Data Analysis

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Introduction

In this study we collected data on 300 sport and exercise science research articles (100 from 3 journals). Based on the work of Büttner et al. (2020), we anticipated at least 150 (50%) of the articles would include a hypothesis that was tested. Based on the work of Fanelli (2010), Scheel, Schijen, and Lakens (2020), and Büttner et al. (2020) we hypothesized that the percentage of articles that find support for their hypothesis was greater than 80%.

Hypothesis

For this study, we hypothesized that the rate of positive results (i.e., studies that find at least partial support for their hypothesis) was greater than 80%. Therefore, the null hypothesis (H_0) was that the proportion of positive results was less than .8 and our alternative was greater than .8. There was no other effect being estimated in this study therefore the intercept of the model is what will be tested.

$H_0 : Intercept \leq 0.8$

$H_1 : Intercept > 0.8$

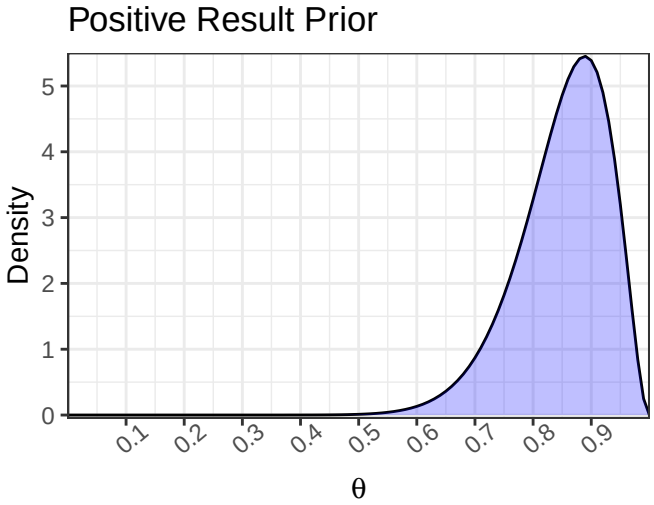
We also hypothesized that more than 60% of studies would test a hypothesis.

$H_0 : Intercept \leq 0.6$

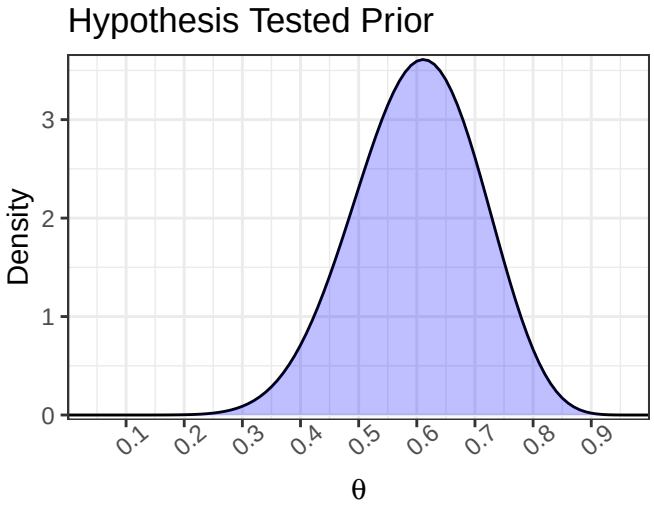
$H_1 : Intercept > 0.6$

Prior Choice

The prior we selected for this analysis was informed by the previous studies assuming the true positive rate is approximately 85% (Fanelli 2010). However, we would like to avoid "spiking" the prior in favor of our hypothesis and therefore want a skeptical prior. Based on the work of Scheel, Schijen, and Lakens (2020) and Büttner et al. (2020) the estimated positive rates in original research investigations ranged from 82%-92%, and even some fields included in the survey by Fanelli (2010) observed rates at low as ~70%. Therefore, we selected a prior of $\beta(17, 3)$, and is visualized it below. This prior is centered around .85, but includes the possibility of higher (.9) and much lower (.7) proportions as compatible parameter estimates.



