



PNGAus Partnership



Navigating the maze of causality: understanding the relationship between carcinogenic betel nut consumption and learning outcomes

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AES Conference
September 19th, 2024



Objectives

Explore real-world challenges of understanding causality using a case study from Papua New Guinea

Practice designing evaluations in fragile settings











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Call free o text:
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DATE: TODAY IS TUESDAY 30th OF JULY 2019 TERM 3 WEEK 3 SPELLING WORDS

STRAND: ENGLISH ①  S _ _ _

S/STRAND: WRITING: ②  S _ _ _

TOPIC: M/LETTERS ③  S _ _ _ _

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11:30 AM
Sun
Star
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KYCIT

Original Investigation | [Published: 28 May 2016](#)

Spatial short-term memory is impaired in dependent betel quid chewers

[Meng-Chun Chiu](#), [Bin Shen](#), [Shuo-Heng Li](#) & [Ming-Chou Ho](#) 

Psychopharmacology **233**, 2925–2932 (2016) | [Cite this article](#)

250 Accesses | 5 Altmetric | [Metrics](#)

Betel quid chewing alters functional connectivity in frontal and default networks: A resting-state fMRI study

[Xiaojun Huang](#)¹, [Zhening Liu](#)^{1,2}, [Tumbwene E Mwansisya](#)³, [Weidan Pu](#)⁴, [Li Zhou](#)¹, [Chang Liu](#)¹, [Xudong Chen](#)¹, [Robert Rohrbaugh](#)⁵, [Carla Marienfeld](#)⁵, [Zhimin Xue](#)¹, [Haihong Liu](#)⁶

Affiliations + expand

PMID: 27227967 DOI: [10.1002/jmri.25322](#)

> [Front Psychiatry](#). 2017 Aug 3;8:139. doi: [10.3389/fpsy.2017.00139](#). eCollection 2017.

Altered Gray-Matter Volumes Associated With Betel Quid Dependence

[Fulai Yuan](#)¹, [Lingyu Kong](#)², [Xueling Zhu](#)^{2,3}, [Canhua Jiang](#)⁴, [Changyun Fang](#)⁴, [Weihua Liao](#)²

Affiliations + expand

PMID: 28824470 PMCID: [PMC5540953](#) DOI: [10.3389/fpsy.2017.00139](#)

[Free PMC article](#)

Executive function deficit in betel-quid-dependent chewers: Mediating role of prefrontal cortical thickness

[Xueling Zhu](#)¹, [Shaohui Liu](#)², [Weihua Liao](#)¹, [Lingyu Kong](#)¹, [Canhua Jiang](#)³, [Fulai Yuan](#)²

Affiliations + expand

PMID: 30379118 DOI: [10.1177/0269881118806299](#)

Reduced Cortical Thickness in the Right Caudal Middle Frontal Is Associated With Symptom Severity in Betel Quid-Dependent Chewers

[Adellah Sariah](#)^{1,2}, [Weidan Pu](#)³, [Zhimin Xue](#)¹, [Zhening Liu](#)¹, [Xiaojun Huang](#)¹

Affiliations + expand

PMID: 32754064 PMCID: [PMC7366340](#) DOI: [10.3389/fpsy.2020.00654](#)

[Free PMC article](#)

