

Table 1.- Necessary Sample Size for one & two samples

($\alpha = .05$, two-tailed test)

t test for One-Sample or Two Related Samples

1- β	Cohen's d													
	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50
.50	99	46	27	18	14	11	9	8	7	6	6	5	5	5
.55	112	51	30	20	15	12	10	8	7	7	6	5	5	5
.60	125	57	33	22	16	13	10	9	8	7	6	6	5	5
.65	140	64	37	25	18	14	11	10	8	7	7	6	6	5
.70	157	71	41	27	20	15	12	10	9	8	7	6	6	5
.75	176	80	46	30	22	17	13	11	10	8	7	7	6	6
.80	199	90	52	34	24	19	15	12	10	9	8	7	7	6
.85	227	102	59	38	27	21	17	14	12	10	9	8	7	7
.90	265	119	68	45	32	24	19	16	13	11	10	9	8	7

t test for Two Independent Samples¹

1- β	Cohen's d													
	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50
.50	194	87	50	32	23	17	14	11	9	8	7	6	6	5
.55	219	98	56	36	26	19	15	12	10	9	8	7	6	6
.60	247	110	63	41	29	22	17	14	11	10	9	8	7	6
.65	277	124	70	46	32	24	19	15	13	11	9	8	7	7
.70	310	139	79	51	36	27	21	17	14	12	10	9	8	7
.75	349	156	88	57	40	30	23	19	15	13	11	10	9	8
.80	394	176	100	64	45	34	26	21	17	15	12	11	10	9
.85	450	201	114	73	51	38	30	24	19	16	14	12	11	10
.90	527	235	133	86	60	44	34	27	23	19	16	14	12	11

Correlation

1- β	r														
	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80
.50	385	172	97	63	44	32	25	20	16	14	12	10	9	8	7
.55	435	194	109	70	49	36	28	22	18	15	12	11	9	8	7
.60	490	218	122	78	54	40	30	24	19	16	13	11	10	8	7
.65	549	244	137	87	60	44	33	26	21	17	14	12	10	9	7
.70	616	273	153	97	67	49	37	29	23	19	15	13	11	9	8
.75	692	306	171	109	75	54	41	32	25	20	17	14	12	10	8
.80	781	345	193	122	84	61	46	35	28	23	18	15	13	10	9
.85	893	395	220	139	95	69	52	40	31	25	20	17	14	11	9
.90	1045	461	257	162	111	80	60	46	36	29	23	19	15	13	10

¹ Values represent required sample size for each sample.

Table 2.- Necessary Sample Size for oneway ANOVA

($\alpha = .05$)

