EXPLORING CORE COMPONENTS RESEARCH IN SOCIAL SERVICES SETTINGS | OCTOBER 2020

ANALYZING CORE COMPONENTS

MAKING RESEARCH RELEVANT

Joshua R. Polanin, Ph.D.
Principal Researcher
American Institutes for Research

AMERICAN INSTITUTES FOR RESEARCH® | AIR.ORG

Copyright © 2020 American Institutes for Research®. All rights reserved.

AIR®

A Guiding Philosophy for Core Component (All?) Analyses

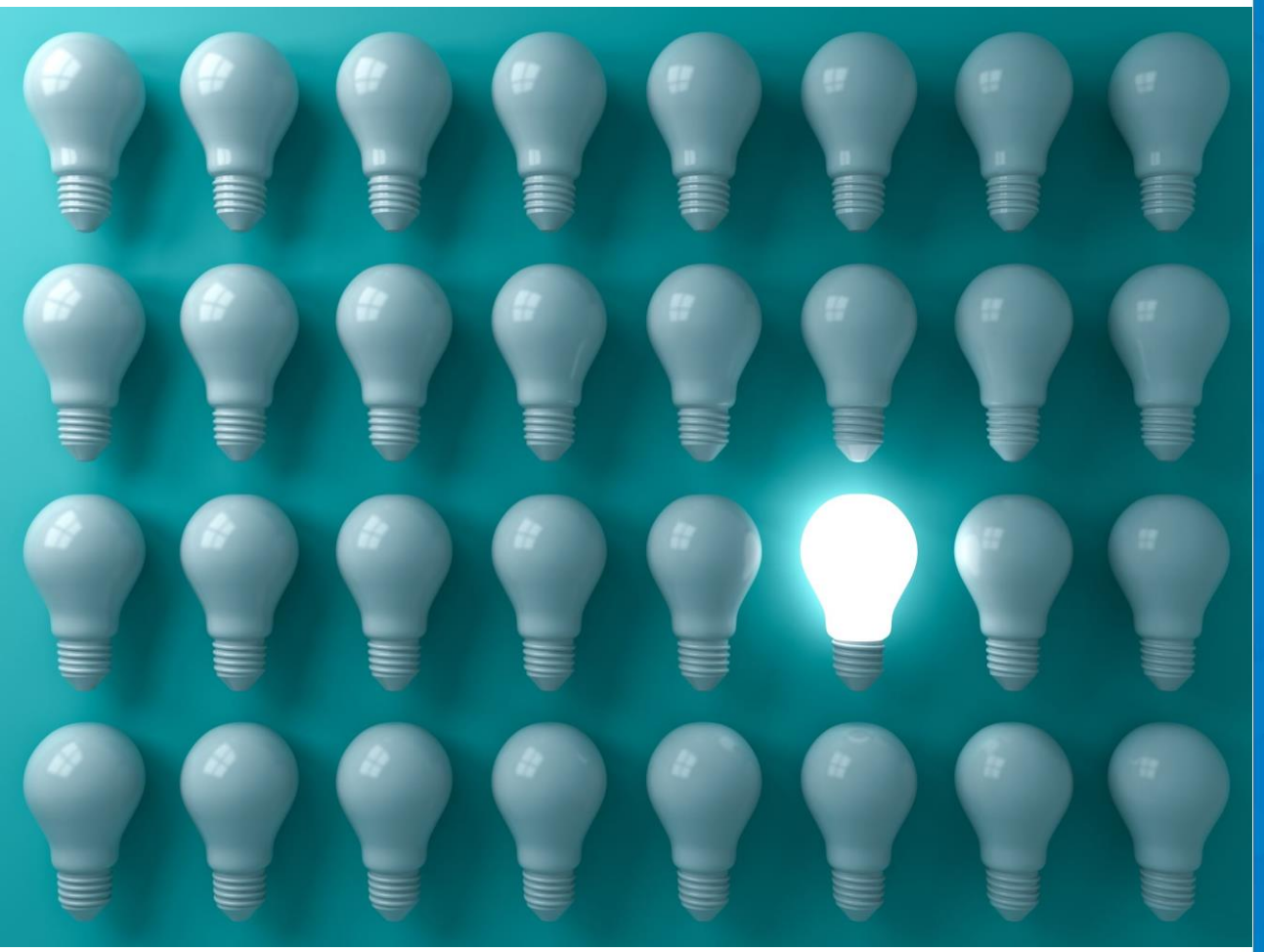
Before Analyzing Core Components, Let's Ask…

- What's the project's purpose?
- Who's the project's audience?
- How will the project's results be used?

What Types of Research Questions are Appropriate?

Example Research Questions

- Do the intervention's core components explain differences in effect sizes?
- What is the relation between the intervention's core components and a study's effect size?
- What types of programs would the meta-analysis predict to have the largest effects?



