



Association.

You keep using that word.

I do not think it means what you think it means.

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Why do I think this is important?

(supervillain origin story)

- I'll admit, I was triggered!
- We owe it to the people we're trying to help

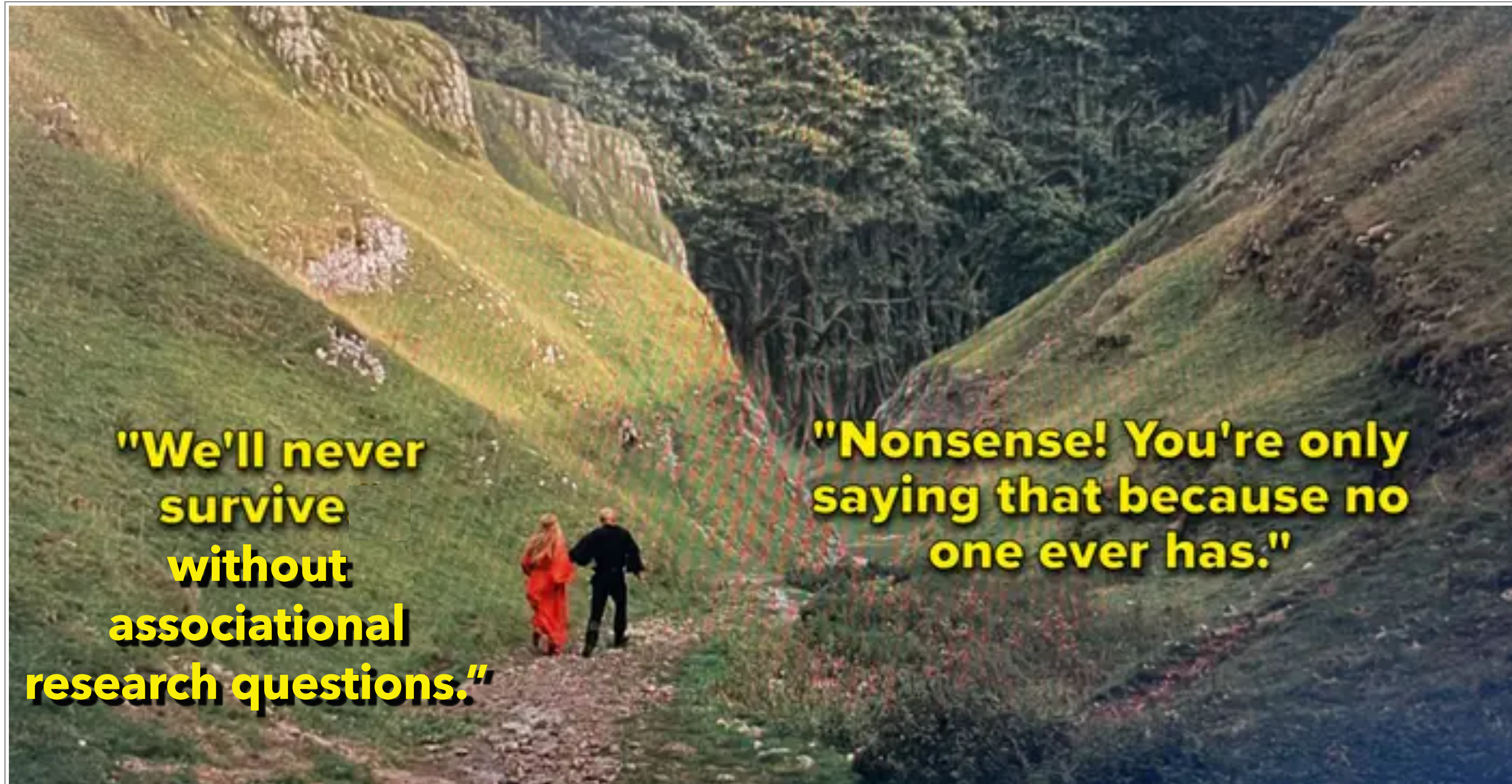


Conclusions:

“Association” is very often used in contexts where it is nonsensical.

We should move quickly to change this.





"We'll never survive without associational research questions."

"Nonsense! You're only saying that because no one ever has."

Inconceivable!

All in April 2026:

IJE:

unclear in general populations. We aimed to assess the associations between low-level prenatal lead exposure and neonatal anthropometric outcomes, and to investigate sex-specific susceptibility.

BMJ:

Objective: To examine the association between prenatal exposure to benzodiazepines or Z-hypnotics and a spectrum of psychiatric disorders in children.

JECH:

Conclusion: Socioeconomic disadvantage has a significant impact on mental health, particularly among lower educational levels. These associations are partly mediated by modifiable behavioural and socioeconomic factors, underscoring the need for targeted prenatal interventions in populations with low SES.

IJE:

African populations, yet their relationship remains understudied. We examined the association between acute-phase reactants (C-reactive protein and ferritin) as markers of acute and chronic inflammation and the incidence of CKD 6 years later in a prospective Ghanaian population-based cohort.

