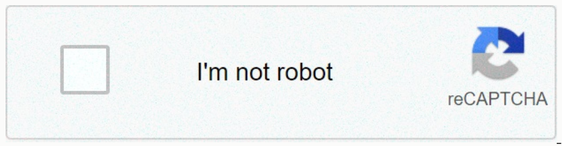

I am not robot!

Krejcie morgan table sample size. Morgan table for sample size. Morgan chart sample size. Morgan sample size.

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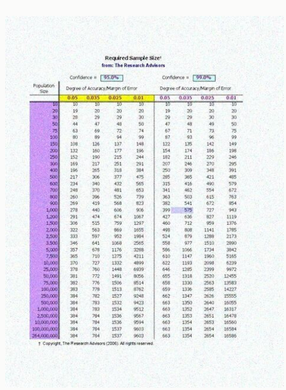

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BMJ. 2017;357:j2835. doi: 10.1136/bmj.j2835. [PMC free article] [PubMed] [CrossRef] [Google Scholar]2. Vandenbroucke JP, Von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. PLoS Med.

Table 1: History learners' responses with regard to a community-centred learning environment

	1 Rarely		2 Sometimes		3 Frequently		4 Usually		5 Almost always		Mean	SD
	F	%	F	%	F	%	F	%	f	%		
Q. 58	35	5.0	117	16.9	43	6.2	119	17.1	376	54.2	3.99	1.321
Q. 62	62	8.9	126	18.2	59	8.5	135	19.5	309	44.5	3.73	1.414
Q. 68	84	12.1	102	14.7	54	7.8	151	21.8	302	43.5	3.70	1.451
Q. 71	49	7.1	126	18.2	55	7.9	213	30.7	249	35.9	3.70	1.311
Q. 75	221	31.8	115	16.6	68	9.8	111	16.0	174	25.1	2.86	1.614
Q. 76	376	54.6	102	14.7	54	7.8	80	11.5	76	11.0	2.09	1.440
Q. 78	313	45.1	117	16.9	59	8.5	55	7.9	146	21.0	2.43	1.608
Q. 83	125	18.0	262	37.8	73	10.5	117	16.1	112	16.1	2.75	1.366
Q. 84	118	17.0	273	39.3	58	8.4	125	18.0	112	16.1	2.77	1.367
Q. 85	68	9.8	197	28.4	75	10.8	176	25.4	173	24.9	3.27	1.367
Q. 86	92	13.3	217	31.3	76	11.0	155	22.3	149	21.5	3.08	1.391
Q. 87	42	6.1	194	28.0	68	9.8	193	27.8	190	27.4	3.43	1.316
Q. 88	141	20.3	259	37.3	64	9.2	95	13.7	128	18.4	2.72	1.417
Q. 90	112	16.1	182	26.2	67	9.7	120	17.3	209	30.1	3.19	1.505

Source: BB Moreeng. 2009. Structuring of a Powerful Learning Environment for the teaching and learning of history in the Further Education and Training Band in the Free State Schools, p. 198.

Morgan sample size.

