

Teen Pregnancy Prevention Evaluation Technical Assistance: Motivation for Bayesian Interpretation and Core Components

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Agenda

- Introduction
- Bayesian interpretation
- Components of teen pregnancy prevention (TPP) programs
- Q&A

Today's Speakers



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Senior
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Principal
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Motivation

- Primary goals of evaluation TA
- Opportunities to enhance evaluations
 - Bayesian posterior probabilities
 - Components of programs

BASIE (BAyeSian Interpretation of Estimates)

A Framework for Interpreting Research Findings



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Outline

- Today
 - *When* to use BASIE?
 - *Why* use BASIE?
- Future
 - BASIE in *theory* – components of the BASIE framework
 - BASIE in *practice* – spreadsheet tool demo

When to Use BASIE?

- You're conducting an impact evaluation
**Impact = difference in mean outcomes
between a treatment and control group**
- You've designed the evaluation, collected the data, run the regression
- Now you have an impact estimate, and you're wondering what to make of it

OR

- You're reading an evaluation report or manuscript and wondering what to make of the findings

Outline

- *When* to use BASIE?
- *Why* use BASIE?
 - Rejecting statistical significance
 - Example: The problem with the dichotomy of significance and insignificance
 - Example: Interpreting with statistical significance

Rejecting Statistical Significance

Rejecting Significance

- In 2016, the American Statistical Association released a statement on the widespread misinterpretation of p -values and statistical significance
- In 2019, *The American Statistician* released a special issue: Statistical Inference in the 21st Century: A World Beyond $p < 0.05$
- In 2019, *Nature* published a commentary with more than 800 signatories: “Scientists Rise Up Against Statistical Significance”

ASA
News

AMERICAN STATISTICAL ASSOCIATION
Promoting the Practice and Profession of Statistics

732 North Washington Street, Alexandria, VA 22314 • (703) 684-1221 • Toll Free: (888) 231-3473 • www.amstat.org • www.twitter.com/AmstatNews

AMERICAN STATISTICAL ASSOCIATION RELEASES STATEMENT ON STATISTICAL SIGNIFICANCE AND P -VALUES

*Provides Principles to Improve the Conduct and Interpretation of Quantitative
Science*
March 7, 2016

THE AMERICAN STATISTICIAN
2019, VOL. 73, NO. S1, 1–19: Editorial
<https://doi.org/10.1080/00031305.2019.1583913>

EDITORIAL

Moving to a World Beyond “ $p < 0.05$ ”

Retire statistical significance

Valentin Amrhein, Sander Greenland, Blake McShane and more than 800 signatories call for an end to hyped claims and the dismissal of possibly crucial effects.

When was the last time you heard a seminar speaker claim there was ‘no difference’ between two groups because the difference was ‘statistically non-significant’?

If your experience matches ours, there’s a good chance that this happened at the last talk you attended. We hope that at least someone in the audience was perplexed if, as frequently happens, a plot or table showed that there actually was a difference.

How do statistics so often lead scientists to deny differences that those not educated in statistics can plainly see? For several generations, researchers have been warned that a statistically non-significant result does not ‘prove’ the null hypothesis (the hypothesis that there is no difference between groups or no effect of a treatment on some measured outcome)¹. Nor do statistically significant results ‘prove’ some other hypothesis. Such misconceptions have famously warped the

literature with overstated claims and, less famously, led to claims of conflicts between studies where none exists.

We have some proposals to keep scientists from falling prey to these misconceptions.

PERVASIVE PROBLEM

Let’s be clear about what must stop: we should never conclude there is ‘no difference’ or ‘no association’ just because a P -value is larger than a threshold such as 0.05 ▶







Why Reject Significance?

- Statistical significance leads to overconfidence in our conclusions
 - $p < 0.05$ – Eureka! It works!
 - $p > 0.05$ – Despair! It failed!
- Statistical significance does not necessarily equal substantive significance—impact size matters
- $p < 0.05$ contributes to replication crisis
 - Publication bias
 - p -hacking and data mining
- Findings from small studies are especially hard to interpret using statistical significance

Example:
**The Problem with the Dichotomy of
Significance and Insignificance**

Place Your Bets

Sunday, Nov. 7

		ELO POINT SPREAD	WIN PROB.	SCORE
	Falcons		26%	
	Saints	-7	74%	
	Bills	-12.5	86%	
	Jaguars		14%	
	Browns		41%	
	Bengals	-2.5	59%	

