SOURCEBOOK

INTRO

APA STYLE

Abstract: This chapter describes basic rules for presenting statistical results in APA style. All rules come from the newest APA style manual. Specific examples of mini-Results summaries are provided, using the analyses elsewhere in this project. Sample data tables are provided for more complex examples.

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General Rules for Results Sections

Purpose of Results Sections

The APA manual describes appropriate strategies for presenting statistical information. These guidelines were established to provide basic minimal standards and to provide some uniformity across studies. In general, your results section should effectively communicate the findings of the study by:

- Providing context for the statistics that will follow by incorporating language about the variable(s);
- Clarifying what you did to analyze the results by identifying the statistical procedures used; and
- Highlighting the implications for the hypotheses by providing simple interpretations of the analyses.

Statistical Information to Include

Significance testing “is but a starting point and that additional reporting elements such as effect sizes, confidence intervals, and extensive description are needed to convey the most complete meaning of the results” (p. 33).

1. Descriptive statistics are essential and “such a set usually includes at least the following: the per-cell sample sizes; the observed cell means (or frequencies of cases in each category for a categorical variable); and the cell standard deviations” (p. 33).
2. For statistical significance tests, “include the obtained magnitude or value of the test statistics, the degrees of freedom, the probability of obtaining a value as extreme as or more extreme than the one obtained (the exact *p* value)” (p. 34).
3. When possible, confidence intervals should be emphasized. “The inclusion of confidence intervals (for estimates of parameters, for functions of parameters such as differences in means, and for effect sizes) can be an extremely effective way of reporting results” (p. 34).
4. “For the reader to appreciate the magnitude or importance of a study’s findings, it is almost always necessary to include some measure of effect size” (p. 34). These can be in the original (raw) units or in a standardized metric.

Information in Text versus Data Displays

“Statistical and mathematical copy can be presented in text, in tables, and in figures. . . Select the mode of presentation that optimizes understanding of the data by the reader” (p. 116).

- The more analyses you have, the more likely it is that they should be presented in a table or figure. “If you need to present 4 to 20 numbers, first consider a well-prepared table” (p. 116).
- “If you present descriptive statistics in a table or figure, you do not need to repeat them in text, although you should (a) mention the table in which the statistics can be found and (b) emphasize particular data in the narrative when they help in interpretation” (p. 117).
- As a result, it is necessary that the text include a description of the variable(s) under study and a description of the statistical procedures used. The text often includes a description of whether the results support the hypotheses.

Note: All quotations pertaining to reporting results are taken from: American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th Ed.). Washington, DC: APA.

Summary of Parametric Statistics

Statistic	Purpose	APA Style	Description
Descriptive Statistics			
Mean	To provide an estimate of the population from which the sample was selected.	*M* = ______	Indicates the center point of the distribution and serves as the reference point for nearly all other statistics.
Standard Deviation	To provide an estimate of the amount of variability/dispersion in the distribution of population scores.	*SD* = ______	Indicates the variability of scores around their respective mean. Zero indicates no variability.
Measures of Effect Size			
Cohen's d	To provide a standardized measure of an effect (defined as the difference between two means).	*d* = ______.	Indicates the size of the treatment effect relative to the within-group variability of scores.
Correlation	To provide a measure of the association between two variables measured in a sample.	*r*(df) = ______	Indicates the strength of the relationship between two variables and can range from –1 to +1.
Eta-Squared	To provide a standardized measure of an effect (defined as the relationship between two variables).	η^2 = ______.	Indicates the proportion of variance in the dependent variable accounted for by the independent variable.
Confidence Intervals			
CI for a Mean	To provide an interval estimate of the population mean. Can be derived from both the z and t distributions.	_____% CI [____, ____]	Indicates that there is the given probability that the interval specified covers the true population mean.
CI for a Mean Difference	To provide an interval estimate of the population mean difference. Can be derived from both the z and t distributions.	_____% CI [____, ____]	Indicates that there is the given probability that the interval specified covers the true population mean difference.
Statistical Significance Tests			
One Sample t Test	To compare a single sample mean to a population mean when the population standard deviation is not known	*t*(df) = _____, *p* = _____.	A small probability is obtained when the statistic is sufficiently large, indicating that the two means significantly differ from each other.
Independent Samples t Test	To compare two sample means when the samples are from a single-factor between-subjects design.		
Paired Samples t Test	To compare two sample means when the samples are from a single-factor within-subjects design.		
One-Way ANOVA	To compare two or more sample means when the means are from a single-factor between-subjects design.	$F(df_1,df_2)$ = ____, *p* = ____.	A small probability is obtained when the statistic is sufficiently large, indicating that the set of means differ significantly from each other.
Repeated Measures ANOVA	To compare two or more sample means when the means are from a single-factor within-subjects design.		
Factorial ANOVA	To compare four or more groups defined by a multiple variables in a factorial research design.		

