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Hypothesis and Study Design

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Disclosures

- No relevant financial disclosures

Lubitz, Carrie C., M.D.

Hey guys. You have both reached out to me about what to cover in your talks. I know these talks are tough - which is why I asked the two of you to give them. I know it is nearly impossible to make these fun, but if anyone can do it...



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Audiences begin to lose attention after roughly 10 minutes of hearing the same presenter stanford.io/2e9VxYb



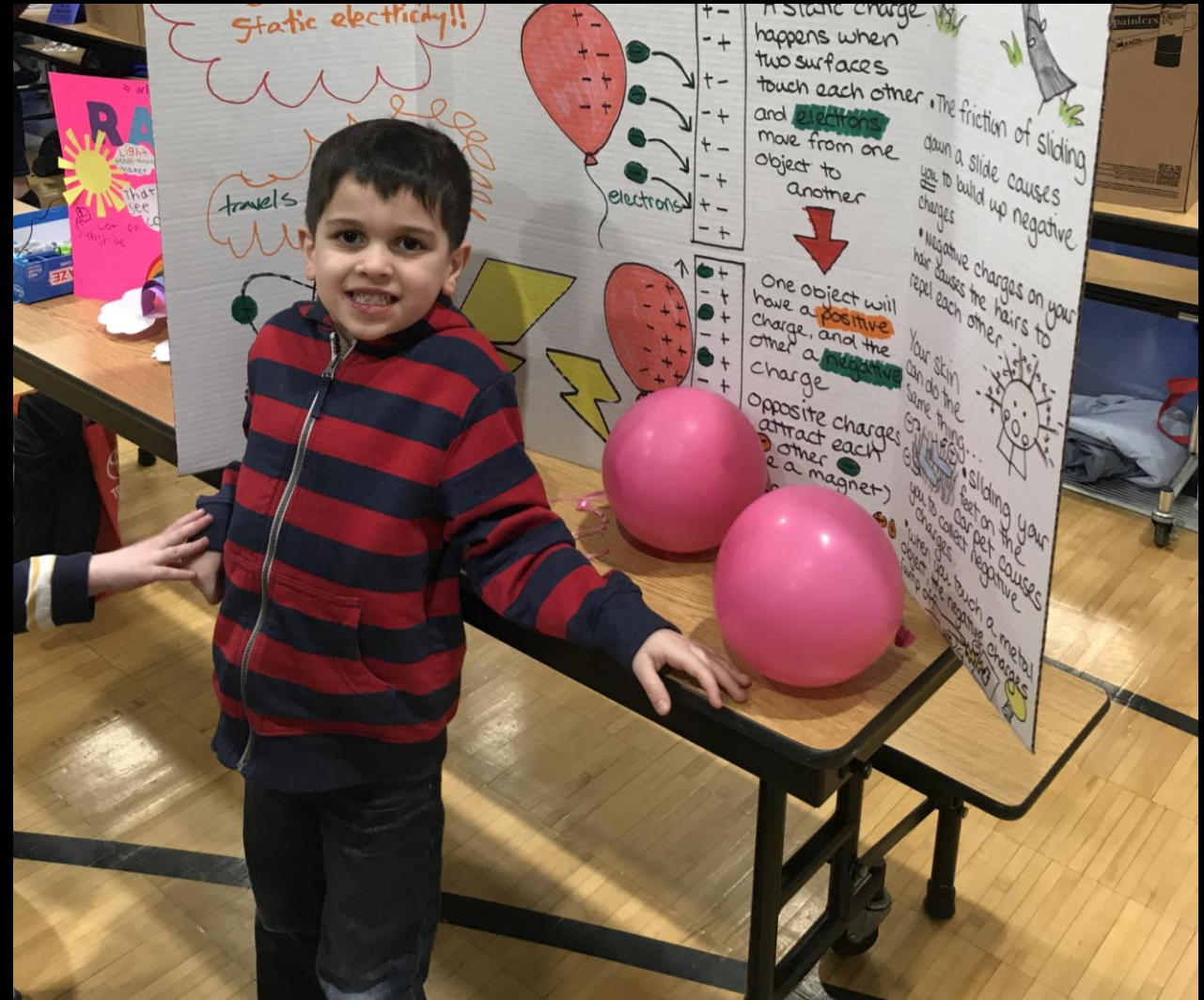
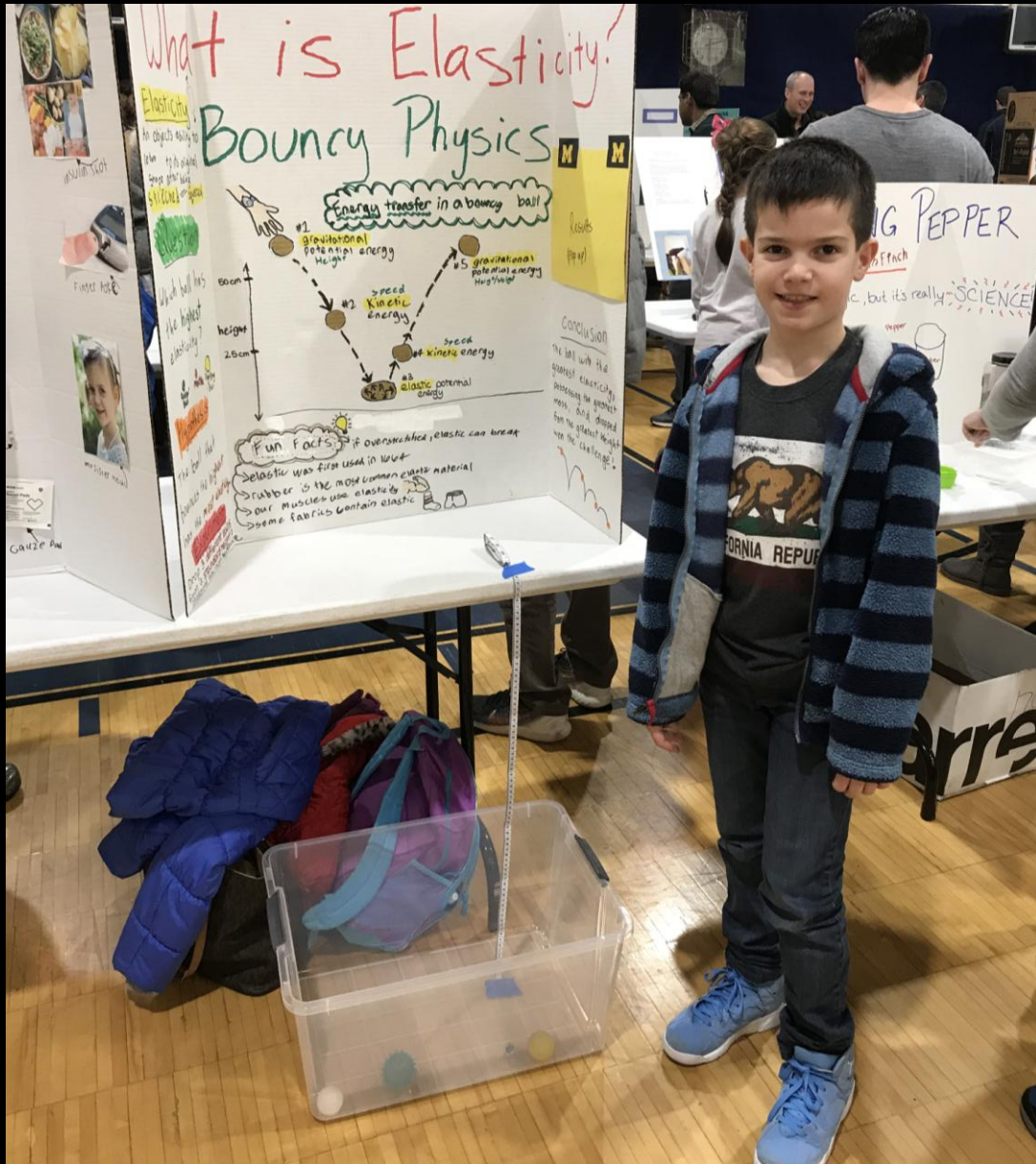
10 Tips For Giving Effective Virtual Presentations

What to know before you go live.