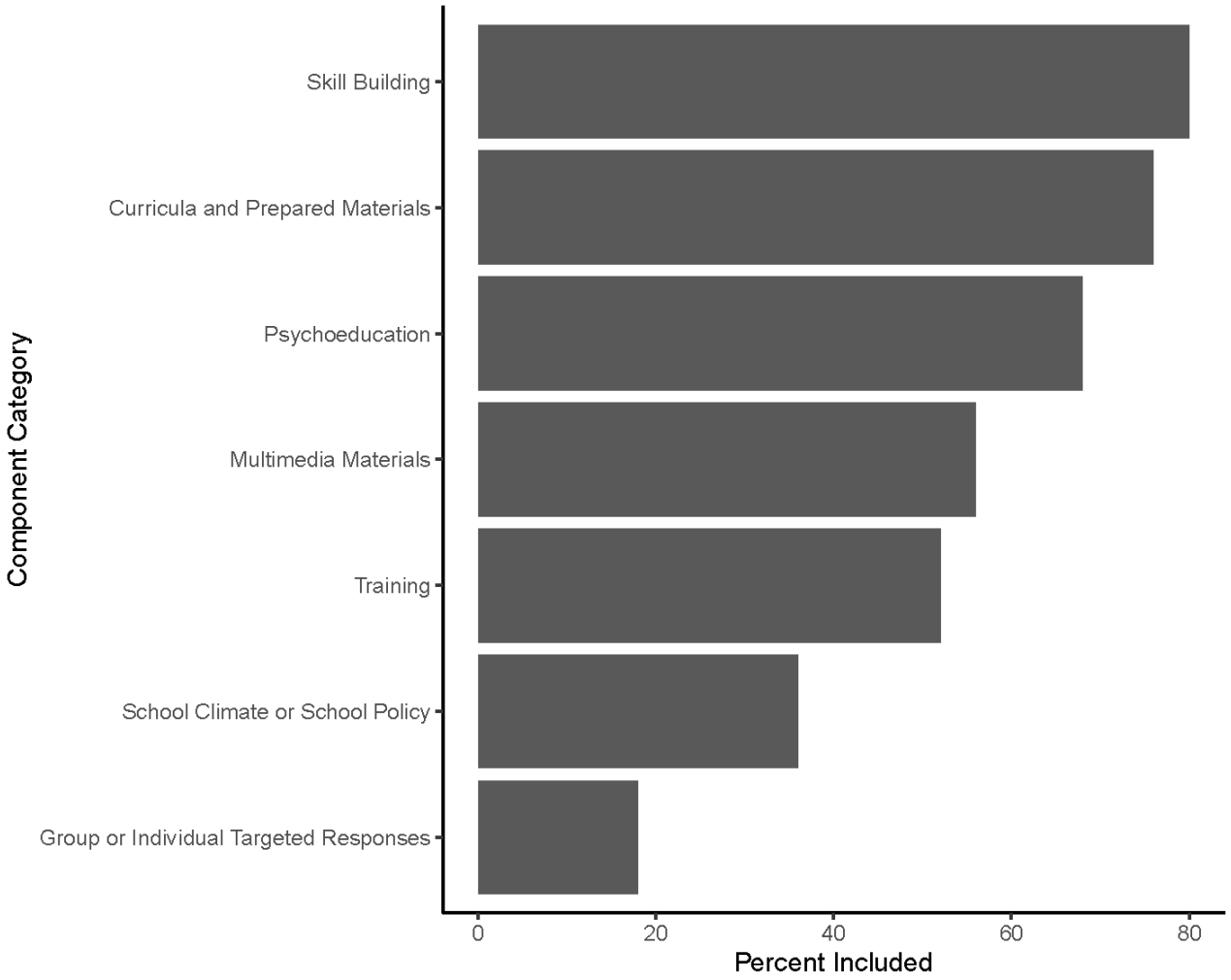
Outline

- Descriptive Analysis
  - The Basics: What and How Often
  - Evidence Gap Map
- Inferential Analysis
  - “ANOVA-like” Analyses
  - Meta-Regression Analyses

Descriptive Analysis

What Was Used & How Often Was It Used?

- Using systematic review results to their fullest potential
- If it's relevant and coded, report it!
- Ask: What will inform the field? How will knowing this information help future practitioners, policymakers, or funders?



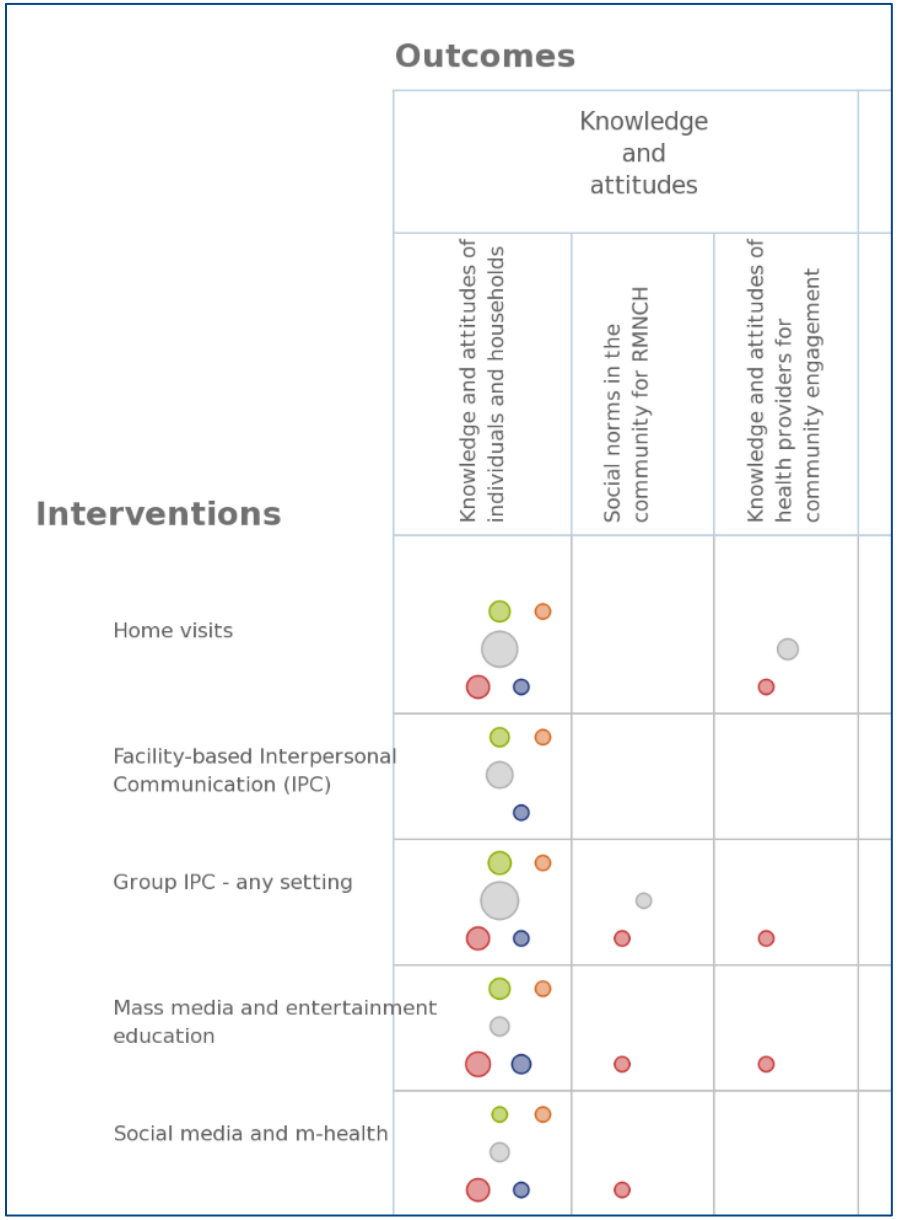
Polanin et al. (*Under Review*). A systematic review and meta-analysis of interventions to decrease cyberbullying perpetration and victimization. *Prevention Science*.