BASIE (BAyeSian Interpretation of Estimates)

- BASIE is a framework for interpreting impact estimates
- BASIE uses Bayes rule and prior evidence to calculate the probability an intervention was effective
- BASIE is a framework based on off-the-shelf components—nothing methodologically new
- We gave BASIE a distinct name to set it apart from the much larger, and sometimes controversial, world of Bayesian statistics
- BASIE is targeted and tailored, defined as much by what it is *not* as by what it is

Example: interpreting with statistical significance

- Hypothetical evaluation of intervention called *Play it Safe!*

Outcome	Impact estimate	Standard error	p-value
Intention to have sex without condoms	-0.18	0.10	0.07
Positive STI test	-0.08	0.11	0.47

- “Evaluation finds no impact of *Play it Safe!*”
 - Even though the intervention was well implemented, the estimated impacts were statistically insignificant

Example: interpreting with BASIE

Outcome	Impact estimate	Standard error	Probability that the true effect is:			
			> 0.05	< 0	< -0.05	< -0.10
Intention to have sex without condoms	-0.18	0.10	2	90	71	44
Positive STI test	-0.08	0.11	12	69	43	19

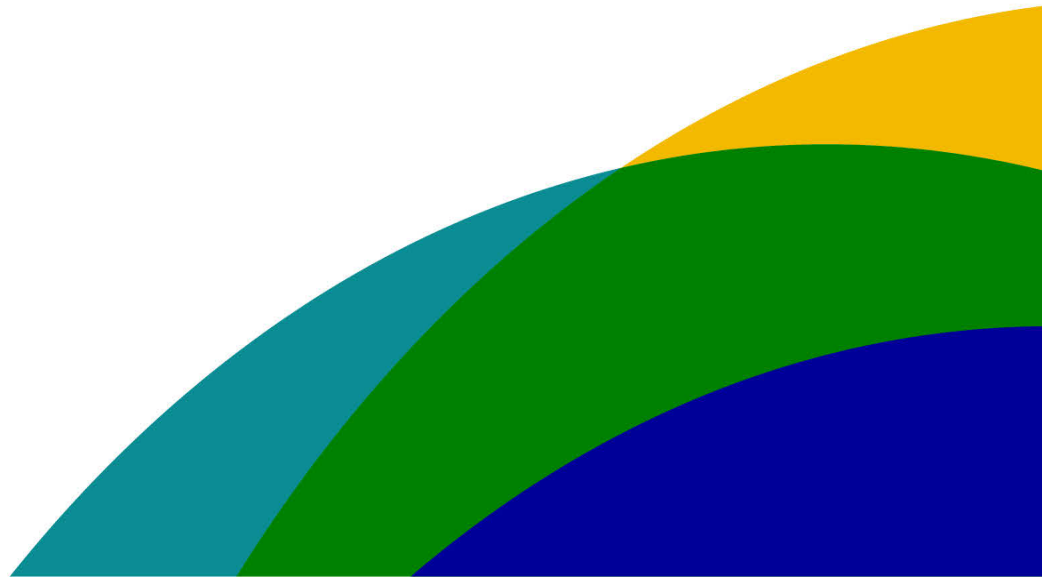
- “Evaluation finds 90 percent chance *Play it Safe!* reduces intention to have sex without condoms”
 - Strong implementation may explain why there is also an 71 percent chance that the program reduced intention to have sex without condoms by at least 0.05 standard deviations
 - There was also a 69 percent chance of lower rates of positive STI tests, though any effect was likely small