Outline

- Finding your inspiration
- Understand what's known and unknown
- Formulate a hypothesis
- Choose a study design
- Write

THE SCIENTIFIC METHOD



Scientific Method



PURPOSE

What do I want to learn?



RESEARCH

Find out as much about your topic as you can.



HYPOTHESIS

Predict what the answer to the problem is.



EXPERIMENT

Design a test to confirm or disprove your hypothesis.



ANALYSIS

Record what happened during the experiment.

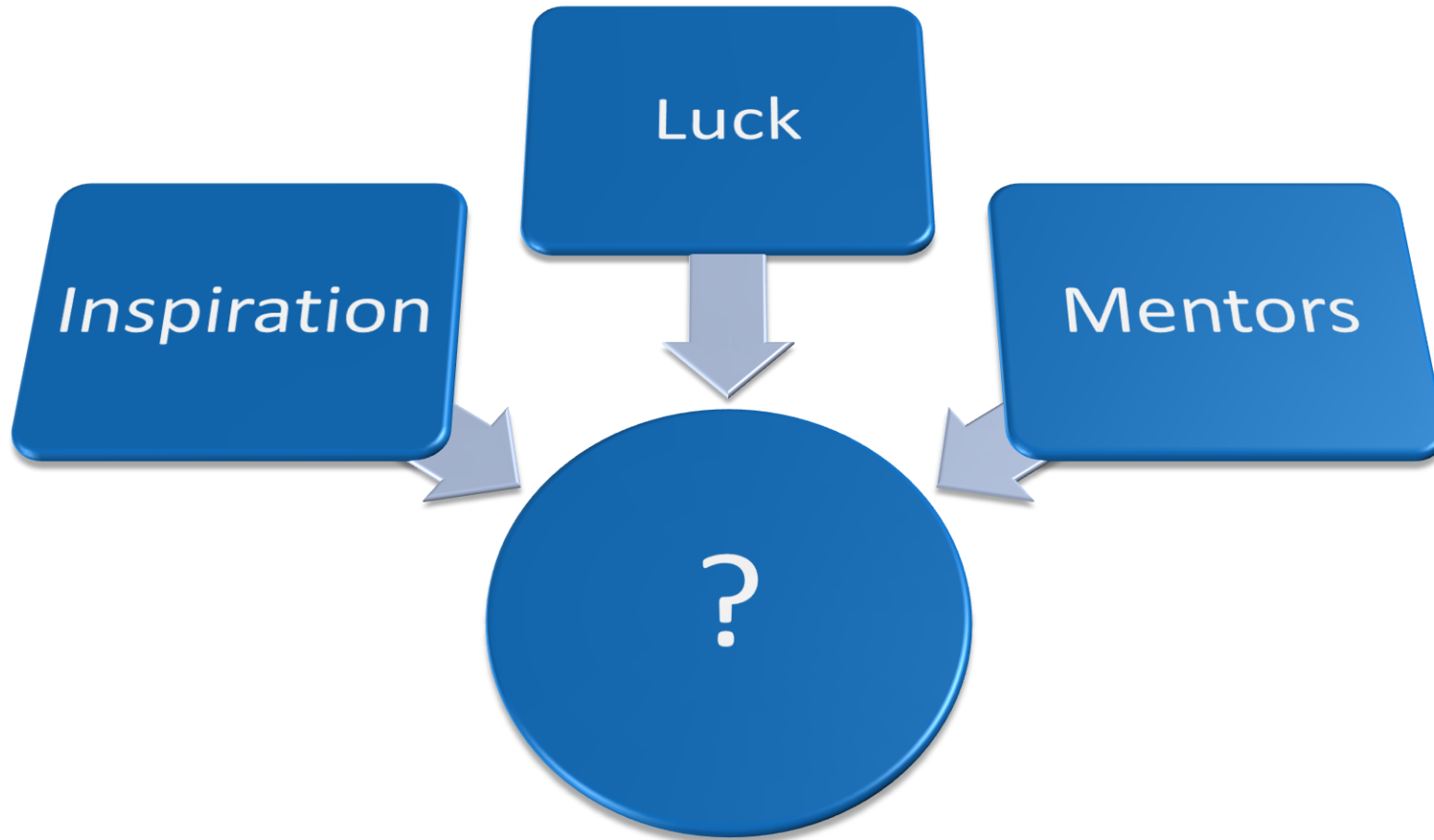


CONCLUSION

Was my hypothesis correct?







Research questions

- What is the role of NK cells in regulating macrophage-mediated adipose tissue inflammation?
- Do we prescribe too many opioids after surgery?
- What are main drivers of variations in hospital mortality rates following high risk surgery?
- Are laparoscopic simulators useful in improving technical skills amongst residents?

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Author	Year	Title	Journal	Last Updated
Ajzen, I.	1991	ACS NSQIP: Data Collection Overview		6/1/10
Ajzen, I.	1991	The Theory of Planned Behavior	Organizational Behavior and Hu...	6/1/10
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Thumbnail view of the article 'Hospital and Patient Characteristics Associated With Death After Surgery'.

Article Title: Hospital and Patient Characteristics Associated With Death After Surgery

Authors: JEFFREY H. SILBER, MD, PhD, *†; SANDEY V. WILLIAMS, MD, ‡§; HEINZ KROMKALER, MD, PhD, §; AND J. SANFORD SCHWARTZ, MD, ‡

Abstract: We asked if the factors that predict overall mortality following two common surgical procedures are different from those that predict adverse outcomes (complications during the hospitalization or death after an adverse occurrence, which we refer to as "failure to recover"). We examined 1072 Medicare patients undergoing elective orthopedic surgery at 10 teaching hospitals. Among patients in the adverse occurrence rate (number of patients who developed an adverse occurrence/number of patients at risk) and failure rate (number of deaths in patients who developed an adverse occurrence/number of patients with an adverse occurrence), the adverse occurrence rate was associated primarily with patient characteristics. In contrast, failure to recover was associated primarily with hospital characteristics. Patient characteristics associated with adverse occurrence or death. Understanding the reasons behind variation in mortality rates across hospitals should support our ability to use mortality statistics to help hospitals upgrade the quality of care. Key words: quality of care; mortality; failure rates; adverse occurrence rate (failure to recover). Med Care 1992; 30:1615-1626