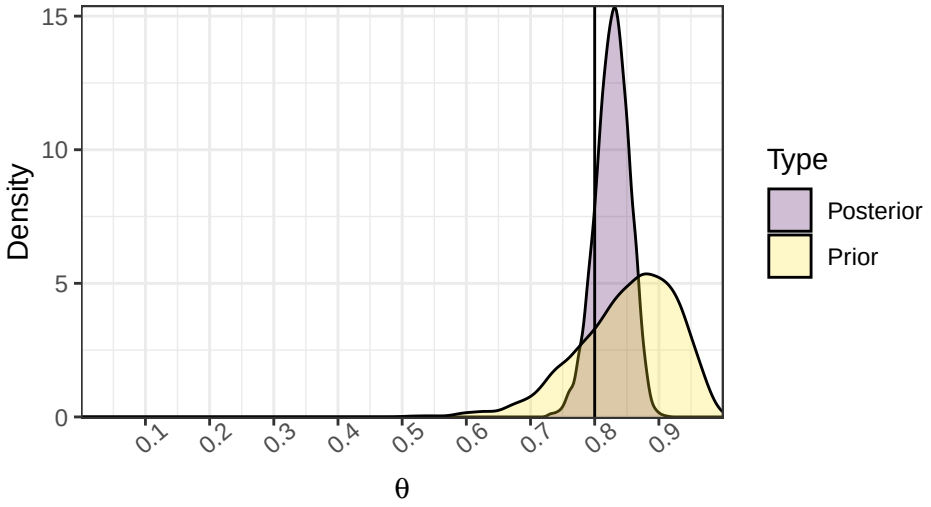
Similarly, we used prior centered at 60% for the secondary hypothesis test.



Hypothesis Test Analyses

Positive Result Rate Analysis

Below, we have incorporated this prior (`prior_1`) and then analyzed this with the `brm` function (saved as `m_test`).



In addition, the hypothesis was tested with the `hypothesis` function and the posterior compatibility intervals (C.I.).

Table 1: Hypothesis Test

Hypothesis	Estimate	Est.Error	CI.Lower	CI.Upper	Evid.Ratio	Post.Prob	Star
(Intercept)-(0.8) > 0	0.0273387	0.0263142	-0.0177693	0.067925	5.688963	0.8505	

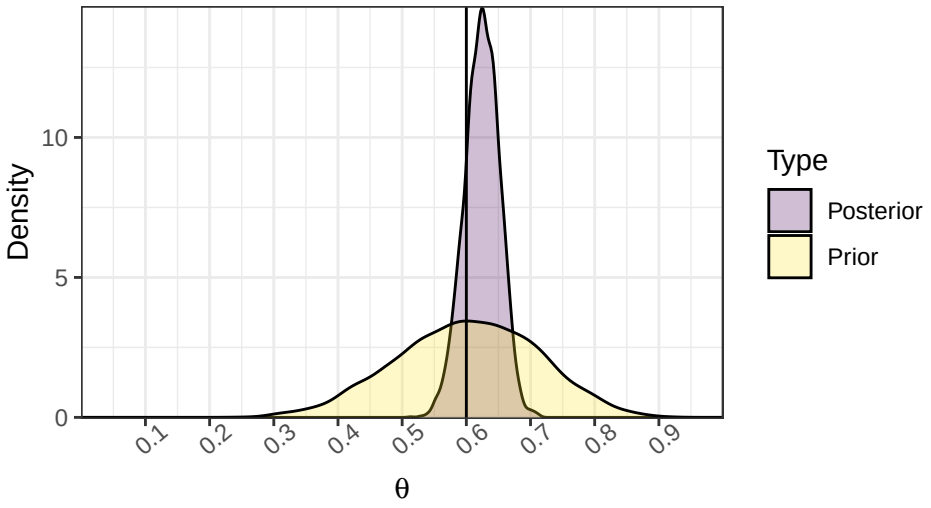
Table 2: 95% Posterior C.I.

	2.5%	97.5%
b_Intercept	0.7726666	0.8743508
prior_b	0.6761030	0.9658665
lp___	-5.6546314	-3.0958643

From the simulated scenario we find that given the data the hypothesis that the true positive result rate is greater than 80% is 5.69 times more likely than the true value being less than 80%.

Hypothesis Tested Analysis

Below, we have incorporated this prior (`prior_1`) and then analyzed this with the `brm` function (saved as `m_test`).



In addition, the hypothesis was tested with the `hypothesis` function and the posterior compatibility intervals (C.I.).

Table 3: Hypothesis Test

Hypothesis	Estimate	Est.Error	CI.Lower	CI.Upper	Evid.Ratio	Post.Prob	Star
(Intercept)-(0.6) > 0	0.0241898	0.0271399	-0.0217887	0.0666973	4.494505	0.818	

Table 4: 95% Posterior C.I.

	2.5%	97.5%
b_Intercept	0.5688612	0.6741532
prior_b	0.3850708	0.8053926
lp___	-5.7315499	-3.2219381

From the simulated scenario we find that given the data the hypothesis that the true positive result rate is greater than 80% is 5.69 times more likely than the true value being less than 80%.

Descriptives Statistics

Hypothesis Testing and Statistics

Contingency tables and binomial probabilities can be created for other data collected in this study of published studies.