Epidemiology:

Association of Maternal Gestational Diabetes Mellitus with Infant Visual Acuity Development

Abstract

Backgrounds: The impact of maternal gestational diabetes mellitus (GDM) and its glycemic subtypes on the early visual development of infants remains unclear.

Total Sample

Study Goal

Semantic sleepwalking

	No.	%
Clearly descriptive	2	2
Seemingly causal ^e	71	69
Clearly causal	13	13
Clearly predictive	2	2
Goal unclear	15	15
Total	103	100

1. Which association is 'the' association?

2. How do you conduct 'associational' research?

3. Are associations evidence for causation?



Objectives

To investigate the association between maternal prescription opioid and antidepressant medication exposures for co-occurring mental health and acute pain management, either alone or in combination, and sPTB.

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To investigate **the association** between maternal prescription opioid and antidepressant medication exposures for co-occurring mental health and acute pain management, either alone or in combination, and sPTB.

Can I be specific about the association?

Abstract

1. Your objective states what you're going to adjust for

- **Objective:** To investigate the association between maternal prescription opioid and antidepressant use and spontaneous preterm birth *adjusted for marital status, education level, pre-pregnancy BMI, year of delivery, parity, and a giant list of maternal comorbidities.*

2. But only later does it say how the adjustment variables were chosen...

- **Methods:** Based on literature review and clinical expertise, we identified and measured relevant socio-demographic characteristics, comorbid conditions and known preterm birth risk factors considered as potential confounders between medication use during pregnancy and spontaneous preterm birth.

Problem 1:

Objectives shouldn't be based on the methods.

Your methods should be based on your objective.

Can I be specific about the association?

Abstract

- **Objective:** To investigate the association between maternal prescription opioid and antidepressant use and spontaneous preterm birth *adjusted for marital status, education level, pre-pregnancy BMI, year of delivery, parity, and a giant list of maternal comorbidities*
- **Discussion:** We estimated the association between maternal prescription opioid and antidepressant use and spontaneous preterm birth *adjusted for marital status, education level, pre-pregnancy BMI, year of delivery, parity, and a giant list of maternal comorbidities*

Problem 2: There's no room for bias!

Phrase	What it refers to
Causal effect	The true, unobservable causal effect
Association (or other non-causal terms)	The relationship between two variables without any reference to causal assumptions
Estimated causal effect	The estimated association in conjunction with causal assumptions

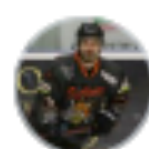
How and when to use causal and associational language

Jeremy A Labrecque,¹ Katrina L Kezios^{2,3}

Deciding which concepts should be described in causal language and which should not

is meant by our research questions, how can we be expected to provide clear answers?

What associations are and how they arise



Jeremy Labrecque 🇨🇦 @jeremylabrecque.bsky.social · now

Clearly most causal analyses are quite biased. I propose that people asking causal questions should not be able to use causal language in their manuscripts. They must replace it with non-causal language (e.g. association).

Jeremy Labrecque 🇨🇦 @jeremylabrecque.bsky.social · 5d

Clearly most predictive models are not very good at predicting. I propose that people asking predictive questions should not be able to use the word prediction in their manuscripts. They must replace it with non-predictive language (e.g. association).



Maarten van Smeden @maartenvsmeden.bsky.social · 6d

Five years ago @laurewynants.bsky.social and I started this living review. Within 1 year we reviewed >700 prediction models for COVID and we found many to be poor and decided to stop reviewing. Many external validation studies followed confirming many indeed were poor

www.bmj.com/content/369/...

RESEARCH

OPEN ACCESS

Check for updates

FAST TRACK

Prediction models for diagnosis and prognosis of covid-19: systematic review and critical appraisal

Laure Wynants,^{1,2} Ben Van Calster,^{2,3} Gary S Collins,^{4,5} Richard D Riley,⁶ Georg Heinze,⁷ Ewoud Schuit,^{8,9} Elena Albu,² Banafsheh Arshi,¹ Vanesa Bellou,¹⁰ Marc M J Bonten,^{8,11} Darren L Dahly,^{12,13} Johanna A Damen,^{8,9} Thomas P A Debray,^{8,14} Valentijn M T de Jong,^{8,9} Maarten De Vos,^{2,15} Paula Dhiman,^{4,5} Joie Ensor,⁶ Shan Gao,⁷ Maria C Haller,^{7,16} Michael O Harhay,^{17,18} Liesbet Henckaerts,^{19,20} Pauline Heus,^{8,9} Jeroen Hoogland,⁸ Mohammed Hudda,²¹ Kevin Jenniskens,^{8,9} Michael Kammer,^{7,22} Nina Kreuzberger,²³ Anna Lohmann,²⁴ Brooke Levis,⁶ Kim Luijken,²⁴ Jie Ma,³ Glen P Martin,²⁵ David J McLernon,²⁶ Constanza L Andaur Navarro,^{8,9} Johannes B Reitsma,^{8,9} Jamie C Sergeant,^{27,28} Chunhu Shi,²⁹ Nicole Skoetz,²² Luc J M Smits,¹ Kym I E Snell,⁶ Matthew Sperrin,³⁰ René Spijker,^{8,9,31} Ewout W Steyerberg,³ Toshihiko Takada,^{8,32} Ioanna Tzoulaki,^{10,33} Sander M J van Kuijk,²⁴ Bas C T van Bussel,^{1,35} Iwan C C van der Horst,³⁵ Kelly Reeve,³⁶ Florian S van Royen,⁸ Jan Y Verbakel,^{37,38} Christine Wallisch,^{7,39,40} Jack Wilkinson,²⁴ Robert Wolff,⁴¹ Lotty Hooft,^{8,9} Karel G M Moons,^{8,9} Maarten van Smeden⁸