Example

Table 3 Intervention characteristics

Characteristic	N (%)	Characteristic	N (%)
Settings		Number of treatment sessions	
School	13 (54.2)	0–50	3 (12.5)
Community-based organization	5 (20.8)	51–100	3 (12.5)
Mixed	3 (12.5)	101–150	7 (29.2)
Unsure	3 (12.5)	151 and greater	4 (16.7)
Program focus		Unsure	7 (29.2)
Academic	3 (12.5)	Length of sessions	
Non-academic	7 (29.2)	1–1.59 h	4 (16.7)
Mixed	10 (41.7)	2–2.59 h	4 (16.7)
Unsure	4 (16.7)	3–3.59 h	10 (41.7)
Manual used for intervention		4 h and greater	3 (12.5)
No	10 (41.7)	Unsure	3 (12.5)
Yes, for entire program	7 (29.2)	Weekly contact frequency	
Yes, for partial treatment	6 (25.0)	Once	1 (4.2)
Unsure	1 (4.2)	Twice	2 (8.3)
Program coverage		Three to Four	9 (37.5)
National	7 (29.2)	Five	8 (33.3)
Local	17 (70.8)	Unsure	4 (16.7)

Kremer, K. P., Maynard, B. R., Polanin, J. R., Vaughn, M. G., & Sarteschi, C. M. (2015). Effects of after-school programs with at-risk youth on attendance and externalizing behaviors: A systematic review and meta-analysis. Journal of youth and adolescence, 44(3), 616-636.

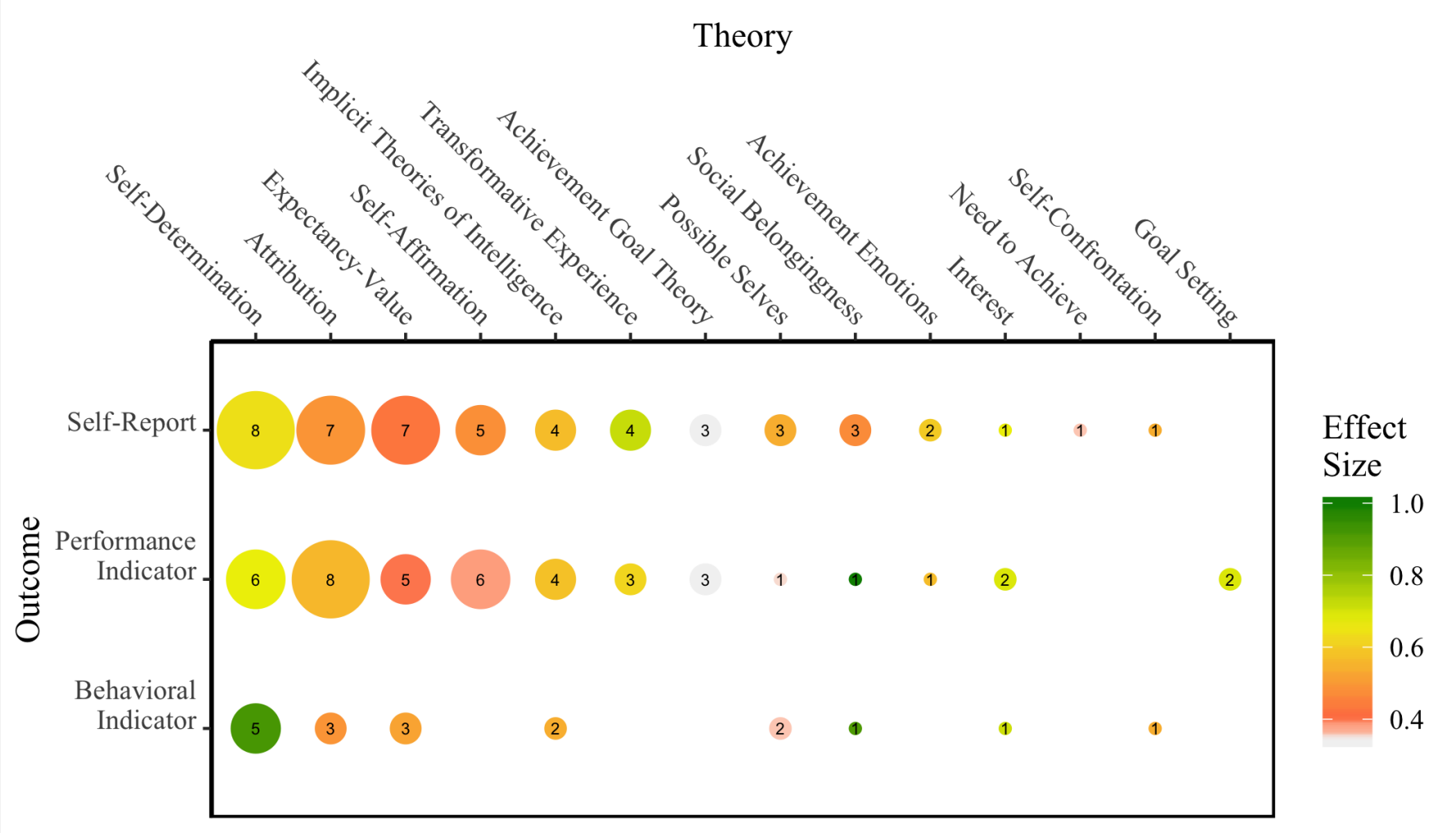


Evidence Gap Maps

- Visualize where and how many studies (or effects) conducted
- Map characteristics on to diagram – usually intervention type and outcome type
- Blank cells ("gaps") as important as completed cells

Portela, A., Stevenson, J., Hinton, R., Emler, M., Tsoli, S., & Snilstveit, B. (2017). Social, behavioral, and community engagement interventions for reproductive, maternal, newborn, and child health: An evidence gap map. 3ie Evidence Gap Map Report 11. London, England: International Initiative for Impact Evaluation (3ie).

