

# What Do Survey Data Really Mean? Considering Issues of Causality and Temporality in Survey Research

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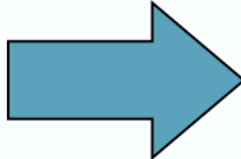
# Theoretical Mechanisms

- Why test theoretically-based factors and theories of health behavior?
- Ultimately, our interest is in causal mechanisms for behavior change
- What *causes* someone to start flossing (more often), brush their teeth (more often), start visiting the dentist regularly, etc.
- If we understand causal mechanisms, we can develop interventions to change behavior through those mechanisms
- These mechanisms are sometimes referred to as “mediators” of behavior change

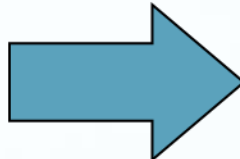


# Mediators of Behavior Change

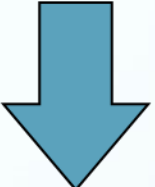
**Behavioral Intervention**



**Change in Mediators**



**Behavior Change**



**Reduce Disease, Improve QOL**

*Active Ingredients*



# But How?



*How do we discover causal mechanisms?*



# Why Survey Research?

- Most common approach is survey research.  
Why?
- We can assess theoretical factors & behaviors that are not readily observable
- We can robustly measure theoretical constructs
- It's feasible and cost-effective to implement, especially with new technologies
- We can achieve high external validity



# Cautions

1. This approach will *not* tell us 100% of what we want to know
  2. This approach *could* be misleading at times
  3. This approach will be strengthened to the extent that we can *combine it with other approaches*
- *For now, let's think about how to use this approach most effectively*



# Common Application

- Cross-sectional survey of a variety of factors that may be associated with preventive dental visitation behavior among young adults
  - Example: Application of Expanded Theory of Planned Behavior
- Assessed behavior - dental visitation in past year
- Conducted multivariate analysis
- Variables most strongly associated with visitation included: *injunctive norms, perceived behavioral control, environmental constraints*



# Common Misconceptions

- Significant variables “predicted” dental visitation (association, not causation)
- Changing these factors in an intervention will lead to changes in the behavior (we have not demonstrated this and can't be sure this will occur)
- These factors led to behavior (causality & temporality)