Note. Many of the statistics from each of the categories are frequently and perhaps often appropriately presented in tables or figures rather than in the text.

Examples of Results in the Text

In simple examples, statistical information is incorporated into the text. Alternatively, the various elements of the analyses could be presented in a table or figure associated with the text.

Frequencies

Though often not reported, simple summary statistics – like the median and quartiles – provide the reader with basic frequency information about the variable under investigation. Both of the following versions present the required information, though the second focuses more on the interpretation of the statistic.

> For the eight participants, Outcome scores of 2.25, 4.00, and 5.50 represented the 25th, 50th, and 75th percentiles, respectively.

> The participants (*N* = 8) had a low *Mdn* Outcome score of 4.00 (*IQR* = 2.25 – 5.50).

Descriptives

The purpose of the descriptive statistics is to provide the reader with an idea about the basic elements of the group(s) being studied. Note that this also forms the basis of the in-text presentation of descriptive statistics for other inferential analyses. Both of the following versions present the required information, though the second focuses more on the interpretation of the statistic.

> The eight participants had a mean Outcome of 4.00 (*SD* = 3.12).

> The participants (*N* = 8) had a low mean Outcome score (*M* = 4.00, *SD* = 3.12).

Correlations

Correlations provide a measure of statistical relationship between two variables. Note that correlations can also have inferential information associated with them (and that this information should be summarized if it is available and of interest like in the second example below).

> For the participants (*N* = 4), the scores on Outcome 1 (*M* = 2.00, *SD* = 2.45) and Outcome 2 (*M* = 6.00, *SD* = 2.45) were moderately correlated, *r*(2) = .50.

> For the participants (*N* = 4), the scores on Outcome 1 (*M* = 2.00, *SD* = 2.45) and Outcome 2 (*M* = 6.00, *SD* = 2.45) were moderately but not statistically significantly correlated, *r*(2) = .50, 95% CI [-0.89, 0.99], *p* = .500.

Regression

Regression models and coefficients provide a measure of statistical relationship between two variables. Note that regression models and coefficients can also have inferential information associated with them (and that this information should be summarized if it is available and of interest like in the second example below).

For the participants (N = 4), the scores on Outcome 1 (M = 2.00, SD = 2.45) moderately predicted Outcome 2 (M = 6.00, SD = 2.45), β = .500, R^2 = .250.

For the participants (N = 4), the scores on Outcome 1 (M = 2.00, SD = 2.45) did not significantly predict Outcome 2 (M = 6.00, SD = 2.45), β = .500, t = 0.816, p = .500.

Confidence Intervals (of the Mean)

Confidence intervals provide a range estimate for a population value (e.g., the mean). Note that the width of the interval can be altered to reflect the level of confidence in the estimate. Both of the following versions present the required information, though the second focuses more on the interpretation of the statistic.

The eight participants had a mean Outcome score of 4.00 (SD = 3.12), 95% CI [1.39, 6.61].

The participants (N = 8) scored low on the Outcome (M = 4.00, SD = 3.12), 95% CI [1.39, 6.61].