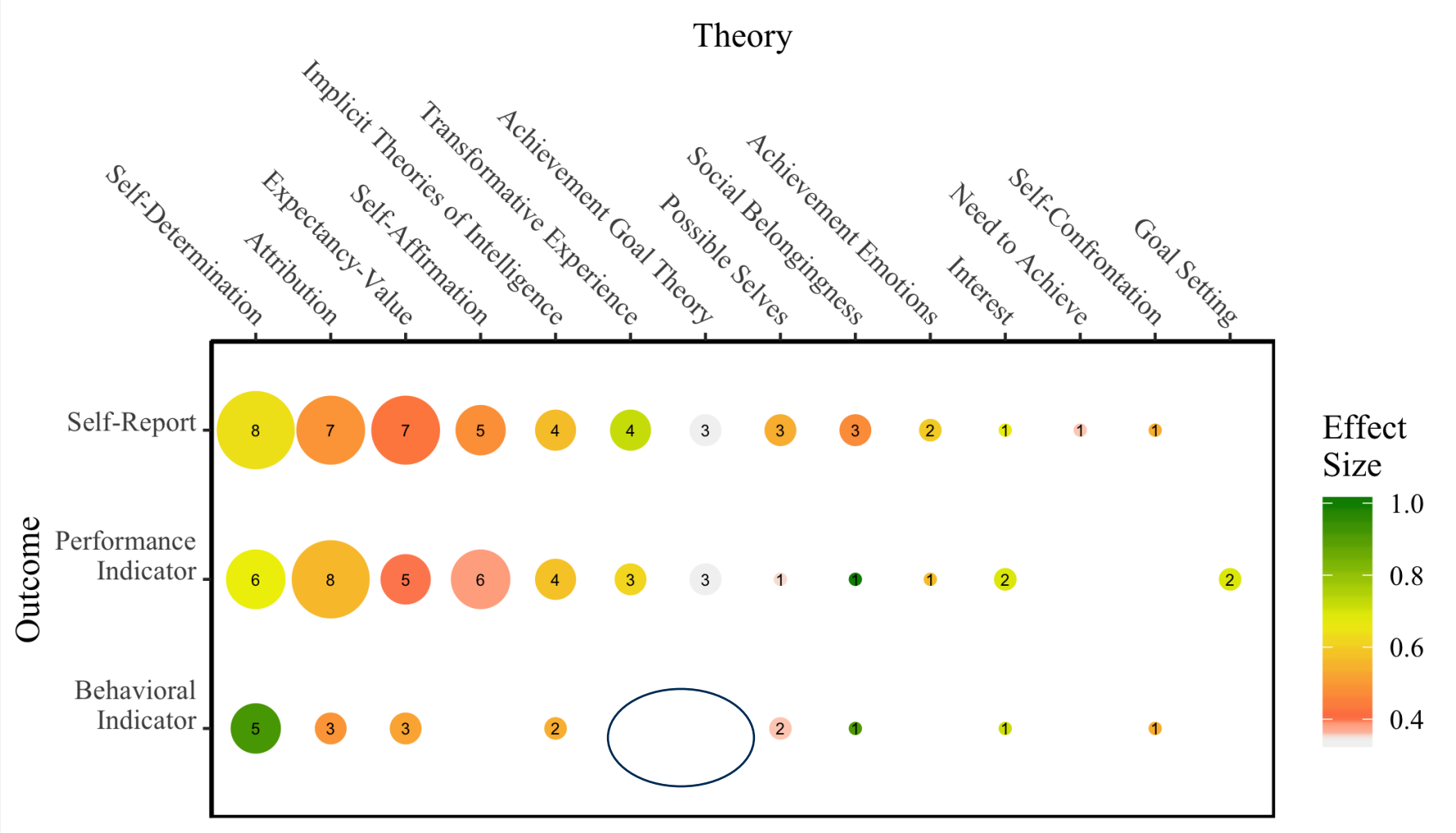
Evidence Gap Map with Meta-Analysis



Map from: Polanin et al. (*Under Review*). Understanding evidence gap maps in education research. *Educational Researcher.*

Data from: Lazowski, R. A., & Hulleman, C. S. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational research*, *86*(2), 602-640.

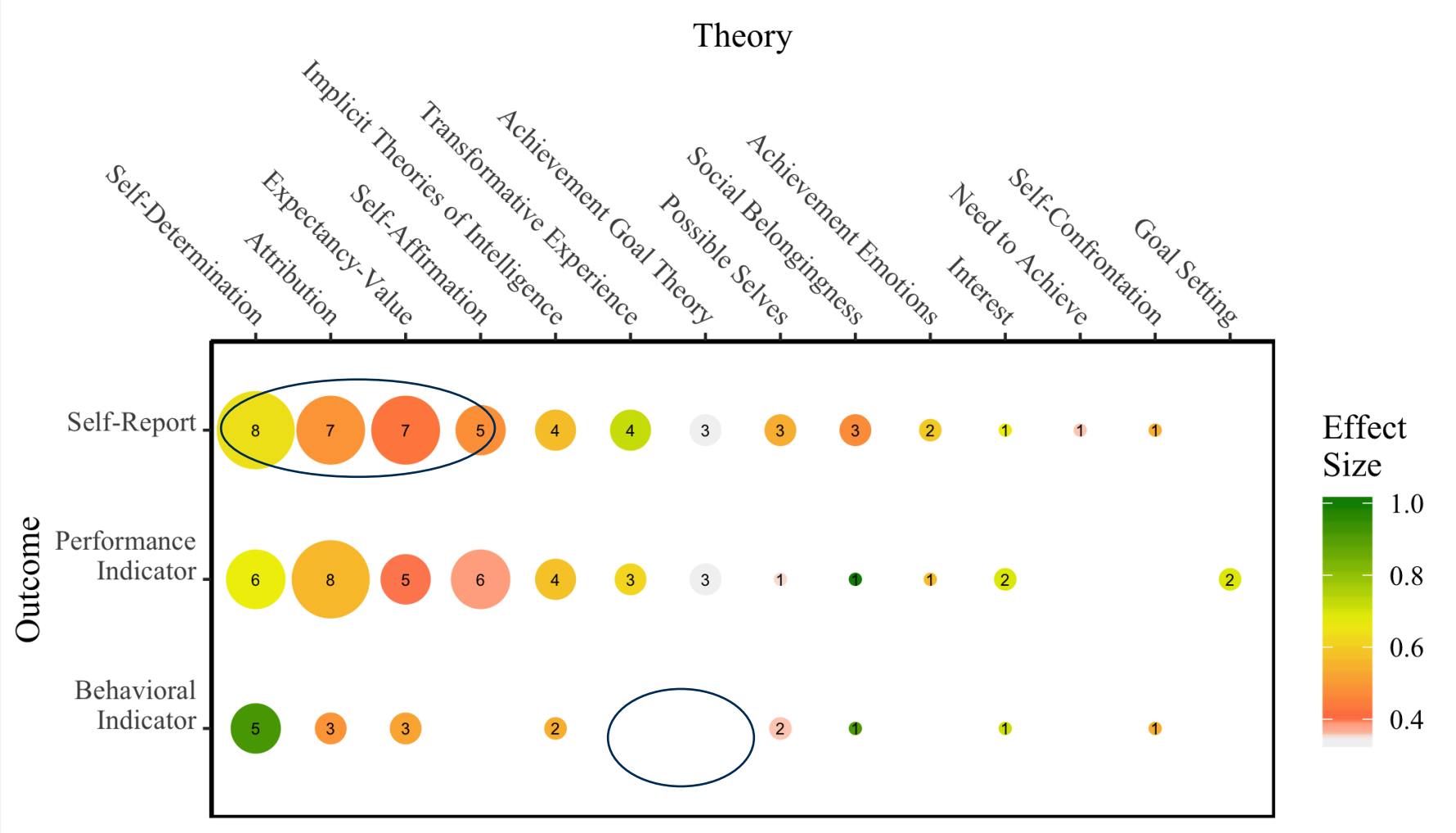
Evidence Gap Map with Meta-Analysis



Map from: Polanin et al. (*Under Review*). Understanding evidence gap maps in education research. *Educational Researcher.*

Data from: Lazowski, R. A., & Hulleman, C. S. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational research*, *86*(2), 602-640.