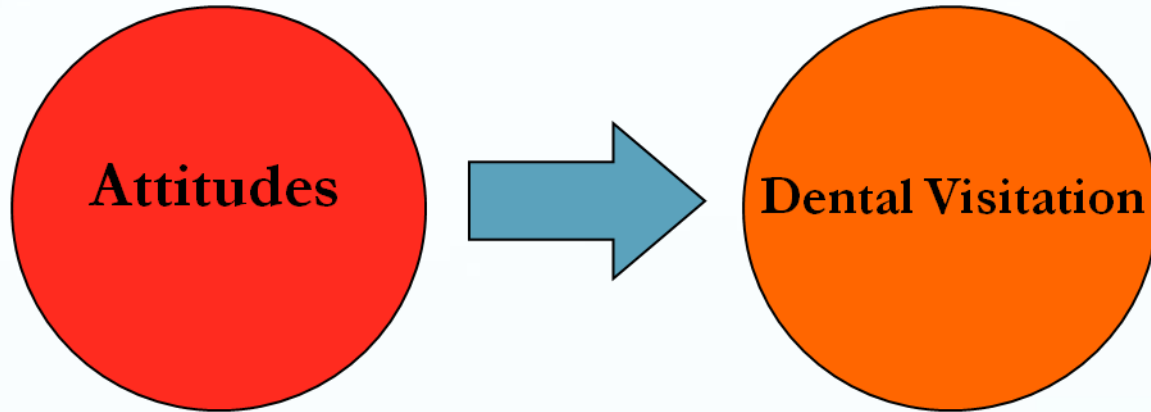


# Temporality

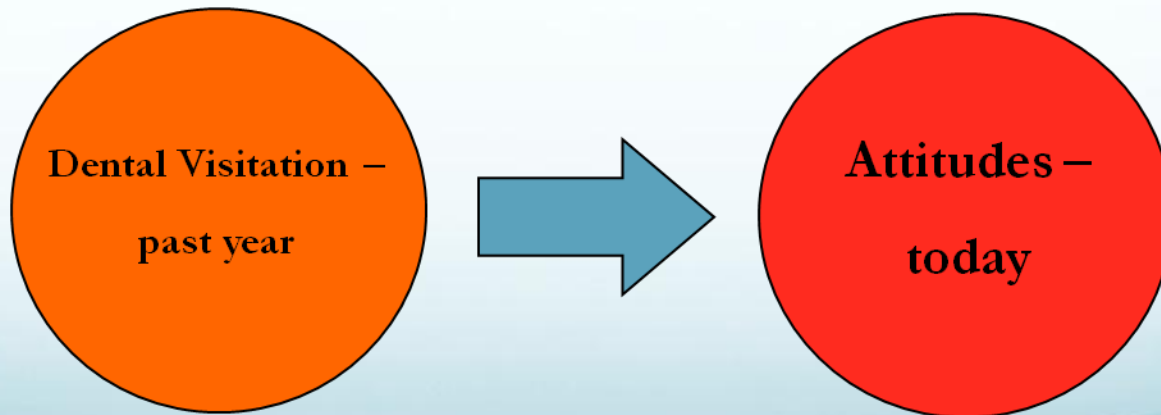
- Behavior measured over the past 1 year
- Visit satisfaction, provider communication, measured with regard to “last visit”
- Attitudes, injunctive norms, perceived behavioral control measured today
- Dental fear measured in the future
- Varying time periods may mean added “noise” in study
- *Implication: Be thoughtful about time periods assessed in survey research.*



# Hypothesis



# Measurement



# Really?

Lets think about this:

*How could our attitudes about dental visitation today have led to our visit to the dentist 1 year ago?*

*Caution: Attitudes today being used as a proxy for past attitudes*

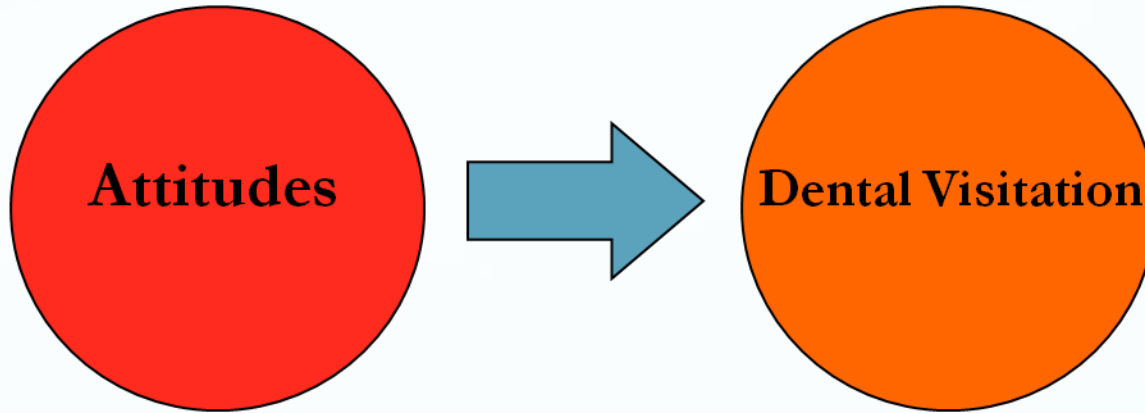


# Longitudinal Surveys

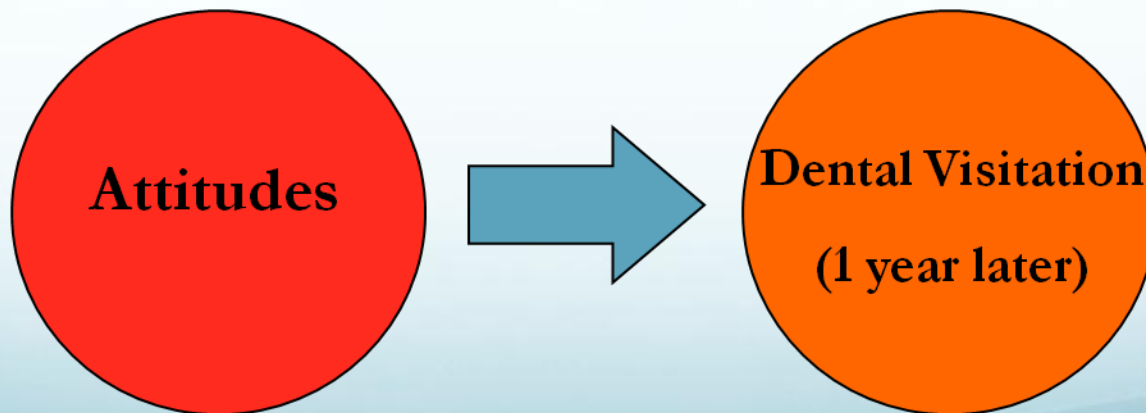
- Rather than a single point in time, assess person at multiple points in time
- Focus on prospective associations as opposed to retrospective associations
- Measure key variables at Time 1; 1 year later, measure behavior (Time 2).
- Temporality
  - Improved – key variables measured before behavior takes place
  - Still not “perfect” – long time lag before behavior; time lags vary for each individual