Table 5: Statistics on Hypothesis Testing

		Hypothesis Tested	
	All	No	Yes
Total	279	96 (100)	183 (100)
Significance Testing			
No	12 (4.3)	6 (6.2)	6 (3.3)
Yes	267 (95.7)	90 (93.8)	177 (96.7)
Effect Size Reported			
No	67 (24)	30 (31.2)	37 (20.2)
Yes	212 (76)	66 (68.8)	146 (79.8)

Table 6: Statistics on Significance Testing

		Significant p-value	
	All	No	Yes
Total	255	4 (100)	251 (100)
Effect Size Reported			
No	58 (22.7)	4 (100)	54 (21.5)
Yes	197 (77.3)	0 (0)	197 (78.5)
p-value Type			
A mix: some exact and relative p-value(s)	140 (54.9)	0 (0)	140 (55.8)
Exact (e.g., p = .049)	82 (32.2)	2 (50)	80 (31.9)
Relative (e.g., p < .05)	33 (12.9)	2 (50)	31 (12.4)

- Effect sizes were reported often with 72.67% [67.25, 77.63] of manuscripts reported some estimate of effect size.
- 98.43% [96.03, 99.57] of manuscripts reported a "significant" p-value.
- 30.71% [25.23, 36.62] of manuscripts reported exact p-values (p = .045) versus relative p-values (p < .05).
- 30.71% [25.23, 36.62] of manuscripts reported at least *some* exact p-values (e.g., p = .045) versus relative p-values (e.g., p < .05).

Preregistration

Recently, there has been an emphasis on trial preregistration. This should be a requirement for clinical trials and any randomized control trial (RCT), and is highly encouraged for animal studies. Overall, from the pilot data, we would conclude that most manuscripts are out of compliance for clinical trials and no animal studies included preregistration information

Table 7: Preregistration Reported

		Preregistration	
	All	No	Yes
Total	300	277 (100)	23 (100)
Clinical Trial			
No	268 (89.3)	261 (94.2)	7 (30.4)
Yes	32 (10.7)	16 (5.8)	16 (69.6)
RCT			
No	247 (82.3)	239 (86.3)	8 (34.8)
Yes	53 (17.7)	38 (13.7)	15 (65.2)
Animal			
No	290 (96.7)	267 (96.4)	23 (100)
Yes	10 (3.3)	10 (3.6)	0 (0)

- 7.67% [4.92, 11.28] of manuscripts reported preregistration or clinical trial registration information.

Sample Size Information

All current guidelines require sample size reporting and encourage sample size justification. However, very few studies actually included a sample size justification. We should note that a sample size justification *does not* mean a power analysis necessarily.

Table 8: Sample Size Justification

		Journal		
	All	EJSS	JSAMS	MSSE
Total	298	99 (100)	99 (100)	100 (100)
Sample Size Justification				
No	234 (78.5)	77 (77.8)	88 (88.9)	69 (69)
Yes	64 (21.5)	22 (22.2)	11 (11.1)	31 (31)
Sample Size Reported				
No (sample size(s) unclear/unreported)	7 (2.3)	0 (0)	6 (6.1)	1 (1)
Partial (some information missing)	3 (1)	1 (1)	1 (1)	1 (1)
Yes (e.g., total and group sample sizes provided)	288 (96.6)	98 (99)	92 (92.9)	98 (98)

- 21.4% [16.89, 26.49] of manuscripts reported some form of sample size justification.
- 96.66% [93.94, 98.38] of manuscripts reported all the required sample size information.