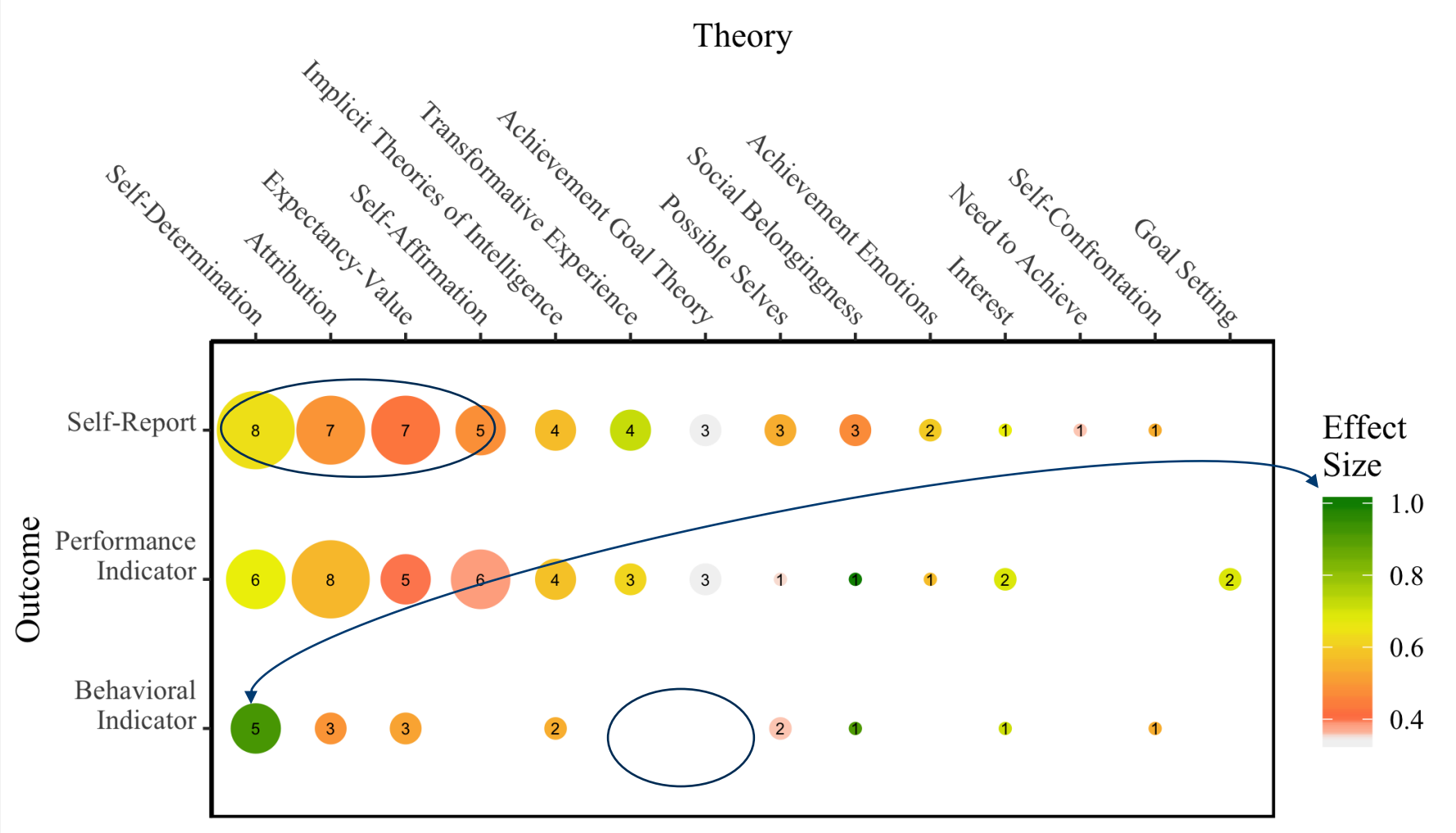
Evidence Gap Map with Meta-Analysis



Map from: Polanin et al. (*Under Review*). Understanding evidence gap maps in education research. *Educational Researcher.*

Data from: Lazowski, R. A., & Hulleman, C. S. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational research*, *86*(2), 602-640.

Evidence Gap Map with Meta-Analysis



Map from: Polanin et al. (*Under Review*). Understanding evidence gap maps in education research. *Educational Researcher.*

Data from: Lazowski, R. A., & Hulleman, C. S. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational research*, *86*(2), 602-640.

Inferential Analysis

ANOVA-like Confirmatory Moderator Analysis

- Compare effect size differences across studies based on their core components
- Use principles of traditional ANOVA model to test for differences across groups
- Great for testing policy-relevant components "at-scale"

Study ID	Core Component	ES
1	Group counseling	.25
2	Individualized counseling	.15
3	Individualized counseling	.13
4	Individualized counseling	.28
5	Group counseling	.22
6	Group counseling	.31

Group Counseling

Study ID	ES
1	.25
5	.22
6	.31
Average	.26

Indiv. Counseling

Study ID	ES
2	.15
3	.13
4	.28
Average	.19

ANOVA-like Confirmatory Moderator Analysis

- Compare effect size differences across studies based on their core components
- Use principles of traditional ANOVA model to test for differences across groups
- Great for testing policy-relevant components "at-scale"

Study ID	Core Component	ES
1	Group counseling	.25
2	Individualized counseling	.15
3	Individualized counseling	.13
4	Individualized counseling	.28
5	Group counseling	.22
6	Group counseling	.31

