites: 1) a non-urban site, 2) an urban disturbed site, and 3) an urban rehabilitated site. They counted reptiles that they saw during a survey. At each site, they

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searched 21 plots that were 10 meters wide and 20 meters long. The sites were located along 7 transects, or paths measured out to collect data. Transects were laid out along the riparian habitat of the stream and there were 3 plots per transect. Each plot was surveyed 5 times. They searched for animals on the ground, under rocks, and in trees and shrubs.

Scientific Question: How do urbanization and riparian rehabilitation impact reptile diversity and abundance?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

What do you predict? Given the hypothesis, what are your predictions for lizard abundance and diversity at the three sites?

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Reptile Diversity			
Reptile Abundance			

Name_____________________

What data will you graph to answer the question?

Independent variable: ________________

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Dependent variables: ________________

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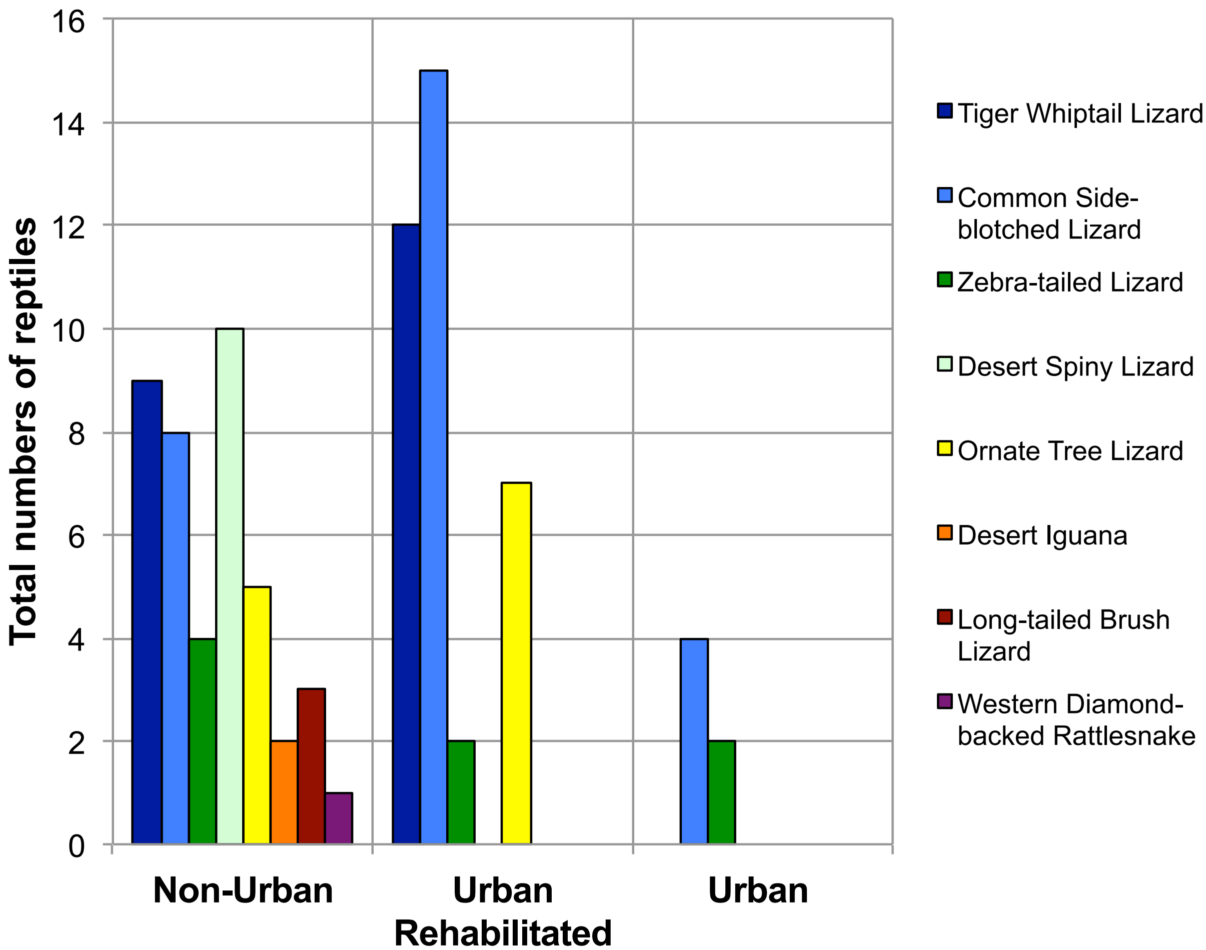
The Common Side-blotched Lizard