Program Components



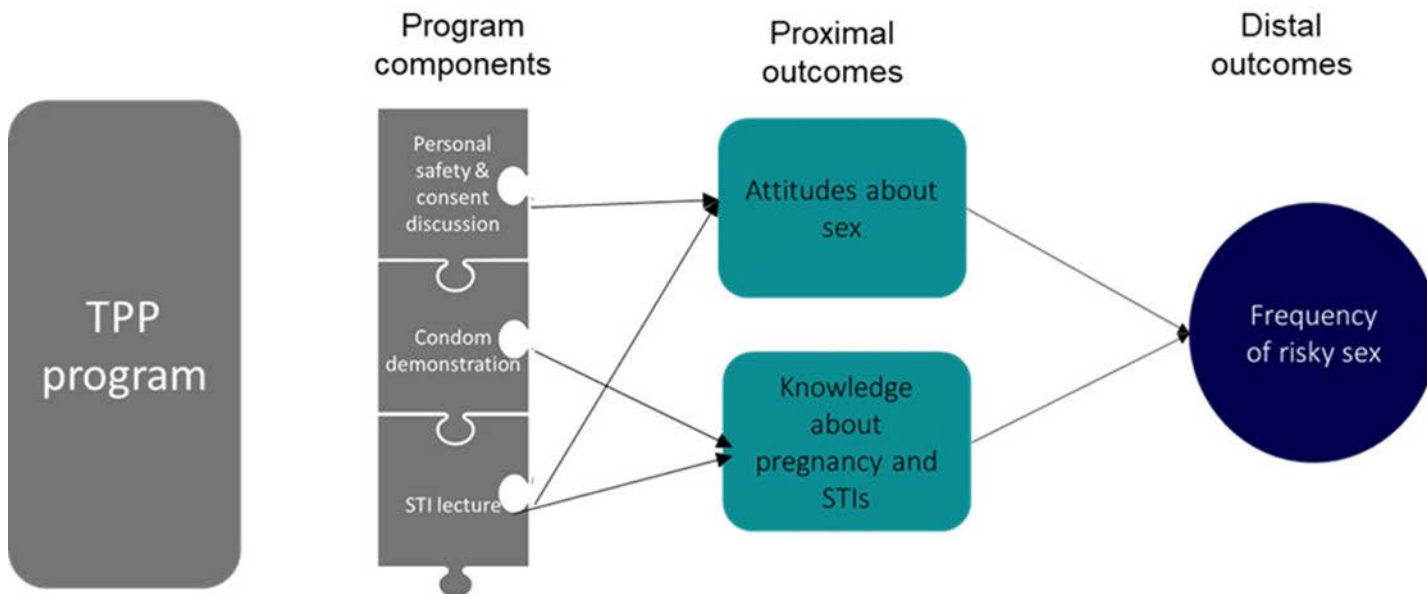
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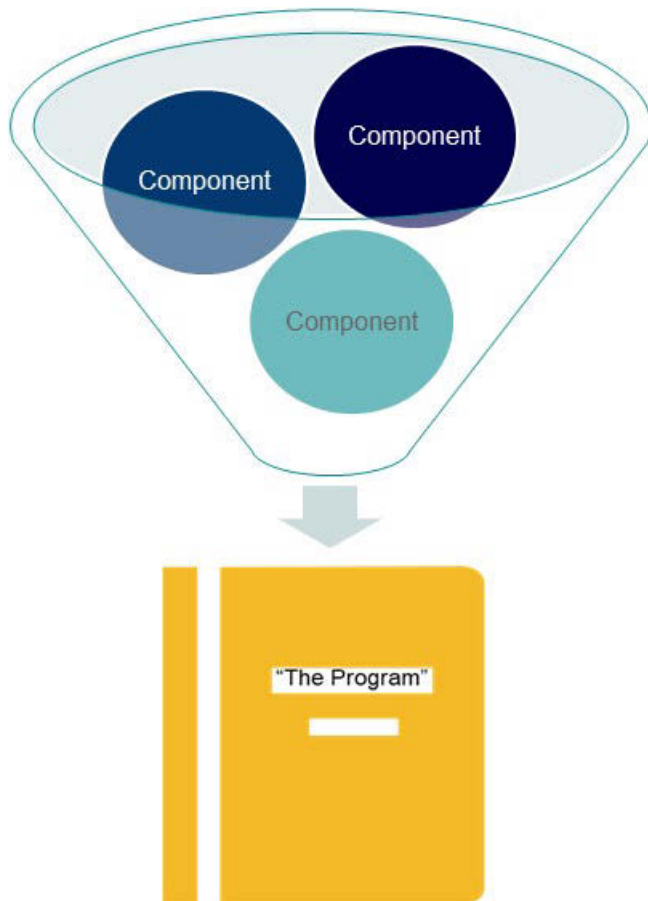


What is a Component Analysis?

- Traditional impact evaluations assess the effects of the whole program
- Component analysis is a way to learn about the smaller pieces of the program—or *components*.