Analysis of Variance²

k	1-β	η ²																			
		.02	.04	.06	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30	.32	.34	.36	.38	.40
3	.50	82	41	27	21	16	14	12	10	9	8	7	7	6	6	5	5	5	5	4	4
	.55	92	46	31	23	18	15	13	11	10	9	8	7	7	6	6	6	5	5	5	4
	.60	103	51	34	25	20	17	14	12	11	10	9	8	7	7	6	6	6	5	5	5
	.65	115	57	38	28	22	18	16	14	12	11	10	9	8	8	7	7	6	6	5	5
	.70	127	63	42	31	25	20	17	15	13	12	11	10	9	8	8	7	7	6	6	5
	.75	142	70	46	34	27	23	19	17	15	13	12	11	10	9	8	8	7	7	6	6
	.80	159	79	52	38	30	25	21	18	16	14	13	12	11	10	9	8	8	7	7	6
	.85	180	89	59	43	34	28	24	21	18	16	14	13	12	11	10	9	9	8	8	7
	.90	208	103	68	50	39	32	27	24	21	18	17	15	14	12	11	11	10	9	8	8
	.95	242	121	80	58	44	36	30	26	22	19	17	15	13	11	10	9	8	7	7	6
4	.50	72	36	24	18	14	12	10	9	8	7	7	6	6	5	5	5	4	4	4	4
	.55	80	40	27	20	16	13	11	10	9	8	7	7	6	6	5	5	5	4	4	4
	.60	89	44	30	22	18	15	13	11	10	9	8	7	7	6	6	5	5	5	4	4
	.65	99	49	33	24	19	16	14	12	11	9	9	8	7	7	6	6	5	5	5	4
	.70	109	54	36	27	21	18	15	13	12	10	9	9	8	7	7	6	6	5	5	4
	.75	121	60	40	30	23	19	17	14	13	11	10	9	8	8	7	7	6	6	5	4
	.80	135	67	44	33	26	21	18	16	14	12	11	10	9	9	8	7	7	6	6	5
	.85	152	75	50	37	29	24	20	18	16	14	12	11	10	9	9	8	8	7	7	6
	.90	175	87	57	42	33	27	23	20	18	16	14	13	12	11	10	9	8	8	7	7
	.95	204	100	66	48	37	30	25	22	19	17	15	13	12	11	10	9	8	7	7	6
5	.50	64	32	22	16	13	11	9	8	7	7	6	6	5	5	5	4	4	4	4	4
	.55	72	36	24	18	14	12	10	9	8	7	7	6	6	5	5	5	4	4	4	4
	.60	79	39	26	20	16	13	11	10	9	8	7	7	6	6	5	5	5	4	4	4
	.65	87	44	29	22	17	14	12	11	9	9	8	7	7	6	6	5	5	5	4	4
	.70	96	48	32	24	19	16	13	12	10	9	8	8	7	7	6	6	5	5	4	4
	.75	107	53	35	26	21	17	15	13	11	10	9	8	8	7	7	6	6	5	5	4
	.80	118	59	39	29	23	19	16	14	12	11	10	9	8	8	7	7	6	6	5	5
	.85	133	66	44	32	26	21	18	16	14	12	11	10	9	8	8	7	7	6	6	5
	.90	152	75	50	37	29	24	20	18	16	14	12	11	10	9	9	8	8	7	7	6
	.95	175	87	57	42	33	27	23	20	18	16	14	13	12	11	10	9	8	7	7	6

² Values represent required sample size for each sample.

Table 3.- POWER TABLES FOR ONE-WAY ANOVA

Approximate Power for Studies Using the Analysis of Variance Testing Hypotheses at the .05 Significance Level			
	Effect Size		
	Small	Medium	Large
	($\eta^2 = .01$)	($\eta^2 = .06$)	($\eta^2 = .14$)
Participants per Group (n)			
Three groups			
10	.07	.20	.45
20	.09	.38	.78
30	.12	.55	.93
40	.15	.68	.98
50	.18	.79	.99
100	.32	.98	*
Four groups			
10	.07	.21	.51
20	.10	.43	.85
30	.13	.61	.96
40	.16	.76	.99
50	.19	.85	*
100	.36	.99	*
Five groups			
10	.07	.23	.56
20	.10	.47	.90
30	.13	.67	.98
40	.17	.81	*
50	.21	.90	*
100	.40	*	*

Approximate Number of Participants Needed in Each Group (Assuming Equal Sample Sizes) to Achieve 80% Power for the One-way Analysis of Variance Testing Hypotheses at the .05 Significance Level

	Effect Size		
	Small	Medium	Large
	($\eta^2 = .01$)	($\eta^2 = .06$)	($\eta^2 = .14$)
Three groups	322	52	21
Four groups	274	45	18
Five groups	240	39	16

Table 4.- POWER TABLES FOR TWO-WAY ANOVA

Approximate Power for Studies Using 2 x 2 or 2 x 3 Analysis of Variance for Hypotheses Tested at the .05 Significance Level

N per Cell	Effect Size		
	Small ($\eta^2 = .01$)	Medium ($\eta^2 = .06$)	Large ($\eta^2 = .14$)
All effects in a 2 x 2 analysis:			
10	.09	.33	.68
20	.13	.60	.94
30	.19	.78	.99
40	.24	.89	*
50	.29	.94	*
100	.52	*	*
Two-level main effect in a 2 x 3 analysis:			
10	.11	.46	.84
20	.18	.77	.99
30	.26	.92	*
40	.34	.97	*
50	.41	.99	*
100	.70	*	*
Three-level main effect and interaction in a 2 x 3 analysis:			
10	.09	.36	.76
20	.14	.67	.98
30	.21	.86	*
40	.27	.94	*
50	.32	.98	*
100	.59	*	*

Approximate Number of Participants Needed in Each Cell (Assuming Equal Sample Sizes) for 80% Power for Studies Using a 2x2 or 2x3 Analysis of Variance, Testing Hypotheses at the .05 Significance Level