Outcome measurement has become a major focus for those concerned about hospital quality of care. The most frequently used outcome measure is the death rate. Valid comparison of hospital death rates require...

FAILURE TO RECOVER

ences between hospitals or groups of hospitals, with respect to the outcome measure in question. Should the difference between two hospital failure rates have statistical significance, would the difference between those same hospitals' death rates not have statistical significance, then we would consider the failure rate to be more powerful than the death rate.

It can be shown that for equivalent adverse occurrence rates, the power to distinguish between two hospitals using the failure rate is always greater than or equal to the power using the death rate.¹ Although somewhat counterintuitive, this result occurs because, although the failure rate and the death rate use the number of adverse occurrences, the denominator of the failure rate is the total number of patients with adverse occurrences, while the denominator of the death rate is the total number of patients. A proof of the failure rate's increased power is offered in the Appendix.

When adverse occurrence rates are not equal across hospitals, the power of the failure rate statistic may be greater than, equal to, or less than that of the death rate. When comparing two hospitals with failure rates F_1 and F_2 , death rates D_1 and D_2 , and adverse occurrence rates A_1 and A_2 , it can be shown that whenever $F_1 > F_2$, $D_1 > D_2$, and $A_1 > A_2$, then the power in distinguishing such hospitals using the failure rate is greater than or equal to the power when using the death rate. For situations where $F_1 > F_2$ and $D_1 > D_2$, the sufficient conditions for superior power using the failure rate instead of the death rate is given in the Appendix. Finally, with well-known adverse occurrence rates, we performed to most hospitals where surgery is performed. We use the term "hospital" to refer to both the hospital and those physicians and staff working in the hospital.