Group Counseling

Study ID	ES
1	.25
5	.22
6	.31
Average	.26

Indiv. Counseling

Study ID	ES
2	.15
3	.13
4	.28
Average	.19

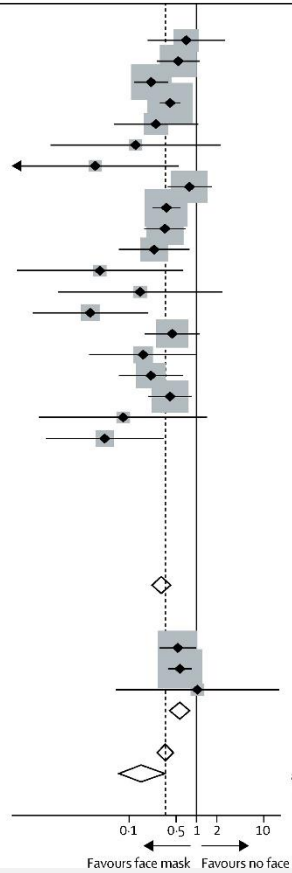
$df = 1, p < .05$

Recent and Relevant Example

Chu, D. K., Akl, E. A., Duda, S., Solo, K., Yaacoub, S., Schünemann, H. J., ... & Hajizadeh, A. (2020). Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: A systematic review and meta-analysis. *The Lancet.* DOI:10.1016/S0140-6736(20)31142-9

	Country	Respirator (0=no)	Infection	Events, face mask (n/N)	Events, no face mask (n/N)	RR (95% CI)	% weight (random)
Health-care setting							
Scales et al (2003)[66]	Canada	0	SARS	3/16	4/15	0·70 (0·19–2·63)	3·2
Liu et al (2009)[51]	China	0	SARS	8/123	43/354	0·54 (0·26–1·11)	6·7
Pei et al (2006)[61]	China	0	SARS	11/98	61/115	0·21 (0·12–0·38)	7·9
Yin et al (2004)[75]	China	0	SARS	46/202	31/55	0·40 (0·29–0·57)	10·3
Park et al (2016)[59]	South Korea	0	MERS	3/24	2/4	0·25 (0·06–1·06)	2·8
Kim et al (2016)[48]	South Korea	0	MERS	0/7	1/2	0·13 (0·01–2·30)	0·8
Heinzerling et al (2020)[44]	USA	0	COVID-19	0/31	3/6	0·03 (0·002–0·54)	0·9
Nishiura et al (2005)[55]	Vietnam	0	SARS	8/43	17/72	0·79 (0·37–1·67)	6·5
Nishiyama et al (2008)[56]	Vietnam	0	SARS	17/61	14/18	0·36 (0·22–0·58)	9·0
Reynolds et al (2006)[64]	Vietnam	0	SARS	8/42	14/25	0·34 (0·17–0·69)	6·7
Loeb et al (2004)[53]	Canada	1	SARS	3/23	5/9	0·23 (0·07–0·78)	3·6
Wang et al (2020)[41]	China	1	COVID-19	0/278	10/215	0·04 (0·002–0·63)	0·9
Seto et al (2003)[67]	China	1	SARS	0/51	13/203	0·15 (0·01–2·40)	0·9
Wang et al (2020)[70]	China	1	COVID-19	1/1286	119/4036	0·03 (0·004–0·19)	1·7
Alraddadi et al (2016)[34]	Saudi Arabia	1	MERS	6/116	12/101	0·44 (0·17–1·12)	5·0
Ho et al (2004)[45]	Singapore	1	SARS	2/62	2/10	0·16 (0·03–1·02)	1·9
Teleman et al (2004)[68]	Singapore	1	SARS	3/26	33/60	0·21 (0·07–0·62)	4·2
Wilder-Smith et al (2005)[72]	Singapore	1	SARS	6/27	39/71	0·40 (0·19–0·84)	6·5
Ki et al (2019)[47]	South Korea	1	MERS	0/218	6/230	0·08 (0·005–1·43)	0·8
Kim et al (2016)[48]	South Korea	1	MERS	1/444	16/308	0·04 (0·01–0·33)	1·6
Hall et al (2014)[43]	Saudi Arabia	1	MERS	0/42	0/6	(Not calculable)	0
Ryu et al (2019)[65]	South Korea	1	MERS	0/24	0/10	(Not calculable)	0
Park et al (2004)[58]	USA	1	SARS	0/60	0/45	(Not calculable)	0
Peck et al (2004)[60]	USA	1	SARS	0/13	0/19	(Not calculable)	0
Burke et al (2020)[37]	USA	1	COVID-19	0/64	0/13	(Not calculable)	0
Ha et al (2004)[42]	Vietnam	1	SARS	0/61	0/1	(Not calculable)	0
Random subtotal (I^2=50%)				**126/3442**	**445/6003**	**0·30 (0·22–0·41)**	**81·9**
Non-health-care setting							
Lau et al (2004)[59]	China	0	SARS	12/89	25/98	0·53 (0·28–0·99)	7·5
Wu et al (2004)[74]	China	0	SARS	25/146	69/229	0·57 (0·38–0·85)	9·7
Tuan et al (2007)[69]	Vietnam	0	SARS	0/9	7/154	1·03 (0·06–16·83)	0·9
Random subtotal (I^2=0%)				**37/244**	**101/481**	**0·56 (0·40–0·79)**	**18·1**
Unadjusted estimates, overall (I^2=48%)				**163/3686**	**546/6484**	**0·34 (0·26–0·45)**	**100·0**
Adjusted estimates, overall (1 COVID-19, 1 MERS, 8 SARS)						**aOR 0·15 (0·07–0·34)**	
						aRR 0·18 (0·08–0·38)	

Interaction by setting, p=0·049; adjusted for N95 and distance, p=0·11

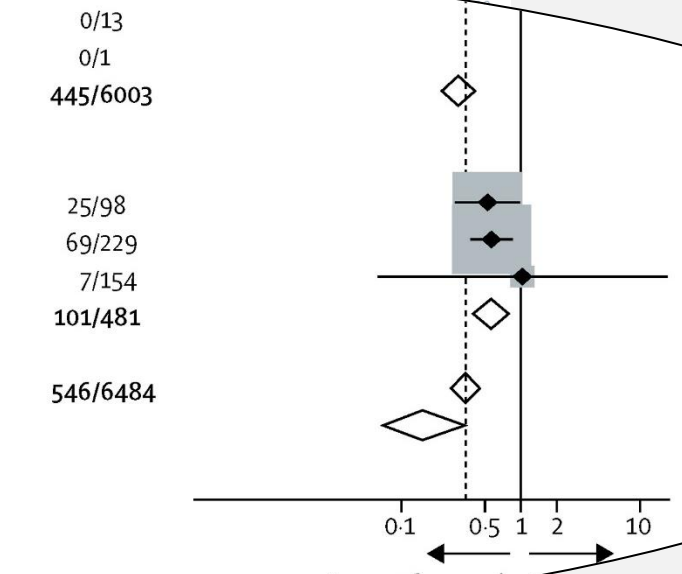


Recent and Relevant Example

Chu, D. K., Akl, E. A., Duda, S., Solo, K., Yaacoub, S., Schünemann, H. J., ... & Hajizadeh, A. (2020). Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: A systematic review and meta-analysis. *The Lancet.* DOI:10.1016/S0140-6736(20)31142-9