	Effect Size		
	Small ($\eta^2 = .01$)	Medium ($\eta^2 = .06$)	Large ($\eta^2 = .14$)
2 x 2: All effects	197	33	14
2 x 3: Two-level main effect	132	22	9
Three-level main effect and interaction	162	27	11

Table 5.- Power and Sample Size for Repeated Measures Analysis of Variance

Degrees of Freedom Treatments = 2, Alpha = .05

	ETA-squared															
Power	.01	.03	.05	.07	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65
.10	32	11	7	5	4	3	2	2	2	2	---	---	---	---	---	---
.50	247	81	48	34	23	15	11	8	7	6	5	4	3	3	3	2
.70	382	125	74	52	36	23	16	13	10	8	7	6	5	4	4	3
.80	478	157	93	65	44	28	20	15	12	10	8	7	6	5	4	4
.90	627	206	121	85	58	37	26	20	16	13	10	9	7	6	5	4
.95	765	251	148	104	70	45	32	24	19	15	13	10	9	7	6	5
.99	1060	347	204	143	97	62	44	33	26	21	17	14	12	10	8	7

Degrees of Freedom Treatments = 3, Alpha = .05

	ETA-squared															
Power	.01	.03	.05	.07	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65
.10	27	9	6	4	3	2	2	2	2	---	---	---	---	---	---	---
.50	191	63	37	27	18	12	9	7	5	5	4	3	3	3	2	2
.70	291	96	57	40	27	18	13	10	8	6	5	5	4	3	3	3
.80	361	118	70	49	34	22	16	12	9	8	6	5	5	4	3	3
.90	469	154	91	64	44	28	20	15	12	10	8	7	6	5	4	4
.95	568	186	110	77	53	33	24	18	14	12	10	8	7	6	5	4
.99	777	254	150	105	72	45	32	25	19	16	13	11	9	7	6	5

Degrees of Freedom Treatments = 4, Alpha = .05

	ETA-squared																
Power	.01	.03	.05	.07	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70
.10	24	8	5	4	3	2	2	2	2	---	---	---	---	---	---	---	---
.50	160	53	31	22	15	10	7	6	5	4	3	3	3	2	2	2	2
.70	241	79	47	33	23	15	11	8	7	5	5	4	3	3	3	2	2
.80	297	98	58	41	28	18	13	10	8	7	5	5	4	3	3	3	2
.90	382	126	74	52	36	23	16	13	10	8	7	6	5	4	4	3	3
.95	461	151	89	63	43	27	20	15	12	10	8	7	6	5	4	3	3
.99	626	205	121	85	58	37	26	20	16	13	10	9	7	6	5	4	4

*These tables are based on power estimates given by Cohen, J. (1977). Statistical power analysis for the behavioral sciences (2nd edition). New York: Academic Press.

**Given the imprecision of the procedures for estimating the necessary sample sizes, the values contained in these and other power tables here are approximate.

Table 6.- POWER TABLES FOR CHI-SQUARE

Cohen's Conventions for Cramer's Phi				
Smallest Dimension of Contingency Table		Effect Size		
		Small	Medium	Large
2 (df = 1)		.10	.30	.50
3 (df = 2)		.07	.21	.35
4 (df = 3)		.06	.17	.29

Approximate Power for the Chi-Square Test of Independence for Testing Hypotheses at the .05 Significance Level				
Total df	Total N	Effect Size		
		Small	Medium	Large
1	25	.08	.32	.70
	50	.11	.56	.94
	100	.17	.85	*
	200	.29	.99	*
2	25	.07	.25	.60
	50	.09	.46	.90
	100	.13	.77	*
	200	.23	.97	*
3	25	.07	.21	.54
	50	.08	.40	.86
	100	.12	.71	.99
	200	.19	.96	*
4	25	.06	.19	.50
	50	.08	.36	.82
	100	.11	.66	.99
	200	.17	.94	*

Approximate Total Number of Participants Needed for 80% Power for the Chi-Square Test of Independence for Testing Hypotheses at the .05 Significance Level			
Total df	Small	Effect Size Medium	Large
1	785	87	26
2	964	107	39
3	1090	121	44
4	1194	133	48