# Hypothesis



# Measurement



# Causation

- Even if temporality was “perfect,” we would not have demonstrated causality
- No guarantee that factors associated with behavior actually cause behavior
- Association is necessary, but not sufficient, to demonstrate causation
- Both theoretical factor (e.g., attitudes) and behavior could be caused by a third factor (i.e., spurious relationship)
- *Implication: Cross-sectional & longitudinal survey research, by itself, cannot determine causal mechanisms*

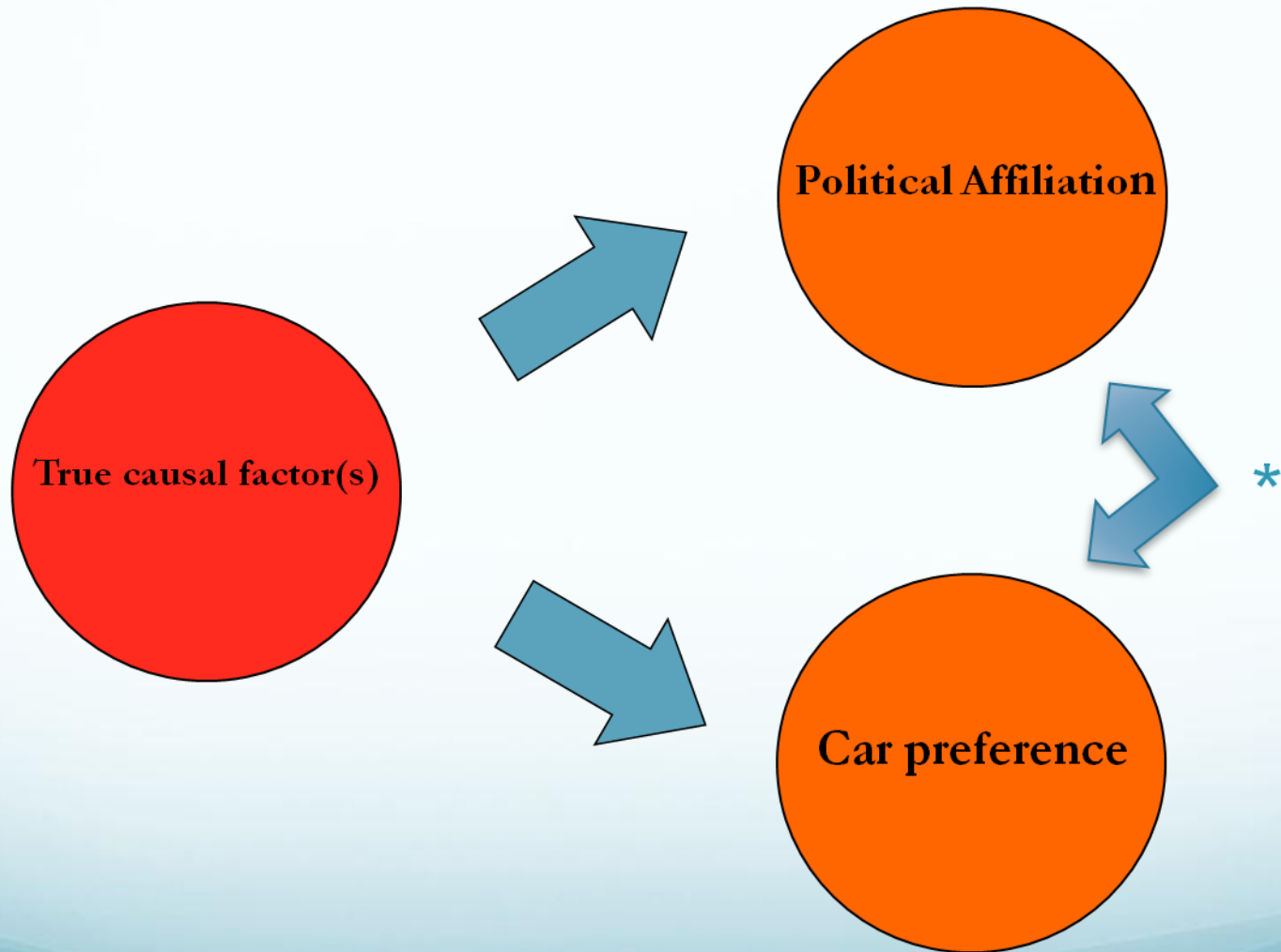


# Cars and Political Affiliation

- A concrete example
- Research demonstrates that car preference is associated with political affiliation\*
- Democrats: Volvo, Subaru, Hyundai, mini-vans, hybrids
- Republican: American cars, Porsche, Jaguar, Land Rover
- *Your car causes you to vote a particular way? Or political affiliation causes you to buy a particular car?*
- Demographic, cultural, socioeconomic explanations