Below is a graph of the data:



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Interpret the data:

Make a claim that answers the scientific question.

Support your claim using data as evidence. Describe the relationship between the dependent and independent variables. Refer to specific parts of the table or graph.

Describe your scientific reasoning and explain how the evidence supports your claim.

What do the data from this study tell us about the scientist's hypothesis?

Your next steps as a scientist: Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer this question?

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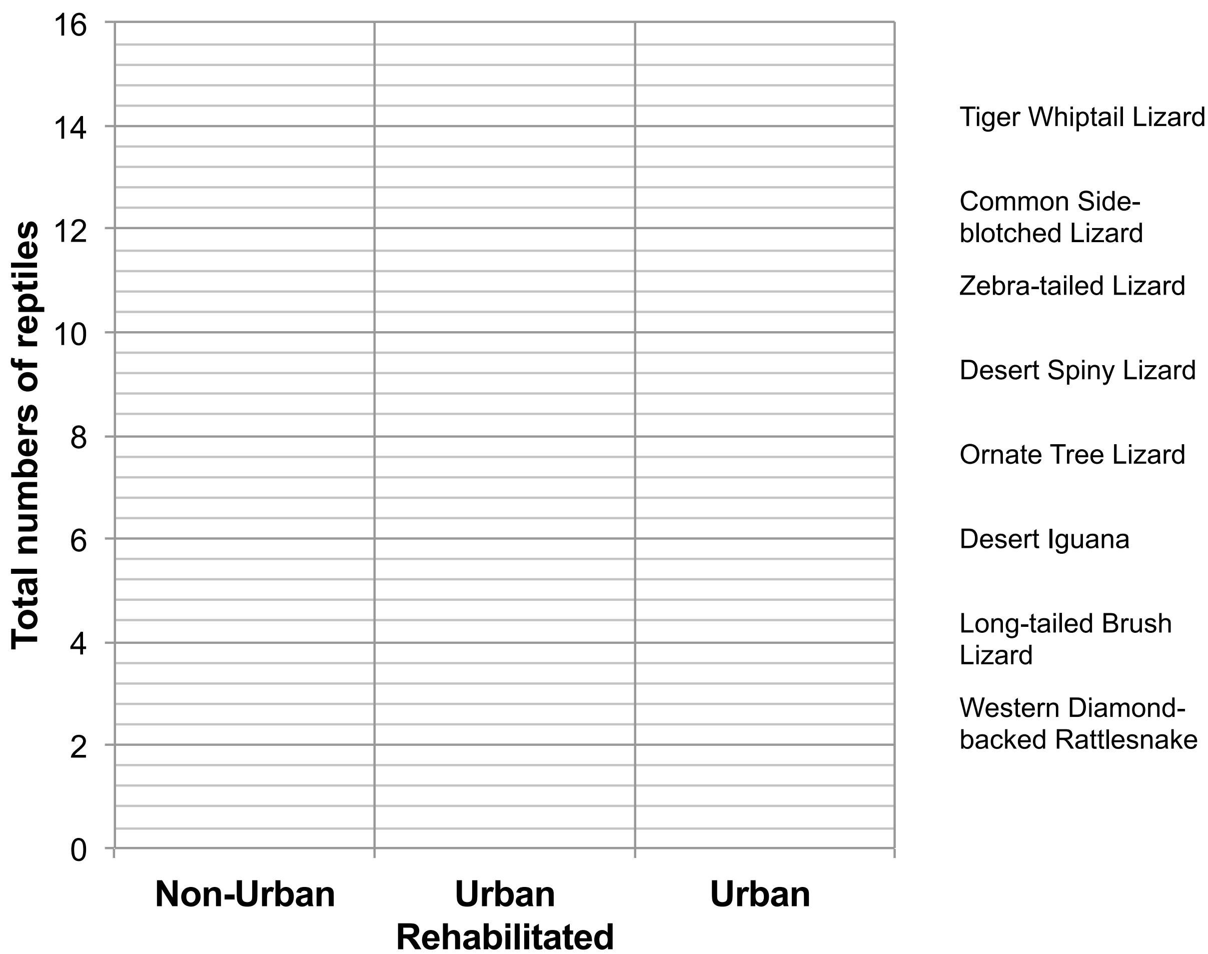