The Model: A Dissection of the Death Rate

For a given diagnosis, the death rate (D) is defined as the ratio of the number of deaths (d) divided by the number of patients (n), or $D = d/n$. The adverse occurrence rate (A) is defined as the number of patients who develop an adverse occurrence (a) divided by the number of patients (n), or $A = a/n$. The failure rate (F) is the number of deaths in those that develop an adverse occurrence (f) divided by the number of those who develop an adverse occurrence (a), or $F = f/a$. The failure rate can be thought of as the probability that the hospital failed to recover the patient after the adverse occurrence (f does not necessarily equal a physician and can be written as the conditional probability of dying given an adverse occurrence, $f|a$). Using this notation, the overall probability of death is:

$$D = (f|a) \cdot (a) = (f|a) \cdot (a) \cdot (n) \cdot (1/n)$$

Thus, the probability of death equals the conditional probability of death given an adverse occurrence multiplied by the probability of an adverse occurrence plus the conditional probability of death given no adverse occurrence multiplied by the probability of no adverse occurrence. When most hospital deaths are prevented by adverse occurrence, they are not elective surgery, the second part of this equation contributes little to the overall probability, and therefore the death rate can be approximated by the failure rate multiplied by the adverse occurrence rate.

Comparing the Power of the Death Rate and Failure Rate

We refer to the "power" of a measure as the ability of that measure to detect differ...