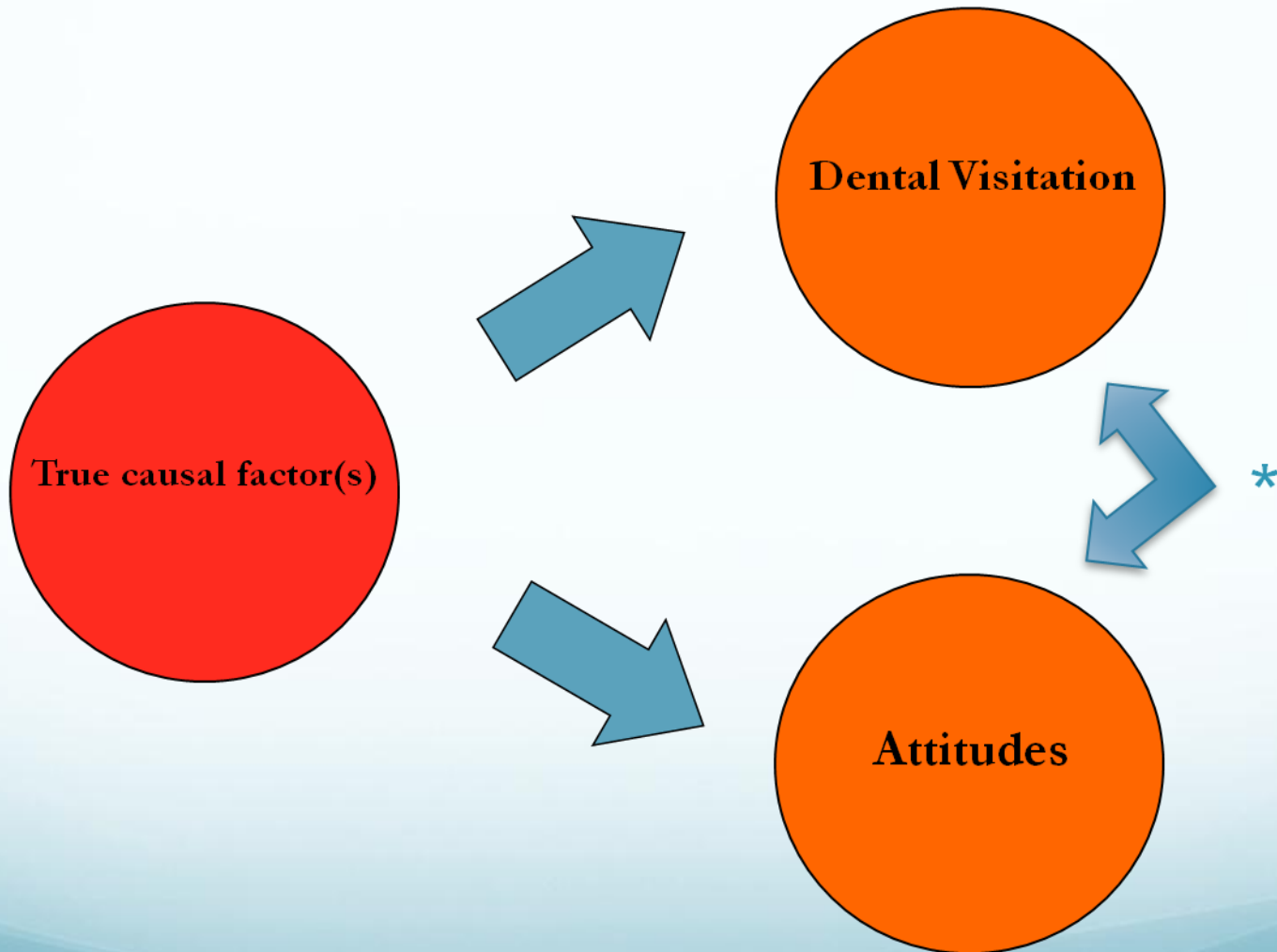


# Spurious Relationship





# Spurious Relationship



# Causation Requirements

1. Theoretically plausible mechanism by which causation operates: *yes*
2. Association of variables: *yes*
3. Ruling out extraneous variables: *we can try, but can't be certain we've ruled them all out or that statistical controls are enough*
4. Demonstrating that one variable causally preceded the other: *often difficult or impossible*



# Causation

*“[correlational designs] refer to situations in which a presumed cause and effect are identified and measured... many commentators doubt the potential of such designs to support strong causal inferences in most cases.”*  
*(Shadish, Cook, & Campbell, 2002, p.18)*