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	First half-split					Second half-split			
Sample	N	Mean	SD	SEM	Sample	N	Mean	SD	SEM
1	10	338.00	129.00	40.79	**38**	**240**	**246.86**	**147.18**	**9.50**
2	20	241.10	166.29	37.18	**39**	**245**	**250.04**	**143.44**	**9.16**
3	30	247.53	139.57	25.48	**40**	**250**	**253.19**	**148.98**	**9.42**
4	40	267.45	152.65	24.14	**41**	**255**	**252.68**	**148.64**	**9.31**
5	50	237.86	159.32	22.53	**42**	**260**	**258.90**	**139.93**	**8.68**
6	60	256.18	147.59	19.05	**43**	**265**	**250.04**	**149.70**	**9.20**
7	70	241.54	141.84	16.95	**44**	**270**	**258.39**	**146.05**	**8.89**
8	80	228.20	147.41	16.48	**45**	**275**	**257.18**	**144.70**	**8.73**
9	90	258.89	151.25	15.94	**46**	**280**	**262.11**	**145.06**	**8.67**
10	100	253.79	138.91	13.89	**47**	**285**	**247.39**	**141.93**	**8.41**
11	105	250.55	148.14	14.46	**48**	**290**	**244.36**	**149.45**	**8.78**
12	110	228.98	140.55	13.40	**49**	**295**	**244.22**	**147.31**	**8.58**
13	115	249.13	135.03	12.59	**50**	**300**	**248.69**	**143.48**	**8.28**
14	120	268.83	138.65	12.66	**51**	**305**	**248.51**	**145.96**	**8.36**
15	125	258.04	143.29	12.82	**52**	**310**	**245.42**	**142.41**	**8.09**
16	130	244.76	139.77	12.26	**53**	**320**	**241.54**	**141.06**	**7.89**
17	135	257.89	151.93	13.08	**54**	**330**	**249.58**	**149.25**	**8.22**
18	140	256.84	147.34	12.45	**55**	**340**	**251.13**	**147.23**	**7.98**
19	145	253.63	147.70	12.27	**56**	**350**	**252.54**	**147.62**	**7.89**
20	150	247.93	145.03	11.84	**57**	**499**	**305.10**	**147.03**	**6.58**
21	155	251.81	151.04	12.13	**58**	**370**	**250.29**	**144.08**	**7.49**
22	160	254.04	146.08	11.55	**59**	**380**	**246.26**	**141.94**	**7.28**
23	165	260.06	141.32	11.00	**60**	**390**	**248.88**	**144.87**	**7.34**
24	170	242.75	144.65	11.09	**61**	**400**	**249.54**	**144.08**	**7.20**
25	175	250.86	145.38	10.99	**62**	**410**	**254.44**	**142.30**	**7.03**
26	180	244.99	146.27	10.90	**63**	**420**	**251.26**	**145.16**	**7.08**
27	185	257.81	137.72	10.13	**64**	**430**	**248.18**	**144.90**	**6.99**
28	190	250.66	144.35	10.47	**65**	**440**	**249.61**	**142.22**	**6.78**
29	195	253.89	142.73	10.22	**66**	**450**	**252.38**	**144.23**	**6.80**
30	200	259.25	143.79	10.17	**67**	**460**	**253.96**	**144.04**	**6.72**
31	205	258.39	147.85	10.33	**68**	**470**	**251.74**	**144.50**	**6.67**
32	210	261.70	137.78	9.51	**69**	**475**	**250.09**	**145.29**	**6.70**
33	215	261.13	148.30	10.11	**70**	**480**	**251.75**	**145.40**	**6.64**
34	220	246.07	145.99	9.84	**71**	**490**	**249.81**	**145.29**	**6.56**
35	225	245.66	143.94	9.60	**72**	**495**	**249.71**	**144.26**	**6.48**
36	230	240.77	145.15	9.57	**73**	**499**	**250.45**	**144.62**	**6.47**
37	235	248.90	147.96	9.65	**Population**	**500**	**250.50**	**144.48**	**6.46**

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* Copyright, 2006, The Research Advisors ( ), All rights reserved. 1.
Pandis N, Chung B, Scherer RW, Elbourne D, Altman DG. CONSORT 2010 statement: extension checklist for reporting within person randomised trials. BMJ. 2017;357:j2835. doi: 10.1136/bmj.j2835. [PMC free article] [PubMed] [CrossRef] [Google Scholar]2. Vandenbroucke JP, Von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. PLoS Med. 2007;4:e297. doi: 10.1371/journal.pmed.0040297. [PMC free article] [PubMed] [CrossRef] [Google Scholar]3. Chia KS.
"Significant-itis" — an obsession with the P-value.

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size
"S" is sample size.

Krejcie, Robert V., Morgan, Daryle W., "Determining Sample Size for Research Activities", Educational and Psychological Measurement, 1970.