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Reptile Abundance			

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Dependent variables: ________________

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Interpret the data:

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Describe your scientific reasoning and explain how the evidence supports your claim.

What do the data from this study tell us about the scientist's hypothesis?

Your next steps as a scientist: Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer this question?

Data Nugget Grading Rubric

Criteria	1	2	3	4	Score/Comments
Hypothesis	Did not attempt to find or underline the hypothesis.	Did not correctly find the hypothesis. Underlined predictions.	Correctly found and underlined part of the hypothesis.	Correctly found and underlined the entire hypothesis and did not underline predictions.	
Variables	Did not attempt to list the variables.	Responded, but did not have correct response for either variable.	Responded, but had a correct response for only one variable.	Responded correctly for both the independent and dependent variable. Correctly identified all variables.	
Graphs (Levels B and C only. Level A graph is provided)	Did not attempt to graph the data or wrong data was graphed.	Data was graphed incorrectly. Both the x and y-axes were mislabeled and wrong graph type was used.	Data was graphed mostly correct. Either the x and y-axes were mislabeled or wrong graph type was used.	Data was graphed correctly. Both the x and y-axes were labeled correctly and appropriate graph type was used.	
Data Interpretation					
Claim *Statement that answers the scientific question.*	Does not make a claim, or statement that answers the scientific question.	Makes an inaccurate claim; answers the question incorrectly.	Makes an accurate but vague or incomplete claim. Does not fully answer the question.	Makes an accurate and complete claim. Fully answers the question.	
Evidence *Scientific data that supports the claim.*	Provides no evidence to support their claim and does not include reference to data.	Makes a general statement describing evidence, but does not include specific data.	Provides some, but not all, of the necessary evidence to support the claim. Makes reference to the graph or table.	Provides all necessary and appropriate evidence to support the claim. Reference to specific parts of the graph or table used in response.	
Reasoning *A justification that connects the evidence to the claim. Shows why the data counts as evidence.*	Does not provide reasoning, or only provides inappropriate reasoning.	Links evidence to the claim but does not connect patterns to scientific principles or concepts.	Links evidence to the claim but with partial or incorrect connection to scientific principles or concepts.	Links evidence to the claim and provides all the necessary scientific principles and concepts to justify why the data count as evidence.	
Scientist Next Steps					
Future Questions *A scientific question can be answered with data and experimentation. Does not ask for a yes/no response or simply for predictions.*	Did not attempt to identify future questions to be investigated.	Identified a question, but not one that could be addressed with research.	Identified a question that can be addressed with research, but question asks for a yes/no answer or simply for predictions.	Provided one or more strong scientific questions that can be addressed by future research.	
Future Experiments and Data Collection	Did not attempt to identify future data to be collected.	Identified new data to be collected but did not provide methodology.	Identified new data to be collected and provided methodology. Identified independent and dependent variables.	Identified new data to be collected and provided adequate methodology. Identified independent and dependent variables. Methods included consideration of the following when appropriate: replication, randomization, and controls.	