Original Articles

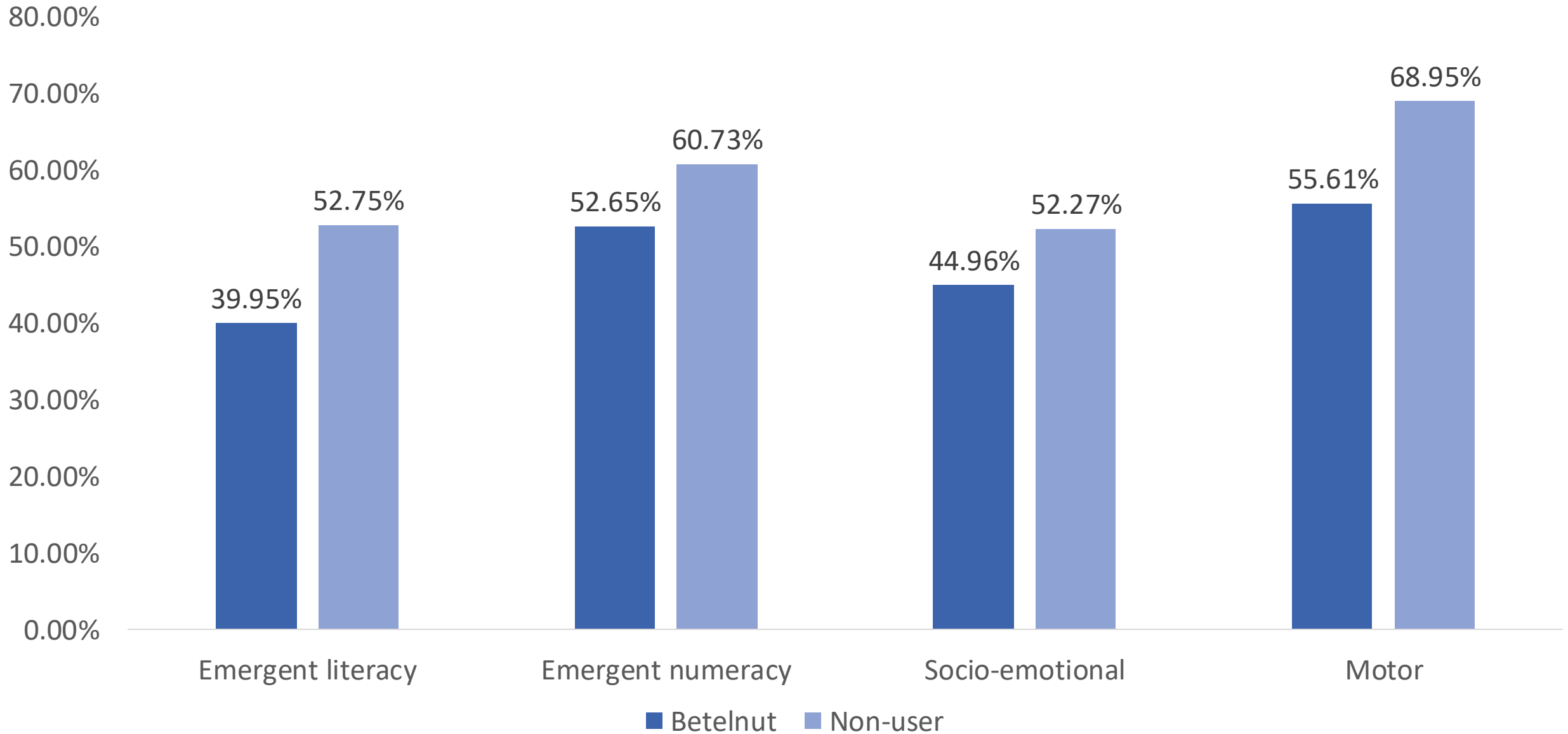
Betel Quid Chewing, Personality and Mood: Betel Quid Chewing Associated with Low Extraversion and Negative Mood

[Hsin-Yi Yen](#), [Ping-Ho Chen](#), [Ying-Chin Ko](#), [Shih-Kuang Chiang](#), [Yevwon Yi-Chi Chang](#) & [Yung-Jong Shiah](#) 