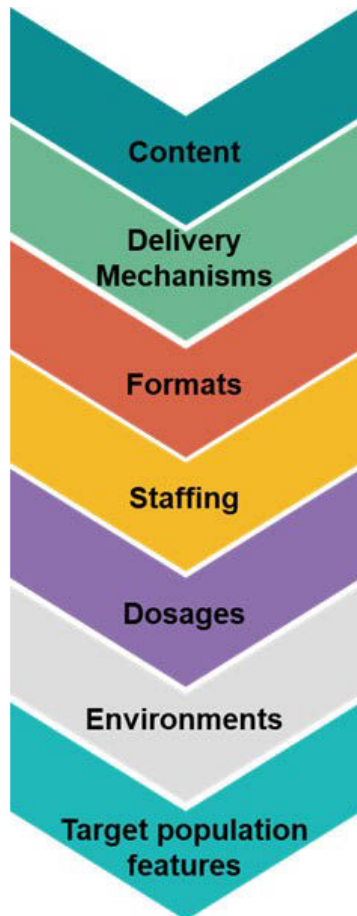


What are Program Components?



- The “ingredients” of a program
- Often defined in a manual or other program documentation

Types of Program Components (1)



Youth experience

The intended subject matter being provided

The intended mechanisms by which the content is provided

The intended formats of the content being delivered

The intended training and characteristics of the individuals delivering content

The intended duration of the program

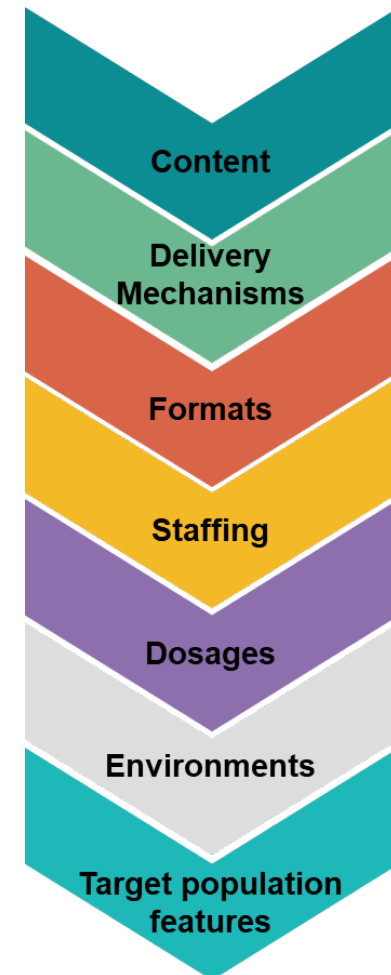
The intended settings or locations where the program occurs

The intended features of the target population receiving programming

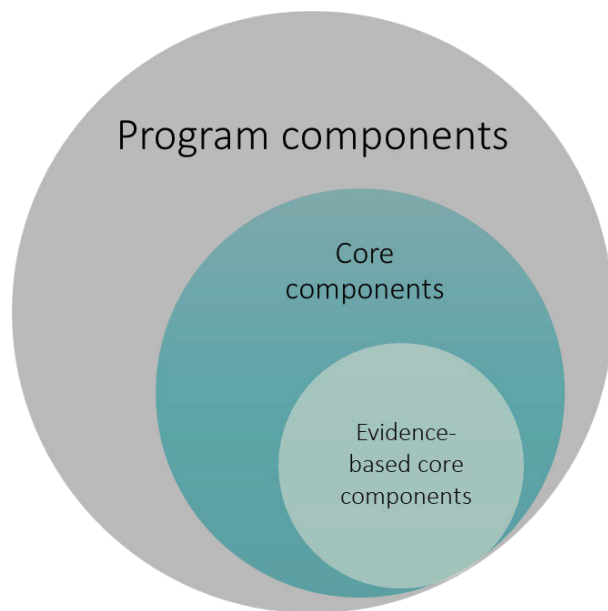
Types of Program Components (2)

- Combinations of program components describe how a program is meant to be implemented

A 20-minute, small group activity with high school students during health class featuring a discussion about communication in healthy relationships



What are Core Components?



- These **core components** are hypothesized to be drivers of program effects, but we don't have the evidence to prove this yet
- Rigorous effectiveness evaluation—one way to produce evidence about which core components affect outcomes
 - **For studies in process, we can disaggregate programs into their components and produce preliminary evidence**
- Doing this will help us learn which program components are **evidence based**
- Doing this again and again, across programs, may help us make changes that improve programs and deepen their impacts

Benefits of Components

- Detailed descriptions of programs for multiple audiences/
purposes
 - More effective communication of logic model drivers
 - Clarity of effective contrast
 - Comparing components across programs
- Answering additional research questions, beyond
effectiveness of program as a whole
 - Naturally occurring variation in components can produce
variation in outcomes

Illustrative Program Description

Content

- Goal setting
- Consent
- Healthy relationships
- Contraception—condoms
- STI prevention
- ...