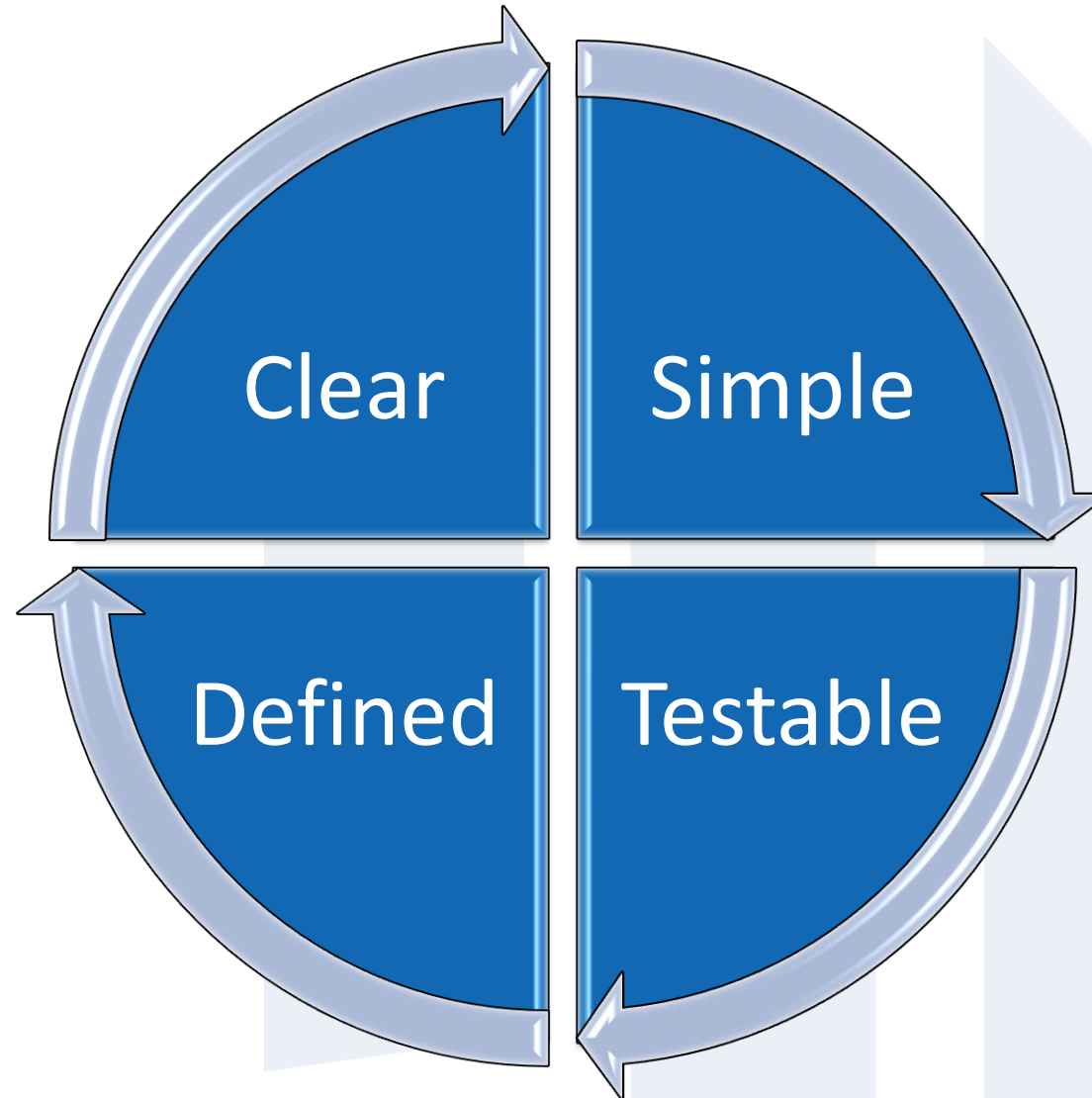




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- **Formulate a hypothesis**
- Choose a study design
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Formulate a hypothesis



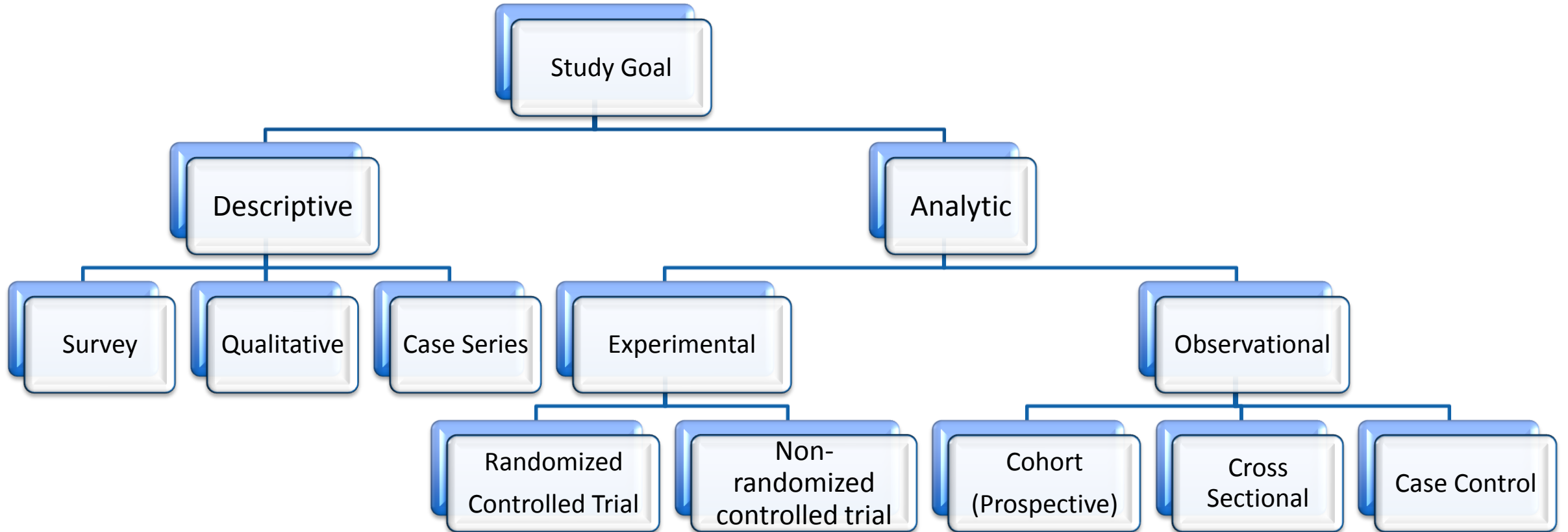
Hypotheses

- Systemic NK cell ablation attenuates intra-abdominal adipose tissue macrophage infiltration in murine obesity
- Following laparoscopic cholecystectomy, patients have >50% of their opioid pills left over
- Failure to rescue is the main driver of variation in hospital mortality after pancreatectomy
- Structured, weekly practice on laparoscopic simulators improves resident OSATS scores more than OR cases alone