Pages 1782-1787 | Published online: 08 Feb 2018

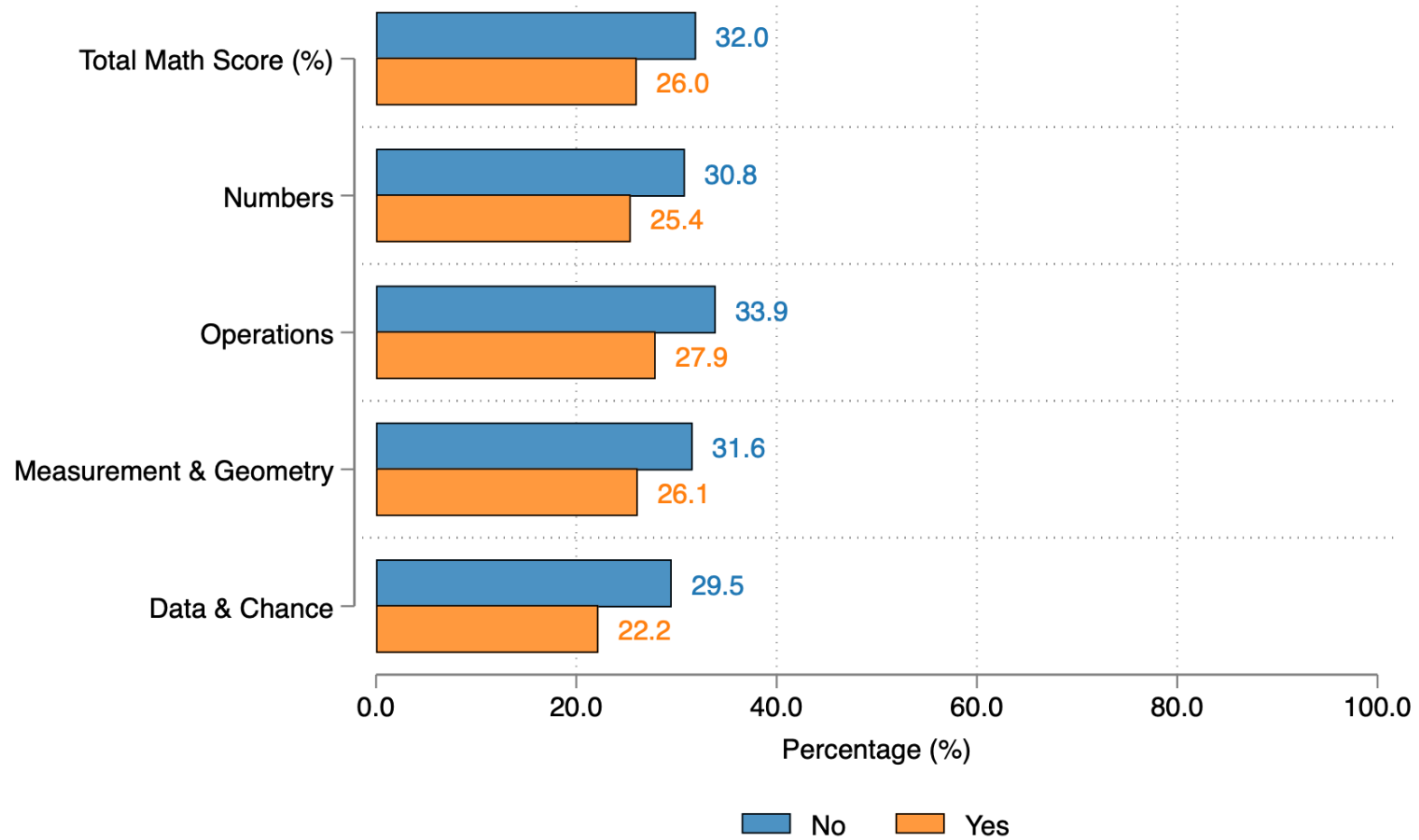
IDELA Scores for users and non-users in early childhood education centers