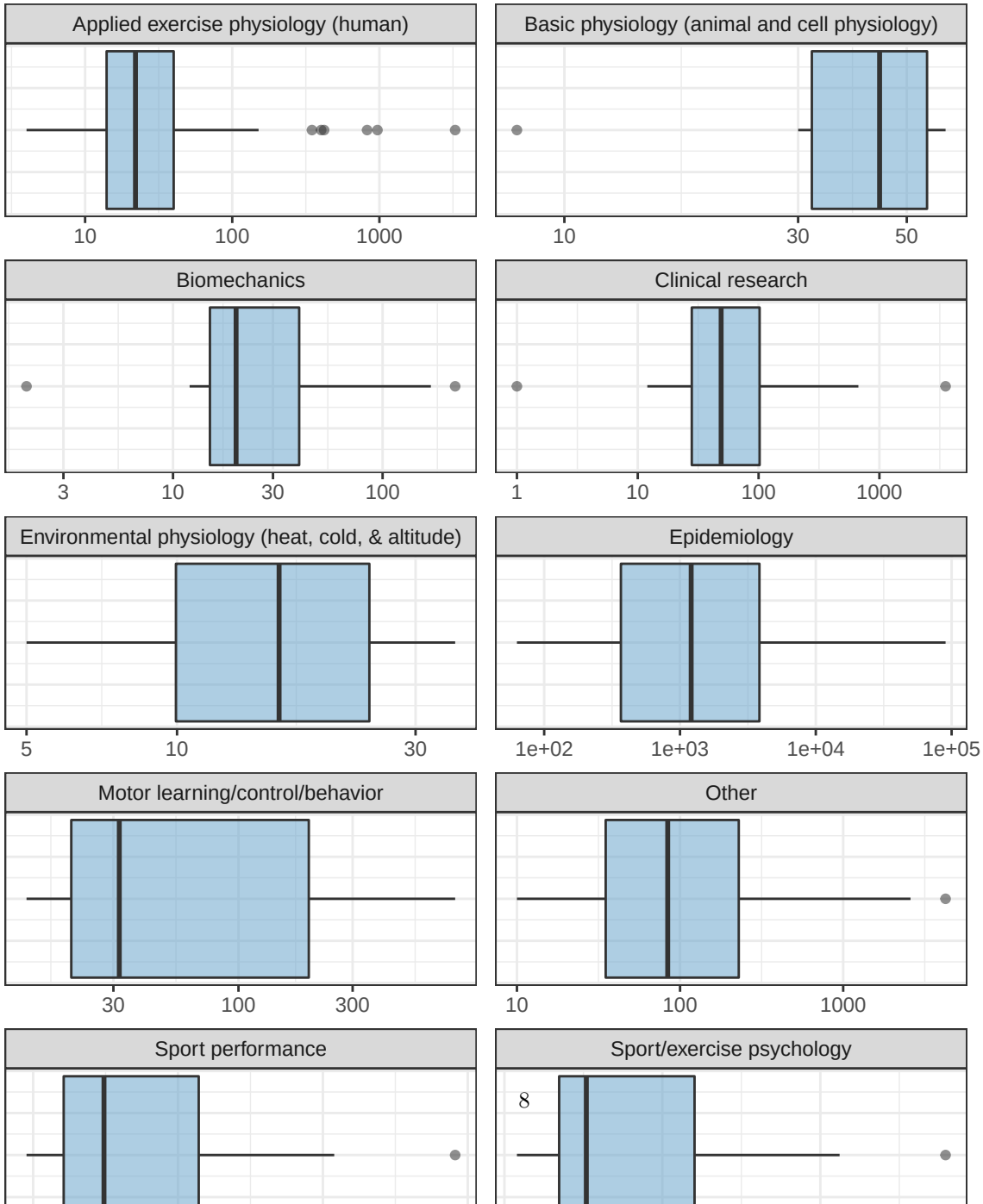
Further, we can illustrate the range of sample sizes with plots of sample sizes reported sample size and compare the sample sizes by sub-discipline. No significant differences in sub-disciplines. Overall, from the given data we would conclude that the sample sizes have a large range, and unsurprisingly epidemiology has the largest median sample size.

Table 9: ANOVA: Compare Sample Size

Analysis	F.value	p.value
Heteroscedastic one-way ANOVA for medians	1.4301	0.144

Table 10: Sample Size by Category

sci_cat	median	IQR	n
Applied exercise physiology (human)	22	26	92
Basic physiology (animal and cell physiology)	44	23	9
Biomechanics	20	25	37
Clinical research	49	74	40
Environmental physiology (heat, cold, & altitude)	16	14	7
Epidemiology	1208	3542	30
Motor learning/control/behavior	32	179	20
Other	84	194	17
Sport performance	32	128	30
Sport/exercise psychology	33	204	11



Other Open Science Practices

We can estimate the proportion of studies that report some type of open data or data sharing in their manuscript.

- 0.67% [0.08, 2.39] of manuscripts reported some form of data sharing or open data.

There is some concern that the replicability of kinesiology is not know so we can also report the proportion of studies that explicitly stating they are replicating previous work.

- 1% [0.21, 2.89] of manuscripts explicitly stated they were replicating a previous study.

References

Büttner, Fionn, Elaine Toomey, Shane McClean, Mark Roe, and Eamonn Delahunt. 2020. "Are Questionable Research Practices Facilitating New Discoveries in Sport and Exercise Medicine? The Proportion of Supported Hypotheses Is Implausibly High." *British Journal of Sports Medicine*, July, bjsports–2019–101863. https://doi.org/10.1136/bjsports-2019-101863.

Fanelli, Daniele. 2010. "'Positive' Results Increase down the Hierarchy of the Sciences." Edited by Enrico Scalas. *PLoS ONE* 5 (4): e10068. https://doi.org/10.1371/journal.pone.0010068.

Scheel, Anne M., Mitchell Schijen, and Daniel Lakens. 2020. "An Excess of Positive Results: Comparing the Standard Psychology Literature with Registered Reports," February. https://doi.org/10.31234/osf.io/p6e9c.