One Sample t Test

For this analysis, a sample mean has been compared to a user-specified test value (or a population mean). Thus, the summary and the inferential statistics focus on that difference. The first example focuses on statistical significance testing, whereas as the second version includes and emphasizes interpretation of the confidence interval and effect size.

A one sample t test showed that the difference in Outcome scores between the current sample (N = 8, M = 4.00, SD = 3.12) and the hypothesized value (7.00) was statistically significant, $t(7)$ = -2.72, p = .030.

Analyses revealed that the current sample (N = 8, M = 4.00, SD = 3.12) had dramatically higher Outcome scores than the hypothesized value (7.00), 95% CI [-5.61, -.39], d = -0.96, $t(7)$ = -2.72, p = .030.

Paired Samples t Test

For this analysis, the differences between two measurements on one set of people are being compared. Thus, the summary and the inferential statistics focus on that difference. The first example focuses on statistical significance testing, whereas as the second version includes and emphasizes interpretation of the confidence interval and effect size.

A paired samples t test showed that the difference in Outcome scores (N = 4) between the first time point (M = 2.00, SD = 2.45) and second time point (M = 6.00, SD = 2.45) was statistically significant, $t(3)$ = -3.27, p = .047.

Analyses revealed that Outcome scores (N = 4) increased dramatically from the first time point (M = 2.00, SD = 2.45) to the second time point (M = 6.00, SD = 2.45), 95% CI [-7.90, -0.10], d = -1.63, $t(3)$ = -3.27, p = .047.

Independent Samples t Test

For this analysis, the emphasis is on comparing the means from two groups. Here again the summary and the inferential statistics focus on the difference. The first example focuses on statistical significance testing, whereas as the second version includes and emphasizes interpretation of the confidence interval and effect size.

> An independent samples *t* test showed that the difference in Outcome scores between the first group (*n* = 4, *M* = 4.00, *SD* = 2.45) and the second group (*n* = 3, *M* = 6.00, *SD* = 2.45) was not statistically significant, *t*(6) = -2.31, *p* = .060.

> Analyses revealed potentially large, yet inconclusive, differences in Outcome scores between the first group (*n* = 4, *M* = 4.00, *SD* = 2.45) and the second group (*n* = 3, *M* = 6.00, *SD* = 2.45), 95% CI [-8.24, 0.24], *d* = -1.63, *t*(6) = -2.31, *p* = .060.

One Way ANOVA

The ANOVA provides an omnibus test of the differences across multiple groups. Because the ANOVA tests the overall differences among the groups, the text discusses the differences in general. The first example focuses on statistical significance testing, whereas as the second version includes and emphasizes interpretation of the effect size.

> A one way ANOVA showed that the differences in Outcome scores between the first group (*n* = 3, *M* = 2.00, *SD* = 2.45), the second group (*n* = 3, *M* = 6.00, *SD* = 2.45), and the third group (*n* = 3, *M* = 7.00, *SD* = 2.45) were statistically significant, *F*(2,9) = 4.67, *p* = .041.

> Analyses revealed large overall differences in Outcome scores between the first group (*n* = 3, *M* = 2.00, *SD* = 2.45), the second group (*n* = 3, *M* = 6.00, *SD* = 2.45), and the third group (*n* = 3, *M* = 7.00, *SD* = 2.45), η^2 = .51, *F*(2,9) = 4.67, *p* = .041.

Post Hoc Comparisons

Post hoc comparisons build on the ANOVA results and provide a more focused comparison among the groups and usually follows a presentation of the ANOVA (which already includes the descriptive information). The first example focuses on statistical significance testing, whereas as the second version includes and emphasizes interpretation of the confidence intervals (and can be presented on its own).

> Tukey’s HSD tests showed that the first group scored statistically significantly different than the third group, *t*(9) = -2.89, *p* = 043. However, the other comparisons were not statistically significant (*p*s > .05).

> A series of Tukey's HSD comparisons revealed that the first group (*n* = 3, *M* = 2.00, *SD* = 2.45) scored substantially lower Outcome scores than the third group (*n* = 3, *M* = 7.00, *SD* = 2.45), 95% CI [-9.84, -.16], *t*(9) = -2.89, *p* = 043. However, the other comparisons revealed effectively little to no difference between the other groups (*p*s > .05).