n = 900





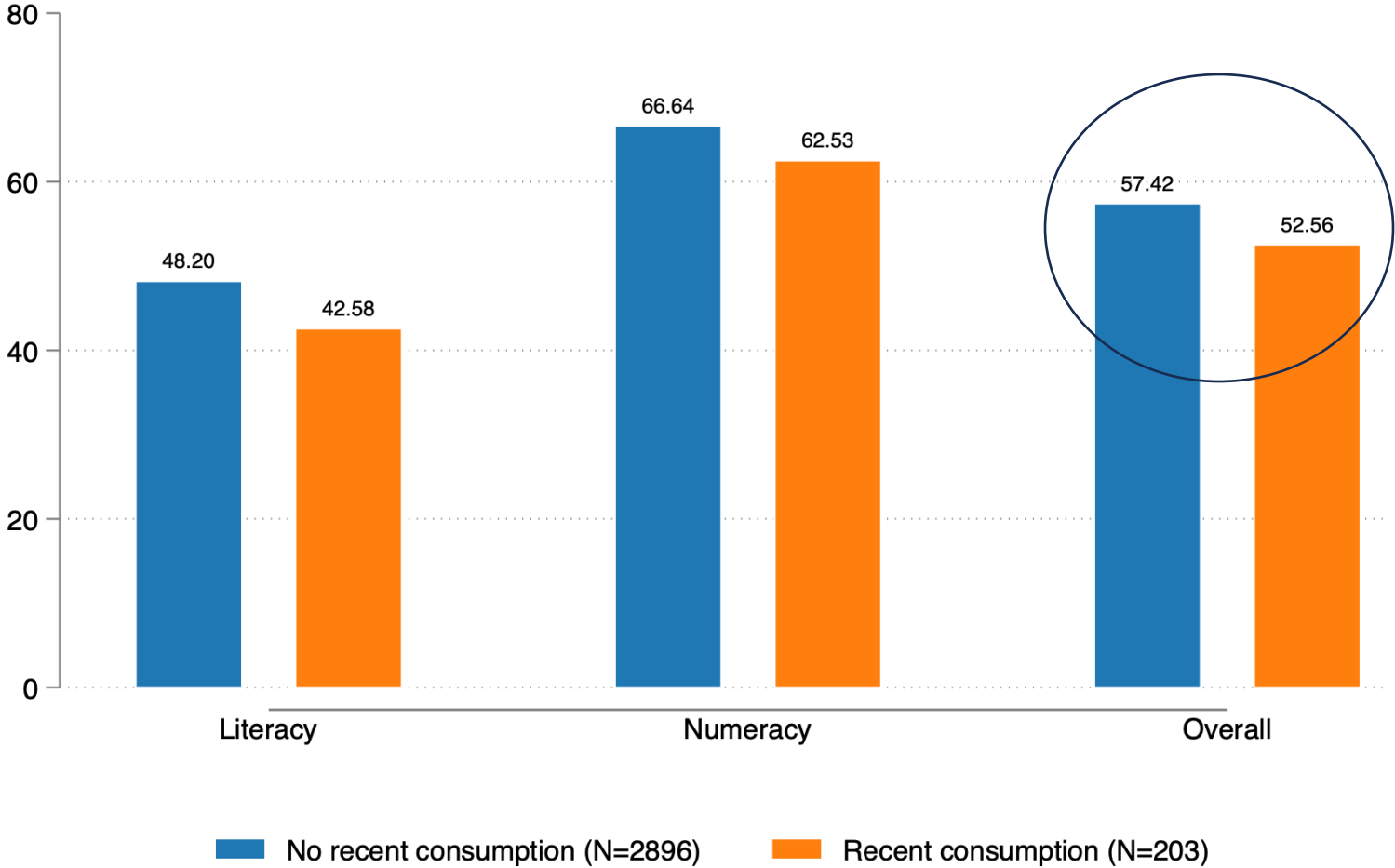
Average Performance in Grade 5 PILNA by Betel Nut Consumption Status (n = 2272)



Statistically significant difference in overall student performance (5 percentage points)