# Other Considerations

- Association of presumed theoretical mediator with behavior often interpreted as *effect* on behavior, but behavior also affects mediator
  - Behavioral performance affects attitudes – dynamic interplay
  - We change our attitudes to fit our behavior (rationalizing)
  - This may especially be a problem in cross-sectional research



# Survey Research

- *This approach will not tell us 100% of what we want to know*
  - Can demonstrate association, *not* causation
- *This approach could be misleading at times*
  - May lead us to think a particular variable plays a causal role when it does not; temporality and measurement affect this



# Survey Research (cont'd)

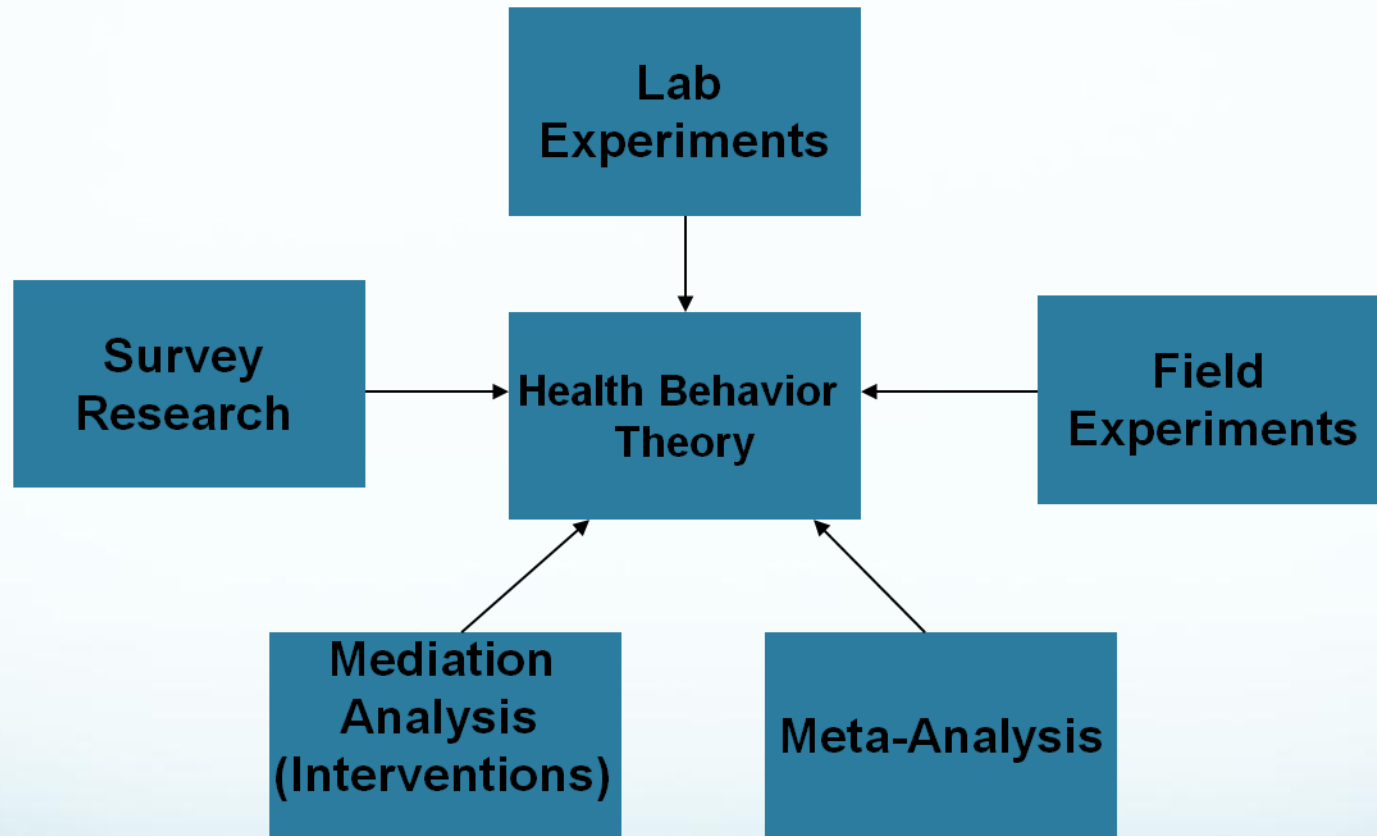
- *This approach will be strengthened to the extent that we can combine it with other approaches*
  - Experiments
  - Quasi-experiments
  - Mediation analysis