Repeated Measures ANOVA

The RMD ANOVA tests for overall differences across the repeated measures. As such, its summary parallels that of the One Way ANOVA. The first example focuses on statistical significance testing, whereas as the second version includes and emphasizes interpretation of the effect size.

> A repeated measures ANOVA showed that the difference in Outcome scores (N = 4) between the first time point (M = 2.00, SD = 2.45) and second time point (M = 6.00, SD = 2.45) was statistically significant, F(1,3) = 10.67, p = .047.
>
> Analyses revealed a substantial increase in Outcome scores (N = 4) from the first time point (M = 2.00, SD = 2.45) to the second time point (M = 6.00, SD = 2.45), partial η^2 = .78, F(1,3) = 10.67, p = .047.

Factorial ANOVA

The Factorial ANOVA provides statistics for the main effects and interactions in a factorial design. Each effect would be summarized in a style analogous to a One Way ANOVA. The first example focuses on statistical significance testing, whereas as the second version includes and emphasizes interpretation of the effect size.

> A 2 (Factor A) x 2 (Factor B) ANOVA was conducted on the Outcome scores. Neither Factor A, F(1,12) = 0.67, p = .430, nor Factor B, F(1,12) = 2.67, p = .128, had a statistically significant impact on the Outcome. However, the interaction was statistically significant, F(1,12) = 6.00, p = .031.
>
> Analyses revealed that neither Factor A, partial η^2 = .05, F(1,12) = 0.67, p = .430, nor Factor B, partial η^2 = .18, F(1,12) = 2.67, p = .128, had an appreciable impact on the Outcome. However, the interaction had a large impact on the Outcome, partial η^2 = .33, F(1,12) = 6.00, p = .031.

Examples of Results in Tables

In more complex examples – such as those with multiple outcome variables or multiple statistical tests – it is often preferable to place statistical information in tables rather than in the text.

Descriptive Statistics with Correlations

This table provides the reader with both the univariate descriptive statistics (the means and standard deviations) and the bivariate descriptive statistics (the correlations).

Variable	*n*	*M*	*SD*	1	2
Outcome 1	4	2.00	2.45	--	
Outcome 2	4	6.00	2.45	.50	--

Descriptive Statistics with Confidence Intervals

This table is useful for removing the basic descriptive statistics (the means and standard deviations) and the confidence intervals from the text.

	Group 1			Group 2		
Variable	*n*	*M* (*SD*)	95% CI	*n*	*M* (*SD*)	95% CI
Outcome 1	4	2.00 (2.45)	[-.73, 4.73]	4	6.00 (2.45)	[3.27, 8.73]
Outcome 2	4	6.00 (2.45)	[3.27, 8.73]	4	7.00 (2.45)	[4.27, 9.73]

Independent and Dependent Samples t Tests

This table is useful removing the basic descriptive statistics and all inferential statistics (the statistical significance tests, confidence intervals, and effect sizes) from the text.

	Group 1		Group 2				95% CI		
Variable	*M*	*SD*	*M*	*SD*	*t*(6)	*p*	*LL*	*UL*	Cohen's *d*
Outcome 1	2.00	2.45	6.00	2.45	-2.31	.060	-8.24	0.24	-1.63
Outcome 2	6.00	2.45	7.00	2.45	-0.58	.585	-5.24	3.24	-0.41

One Way and Repeated Measures ANOVAs with Post Hoc Tests

This table is useful for removing the descriptive and inferential statistics from the text, while also summarizing the post hoc tests.

	Group 1		Group 2		Group 3					
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	$F(2, 6)$	*p*	η^2	Tukey's HSD
Outcome 1	2.00	2.45	6.00	2.45	7.00	2.45	4.67	.041	.509	1 = 2 < 3
Outcome 2	6.00	2.45	7.00	2.45	5.00	2.45	0.67	.537	.129	1 = 2 = 3