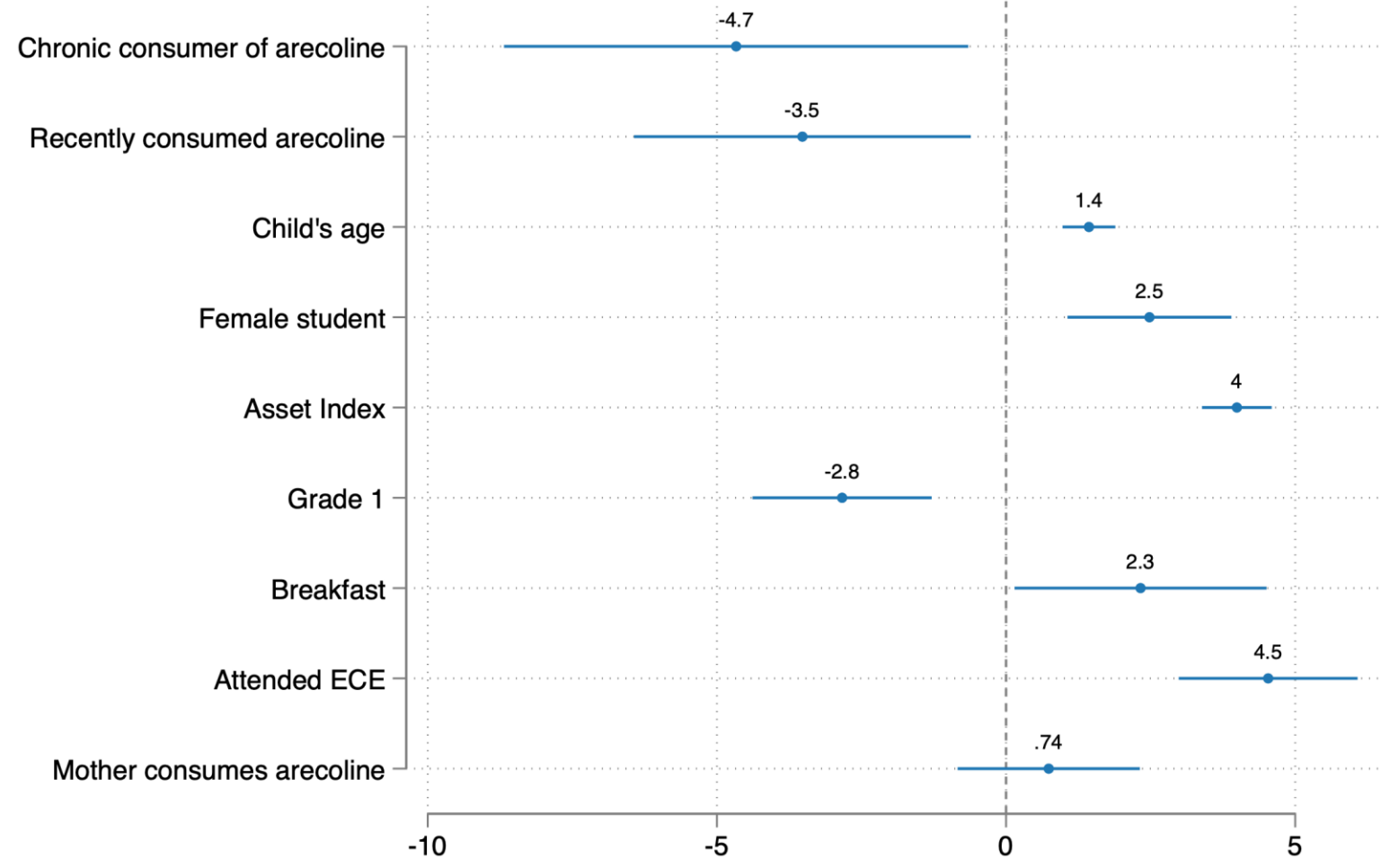


Student Performance by Arecoline Consumption Status (N = 3099 elementary students)





Variables associated with student performance



Controlling for age, sex, family wealth, grade, breakfast, ECE status and mother's chewing status and province level fixed effects, a student who was a chronic consumer of arecoline scored 4.7 percentage points lower on the assessment while a student who was under the influence of arecoline on the the day of the assessment scored 3.5 percentage points lower. These findings are statistically significant using the standard 95% confidence interval.

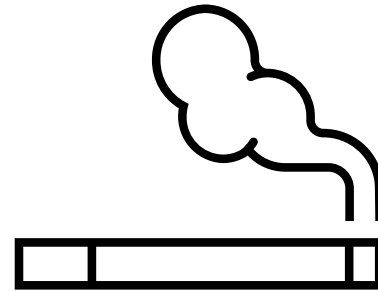


But is this causal?



What are some of the challenges with the multi-level models/ multi-variate analysis?

And why can't we simply do an RCT?





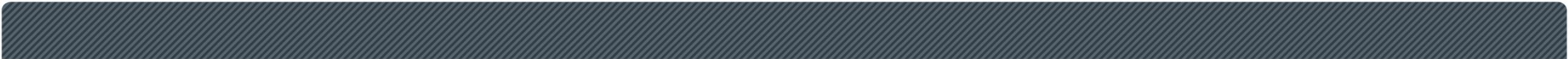
Group Activity: Pitch an Evaluation Design

Scenario: Betel nut consumption in Papua New Guinea may affect learning outcomes. Design an evaluation that measures this causal relationship.





Time to hear the pitches..!



Let's look at some examples (and why they may not work!)

Propensity Score Matching (PSM)

Match children who chew betel nut with similar children (in terms of age, socioeconomic status, etc.) who don't. Then compare their school attendance to estimate the effect of betel nut consumption.



Difference-in-Differences (DiD)

A province bans betel nut consumption, while a neighbouring province doesn't. You compare changes in school attendance rates between the two provinces before and after the ban to estimate the effect of betel nut on education.



Instrumental Variables (IV)

Distance from betel nut markets is used as an instrument. Children living farther from markets are less likely to consume betel nut, allowing you to estimate its impact on their school performance.



Natural Experiments

A sudden betel nut shortage in one region due to bad weather reduces consumption. You compare school outcomes in that region to unaffected regions to estimate the impact of betel nut consumption.






Key takeaways

- Causality is extremely tricky to establish, especially in fragile and complex environments.
- When RCTs are unfeasible, alternative methods like DiD, IV, and PSM are potentially powerful tools but not without drawbacks.
- Ethics should always guide the design of evaluations, particularly in vulnerable communities.

Understanding causal relationships is useful for informed and ethical policy-making!





Australian High Commission

Papua New Guinea



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