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Study Types

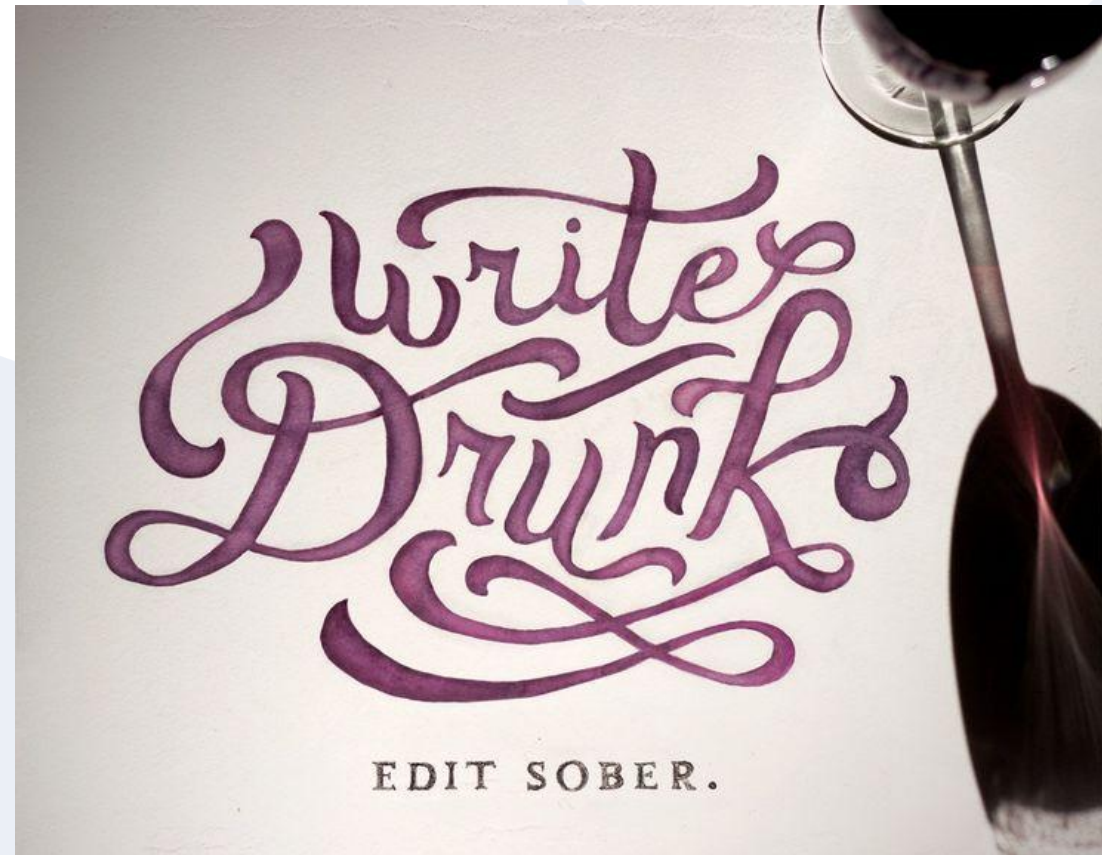


Outline

- Finding your inspiration
- Understand what's known and unknown
- Formulate a hypothesis
- Design your study
- **Write**

Write... something

- Review article
- Methods paper
- Research paper
- Pilot grant
- Large grant proposal





Summary

- Find something you are passionate about
- Ask an interesting question
- Do your research
- Run with it

What's your story?



Thank you

 [twitter](#) @AmirGhaferi

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