March 7, 2025 at 10:49 AM Everybody can reply [↗](#)

1 like



What about descriptive studies?

- Descriptive questions can use the word association but...
- The word association is cursed

- **Unclear:** "Here we analyzed the association of educational level with mortality in a nationally representative cohort."
- **Descriptive:** "Our aim is to see whether people with different education levels experience different risks of mortality."
- **Causal:** "Our aim is to see whether education level affects the risk of mortality."

1. Which association is 'the' association?

2. How do you conduct 'associational' research?

3. Are associations evidence for causation?



“Associational research”

*“But I’m not doing causal research, I’m doing
association research”*

1. Which association is 'the' association?
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- **Some consensus**

- There are only descriptive, predictive, causal questions
- But around 2/3 of articles frame their question as “associational”

- **Two possibilities:**

1. Associational questions are a different category and the 3 question framework must be amended.
2. Associational questions fall under one or more existing categories and should be restated in those terms

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	Descriptive	Predictive	Causal
<i>Estimand</i>	$\Pr[Y=1 E=\text{high}]-\Pr[Y=1 E=\text{low}]$	$\Pr[Y=1 L]$	$\Pr[Y^{a=1}=1]-\Pr[Y^{a=0}=1]$
<i>Estimator</i>	Many	Many	Many
<i>Assumptions</i>	No selection bias or measurement error	Don't ask me, I don't really do prediction	Consistency, positivity, conditional exchangeability, no measurement error, well-specified models
<i>Covariate selection</i>	Admissibility	N/A	To satisfy conditional exchangeability
<i>Interpretation</i>	The difference in risk between high and low education groups	The predicted risk given prediction model	The causal effect of A on Y
<i>Bias</i>	The difference between the estimated difference and the true difference	The difference between the predicted and the true risk	The difference between the estimated and true causal effect

Descriptive

Causal

Associational

 Assumptions

No selection bias
No measurement error

Consistency
Positivity
Conditional exchangeability
No measurement error
Well-specified models

?

Covariate selection

Select covariates (if necessary) implied by estimand (permissibility)

Select covariates to satisfy conditional exchangeability

?

Verdict?

- My opinion: there is no way to fill in the "Associational" column
- Therefore, associational research is not its own category and questions should be restated to fall into one of the other categories

Crucially important implication

- If your "associational" question is actually:
 - **descriptive:** use the appropriate descriptive methods.
 - **causal:** use causal inference

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A does not cause Y

A causes Y

**All confounding
controlled**

A-Y not associated

A-Y associated

**Uncontrolled
confounding**

A-Y associated

A-Y associated

An association, by itself, is not evidence for someone else to do a causal study.

The best way to create evidence for a future causal study is it to do the best causal study with the data you have at hand.

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If you can't answer these questions, you shouldn't use associational language in your research question.

1. Which association is 'the' association?
2. How do you conduct 'associational' research?
3. Are associations evidence for causation?

The ball is in
your court non-causal
language journal editors!!



Aren't you worried about people
over interpreting their results?

How I hope things will change

- No journal should allow associational research questions unless clearly descriptive
- Research questions clearly fall into a descriptive/predictive/causal category
- **This is not just about language.** If you discover that you're doing causal inference. You need causal expertise.
- Put more effort into making arguments for/against causal assumptions

Why isn't there more take up of causal inference?



Jeremy Labrecque

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Causal inference courses: here's how you estimate causal effects and these are the assumptions you rely on and by the way the assumptions are always violated kthxbye

1:30 PM · Apr 21, 2026  Everybody can reply 

- The assumptions are of the form:

- $Y^a \perp A | L$

- **But we need to connect these assumptions to substantive knowledge!**

- **How can we best leverage substantive knowledge!**

A final thought

- Estimate of the effect of loneliness on CVD: RR 1.15 (1.04-1.27)
- “While we took measures to reduce concerns about reverse causation (e.g. removing people with CVD at baseline), **unmeasured confounding remains possible.**”
- These two statements are consistent with RR 0- ∞
- How do you conclude anything about this study?
- This is where causal inference can prove its worth!

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I would love to hear from you!!

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• Kezios KL. Is the Way Forward to Step Back? Documenting the Frequency With Which Study Goals Are Misaligned With Study Methods and Interpretations in the Epidemiologic Literature. *Epidemiol Rev.* 2022;43(1):4-18. doi: 10.1093/epirev/mxab008.

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