	Country	Respirator (0=no)	Infection	Events, face mask (n/N)	Events, no face mask (n/N)	RR (95% CI)	% weight (random)
Health-care setting							
Scales et al (2003)[66]	Canada	0	SARS	[illegible]	[illegible]	0·70 (0·19–2·63)	3·2
Liu et al (2009)[61]	[illegible]	[illegible]	SARS	0/13	0/19	[illegible]	6·7
[illegible]	USA	1	COVID-19	0/64	0/13		
[illegible] (2004)[42]	Vietnam	1	SARS	0/61	0/1		
Random subtotal (I^2=50%)				**126/3442**	**445/6003**	**0·30 (0·22[illegible]**	
Non-health-care setting							
Lau et al (2004)[50]	China	0	SARS	12/89	25/98	0·53 (0·28–0·99)	
Wu et al (2004)[74]	China	0	SARS	25/146	69/229	0·57 (0·38–0·85)	9·[illegible]
Tuan et al (2007)[69]	Vietnam	0	SARS	0/9	7/154	1·03 (0·06–16·83)	0·9
Random subtotal (I^2=0%)				**37/244**	**101/481**	**0·56 (0·40–0·79)**	**18·1**
Unadjusted estimates, overall (I^2=48%)				**163/3686**	**546/6484**	**0·34 (0·26–0·45)**	**1[illegible]**
Adjusted estimates, overall (1 COVID-19, 1 MERS, 8 SARS)						**aOR 0·15 (0·07–0·34)**	
						aRR 0·18 (0·08–0·38)	

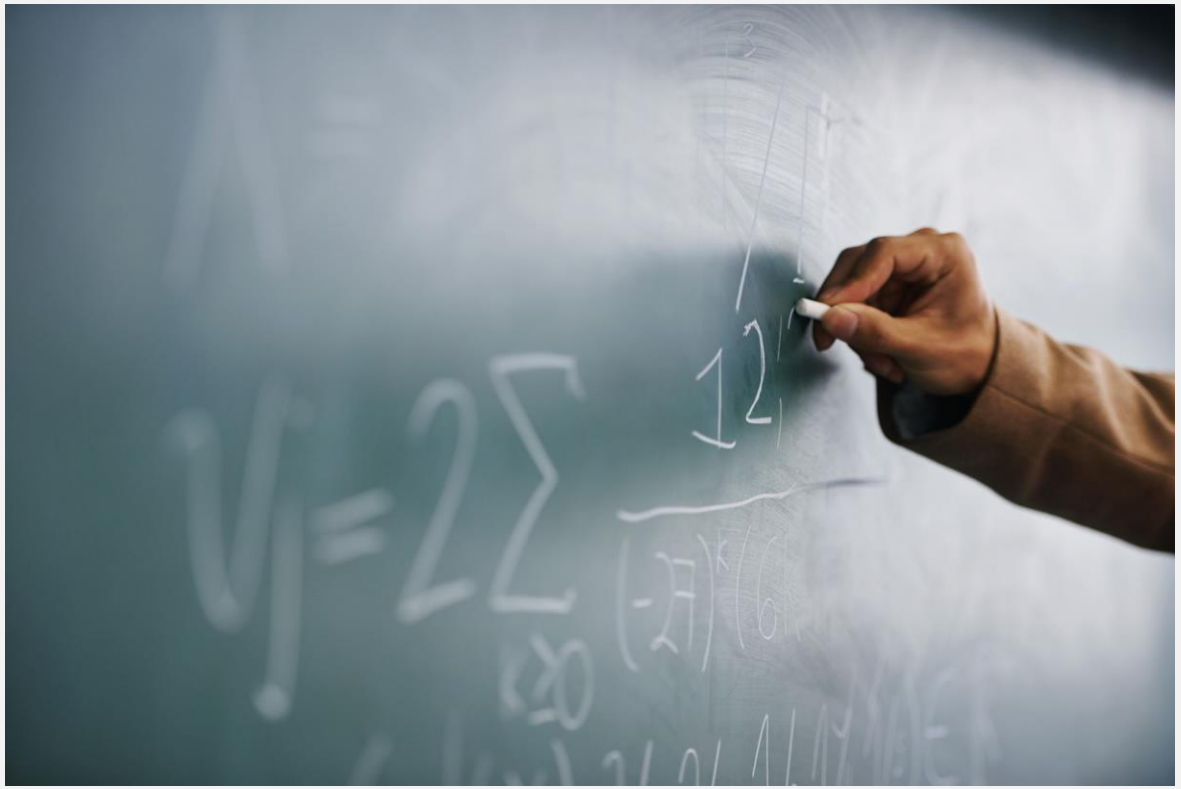
Interaction by setting, p=0·049; adjusted for N95 and distance, p=0·11



Wu et al (2004)[74] China 0 SARS 25/146 69/229 0·57 (0·38–0·85) 9·7
Tuan et al (2007)[69] Vietnam 0 SARS 0/9 7/154 1·03 (0·06–16·83) 0·9
Random subtotal (I^2=0%) 37/244 101/481 0·56 (0·40–0·79) 18·1
Unadjusted estimates, overall (I^2=48%) 163/3686 546/6484 0·34 (0·26–0·45) 100·0
Adjusted estimates, overall (1 COVID-19, 1 MERS, 8 SARS) aOR 0·15 (0·07–0·34) aRR 0·18 (0·08–0·38)
Interaction by setting, p=0·049; adjusted for N95 and distance, p=0·11
0·1 0·5 1 2 10
Favours face mask Favours no face mask

Exploring Core Components Relations with Effect Sizes using Multiple Predictor Meta-Regression

$$y_{ij} = \beta_0 + \beta_1 x_1 + \ldots + \beta_p x_p + e_{ij}$$



- Testing combination of predictors
- Unsure what might be related to size of the effect
- Worried about confounding
- Lots of data needs to be available

Examples?