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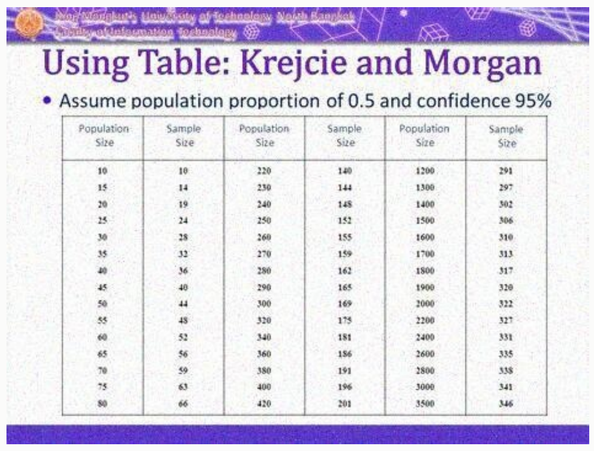

Population Size	Sample Size	Population Size	Sample Size	Population Size	Sample Size
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346

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But why bother with these formulas? It is possible to use one of them to construct a table that suggests the optimal sample size – given a population size, a specific margin of error, and a desired confidence interval. This can help researchers avoid the formulas altogether. The table below presents the results of one set of these calculations. It may be used to determine the appropriate sample size for almost any study. Many researchers (and research texts) suggest that the first column within the table should suffice (Confidence Level = 95%, Margin of Error = 5%). To use these values, simply determine the size of the population down the left most column (use the next highest value if your exact population size is not listed). The value in the next column is the sample size that is required to generate a Margin of Error of ± 5% for any population proportion. However, a 10% interval may be considered unreasonably large. Should more precision be required (i.e., a smaller, more useful Margin of Error) or greater confidence desired (0.01), the other columns of the table should be employed.
Thus, if you have 5000 customers and you want to sample a sufficient number to generate a 95% confidence interval that predicted the proportion who would be repeat customers within plus or minus 2.5%, you would need responses from a (random) sample of 1176 of all your customers. As you can see, using the table is much simpler than employing a formula. Professional researchers typically set a sample size level of about 500 to optimally estimate a single population parameter (e.g., the proportion of likely voters who will vote for a particular candidate). This will construct a 95% confidence interval with a Margin of Error of about ±4.4% (for large populations). Since there is an inverse relationship between sample size and the Margin of Error, smaller sample sizes will yield larger Margins of Error. For example, a sample size of only 100 will construct a 95% confidence interval with a Margin of Error of almost ±13%, too large a range for estimating the true population proportion with any accuracy. Note that all of the sample estimates discussed present figures for the largest possible sample size for the desired level of confidence. Should the proportion of the sample with the desired characteristic be substantially different than 50%, then the desired level of accuracy can be established with a smaller sample. However, since you can't know what this percentage is until you actually ask a sample, it is wisest to assume that it will be 50% and use the listed larger sample size. The number of sub-groups (or "comparison" groups) is another consideration in the determination of a sufficient sample size. Since the parameter must be measured for each sub-group, the size of the sample for each sub-group must be sufficiently large to permit a reasonable (sufficiently narrow) estimation. Treat each sub-group as a population and then use the table to determine the recommended sample size for each sub-group. Then use a stratified random sampling technique within each sub-group to select the specific individuals to be included. If you would like to calculate sample sizes for different population sizes, confidence levels, or margins of error, download the Sample Size spreadsheet and change the input values to those desired. Download the spreadsheet by clicking on the download button: Note: The spreadsheet was designed for a 17" monitor, so you may have to resize it ("Zoom" it out). The formula used for these calculations was: This formula is the one used by Krejcie & Morgan in their 1970 article "Determining Sample Size for Research Activities" (Educational and Psychological Measurement, #30, pp. 607-610). * Copyright, 2006, The Research Advisors ( ), All rights reserved.