# Traditional Paradigm



# New Paradigm



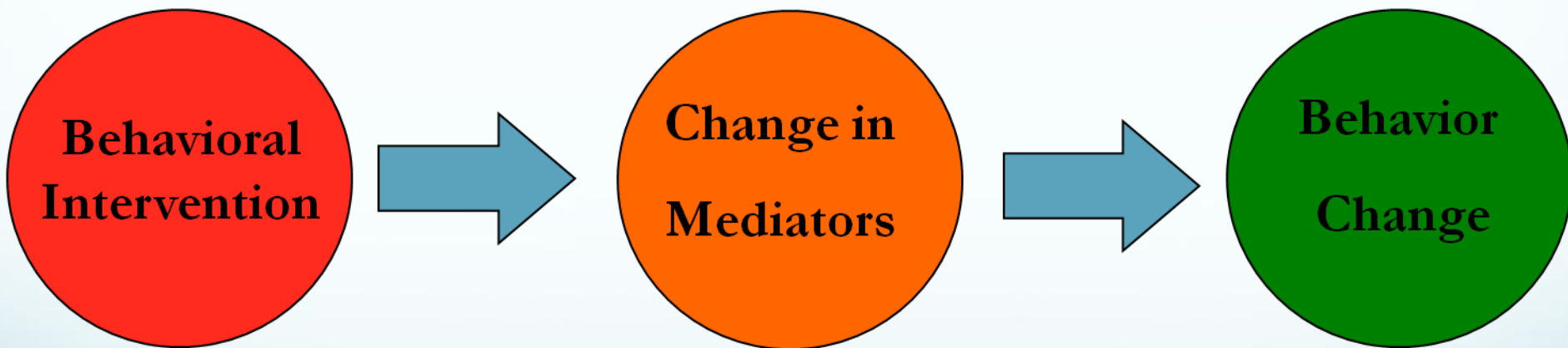
Noar, S. M., & Mehtrotra, P. (2011). Toward a new methodological paradigm for testing theories of health behavior and health behavior change. *Patient Education & Counseling*, 82(3), 468-474.





# Mediation Analysis

*Is change in the behavior the result of change in one or more mediators?*



# Conclusion

- Neither cross-sectional nor longitudinal survey research can definitively determine causal mechanisms
- So why do it?
- Association *is* one of the requirements for causation
- In most cases, it will be better for ruling causal factors out than for definitively ruling them in
- Whether cross sectional or longitudinal, survey design and temporal dimensions of measures should be carefully thought out



Thank you!