Meta-regression. Our meta-regression model for the primary analysis was estimated using the R package *robumeta* (Fisher, Tipton, & Hou, 2017) and specified as:

$$\begin{aligned} ES_{ij} = {} & \beta_0 + \beta_1(RCT)_{ij} + \beta_2(TCHONLY)_{ij} \\ & + \beta_3(TCH\ \&\ STU)_{ij} + \beta_4(SCITYPE)_{ij} \\ & + \beta_5(TESTDEV)_{ij} + \beta_6(HIGRD)_{ij} \\ & + \beta_7(TRTPROV)_{ij} + e_{ij}. \end{aligned} \quad (3)$$

We grand mean centered all variables in the regression. As a result, the intercept is an estimate of the average effect size at the grand mean of all predictors. We assessed statistical significance of an estimated regression coefficient (β_j) with the test statistic t_j^R:

$$t_j^R = \frac{b_j}{S_j^R}, \quad (4)$$

where S_j^R is the robust standard error including adjustments for small samples (Tipton, 2015).

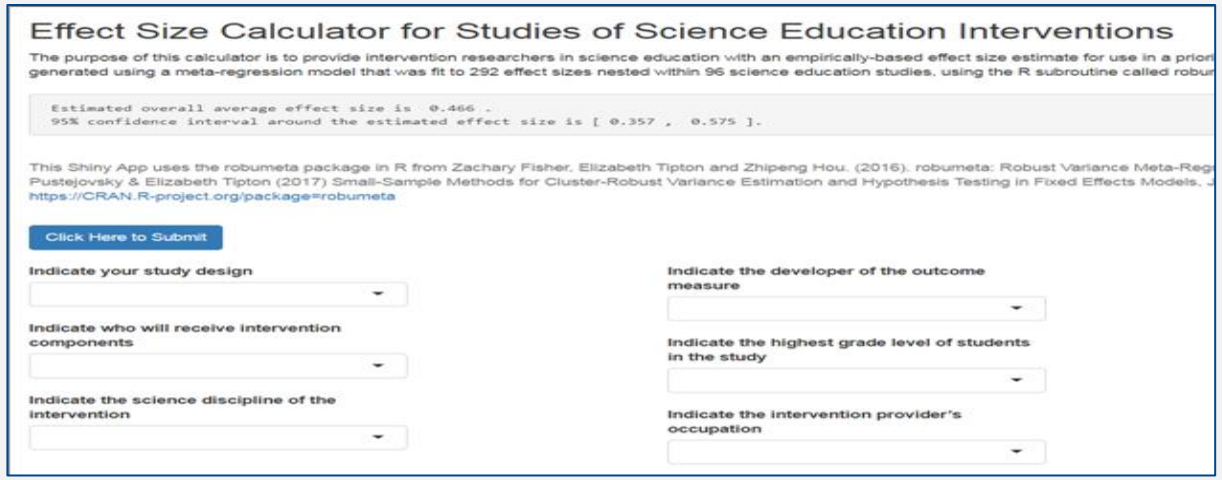
The test statistic is compared with critical values from student's t distribution with η_j degrees of freedom (these

TABLE 3

Results of Robust Variance Estimation Meta-Regression Using 96 Studies With 292 Effect Sizes

Parameter	Estimate	*SE*	*t* value	*df*	*p*	95% CI Lower	95% CI Upper
Intercept	0.489	0.060	8.161	43	<.001	0.368	0.610
RCT	−0.004	0.179	−0.024	11	.98	−0.397	0.388
TCHONLY	0.060	0.148	0.405	9	.69	−0.276	0.396
TCH&STU	0.149	0.136	1.097	40	.28	−0.125	0.423
SCITYPE	−0.044	0.120	−0.363	61	.72	−0.284	0.196
TESTDEV	0.258	0.102	2.522	48	.02	0.052	0.463
HIGRD	0.053	0.114	0.463	68	.65	−0.175	0.280
TRTPROV	−0.005	0.139	−0.036	22	.97	−0.295	0.284

Note. RCT, 1 = randomized design; *TCHONLY*, 1 = intervention with teachers only; *TCH&STU*, 1 = intervention for both teachers and students; *SCITYPE*, 1 = physics, chemistry, or physical science; *TESTDEV*, 1 = assessment developer is author or researcher; *HIGRD*, 1 = highest grade in study includes upper secondary (Grades 9–12); *TRTPROV*, 1 = treatment provider is a teacher. See Table 2 for the reference group of each variable.



https://joe-shiny.bscs.org/

Taylor, J., Kowalski, S., Polanin, J.R., Wilson, S.J., Wilson, C., Stuhlsatz, M., Askinas, K., & Tipton, E. (2018). Investigating science education intervention effect sizes for a priori power analyses. *AERA Open, 4*(3). doi:10.1177/2332858418791991

Thank you!

Joshua R. Polanin, Ph.D.

American Institutes for Research
Principal Researcher
202-403-5509
jpolanin@air.org

@joshuarpolanin

sites.google.com/site/joshuarpolanin/home

Chu, D. K., Akl, E. A., Duda, S., Solo, K., Yaacoub, S., Schünemann, H. J., ... & Hajizadeh, A. (2020). Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: A systematic review and meta-analysis. *The Lancet.*

Kremer, K. P., Maynard, B. R., Polanin, J. R., Vaughn, M. G., & Sarteschi, C. M. (2015). Effects of after-school programs with at-risk youth on attendance and externalizing behaviors: A systematic review and meta-analysis. Journal of youth and adolescence, 44(3), 616-636.

Lazowski, R. A., & Hulleman, C. S. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational research*, *86*(2), 602-640.

Polanin et al. (*Under Review*). A systematic review and meta-analysis of interventions to decrease cyberbullying perpetration and victimization. *Prevention Science*.

Polanin et al. (*Under Review*). Understanding evidence gap maps in education research. *Educational Researcher.*

Portela, A., Stevenson, J., Hinton, R., Emler, M., Tsoli, S., & Snilstveit, B. (2017). *Social, behavioral, and community engagement interventions for reproductive, maternal, newborn, and child health: An evidence gap map*. 3ie Evidence Gap Map Report 11. London, England: International Initiative for Impact Evaluation (3ie).

Taylor, J., Kowalski, S., Polanin, J.R., Wilson, S.J., Wilson, C., Stuhlsatz, M., Askinas, K., & Tipton, E. (2018). Investigating science education intervention effect sizes for a priori power analyses. *AERA Open, 4*(3). doi:10.1177/2332858418791991

JOSHUA R. POLANIN

PRINCIPAL RESEARCHER

202.403.5509

JPOLANIN@AIR.ORG

MAKING RESEARCH RELEVANT

THANK YOU

Notice of Trademark: "American Institutes for Research" and "AIR" are registered trademarks. All other brand, product, or company names are trademarks or registered trademarks of their respective owners.

Copyright © 20XX American Institutes for Research®. All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, website display, or other electronic or mechanical methods, without the prior written permission of the American Institutes for Research. For permission requests, please use the Contact Us form on www.air.org.