Delivery mechanism

- Lecture
- Demonstration
- Role play/practice
- ...

Dosage

- 8 1-hr classroom sessions
- ...

Staffing

- Health educator
- Developer training
- ...

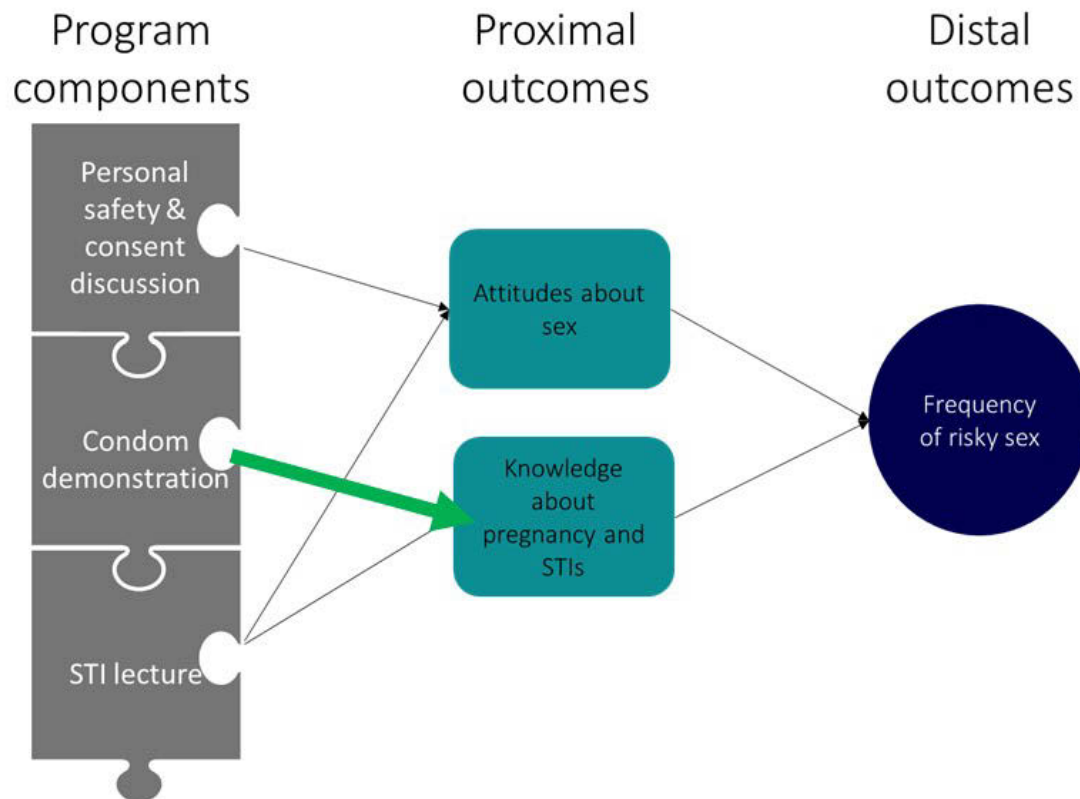
Format

- Full-group activity
- Small-group activity
- In person
- ...

Environment

- High school health class
- ...

Illustrative Component Finding



“Individuals who attended the condom demonstration lesson had scores on the pregnancy and STI knowledge scale that were 11 percentage points higher than those who did not attend that lesson ($p = .02$).”

Future Webinar About Component Analysis

- We will introduce three resources for your use:
 - FAQ
 - Components Checklist
 - Checklist Instructions
- We will also discuss
 - Approaches to summarize components of your program for reports/articles
 - Analytic approaches for linking variation in components to variation in outcomes

How to Prepare for Future Component Work

- Hypothesize which components of your program are core
- Develop logic models that link components to outcomes
- Collect implementation data on these components, with the ability to link them to outcomes
- Plan to attend a future webinar 😊



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Q & A

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Resources

- Bayesian interpretation
 - [Moving Beyond Statistical Significance: The BASIE \(BAyeSian Interpretation of Estimates\) Framework for Interpreting Findings from Impact Evaluations](#)
- Components
 - [Structural Elements of an Intervention](#)
 - [Understanding How Components of an Intervention Can Influence Outcomes](#)