1. Pandis N, Chung B, Scherer RW, Elbourne D, Altman DG. CONSORT 2010 statement: extension checklist for reporting within person randomised trials. BMJ. 2017;357:j2835. doi: 10.1136/bmj.j2835. [PMC free article] [PubMed] [CrossRef] [Google Scholar]2. Vandenbroucke JP, Von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. PLoS Med. 2007;4:e297. doi: 10.1371/journal.pmed.0040297. [PMC free article] [PubMed] [CrossRef] [Google Scholar]3. Chia KS. "Significant-itis" — an obsession with the P-value.
Scand J Work Environ Health. 1997;23:152–154.
doi: 10.5271/sjweh.193. [PubMed] [CrossRef] [Google Scholar]4. Cohen J. The earth is round (P < 0.05) Am Psychol. 1994;47:997–1003. doi: 10.1037/0003-066X.49.12.997. [CrossRef] [Google Scholar]5. Gelman A. P-values and statistical practice. Epidemiology. 2013;24:69–72. doi: 10.1097/EDE.0b013e31827886f7. [PubMed] [CrossRef] [Google Scholar]6.
Casella G, Berger RL. Statistical inference. Pacific Grove, CA: Duxbury Press; 2002. [Google Scholar]7.
Evans M, Hastings N, Peacock B. Statistical distributions. 3rd ed. New York: Wiley; 2000.
[Google Scholar]8. Ferguson CJ. An effect size primer: a guide for clinicians and researchers. Prof Psychol Res Pr. 2009;40:532–538. doi: 10.1037/a0015808. [CrossRef] [Google Scholar]9. Cohen J. A power primer.
Psychol Bull. 1992;112:155–159.
doi: 10.1037/0033-2909.112.1.155. [PubMed] [CrossRef] [Google Scholar]10. Krejcie RV, Morgan DW. Determining sample size for research activities. Educ Psychol Meas.
1970;30:607–610. doi: 10.1177/001316447003000308. [CrossRef] [Google Scholar]11. Bujang MA, Baharum N. Guidelines of the minimum sample size requirements for Kappa agreement test.
Epidemiology, Biostatistics, and Public Health. 2017;14(2):e12267–1. doi: 10.2427/12267. [CrossRef] [Google Scholar]12. Bujang MA, Adnan TH. Requirements for minimum sample size for sensitivity and specificity analysis. J Clin Diagn Res. 2016;10(10):YE01–YE06. doi: 10.7860/JCDR/2016/18129.8744. [PMC free article] [PubMed] [CrossRef] [Google Scholar]13. Peduzzi P, Concato J, Feinstein AR, Holford TR. Importance of events per independent variable in proportional hazards regression analysis. II. Accuracy and precision of regression estimates. J Clin Epidemiol. 1995;48:1503–1510. doi: 10.1016/0895-4356(95)00048-8.
[PubMed] [CrossRef] [Google Scholar]14. Peduzzi P, Concato J, Kemper E, Holford TR, Feinstein AR. A simulation study of the number of events per variable in logistic regression analysis.
J Clin Epidemiol. 1996;49:1373–1379. doi: 10.1016/S0895-4356(96)00236-3. [PubMed] [CrossRef] [Google Scholar]15.
MacCallum RC, Widaman KF, Zhang S, Hong S. Sample size in factor analysis. Psychol Methods.
1999;4:84–99. doi: 10.1037/1082-989X.4.1.84. [CrossRef] [Google Scholar]16. Lachin JM. Introduction to sample size determination and power analysis for clinical trials. Controlled Clin Trials. 1981;2(2):93–113. doi: 10.1016/0197-2456(81)90001-5. [PubMed] [CrossRef] [Google Scholar]17. Campbell MJ, Julious SA, Altman DG. Estimating sample sizes for binary, ordered categorical, and continuous outcomes in two group comparisons. BMJ. 1995;311:1145–1148. doi: 10.1136/bmj.311.7013.1145.
[PMC free article] [PubMed] [CrossRef] [Google Scholar]18. Bartlett JE, Kotrlik JW, Higgins C. Organizational research: determining appropriate sample size for survey research. Inf Technol Learn Perform J. 2001;19:43–50. [Google Scholar]19. Israel GD. Determining sample size (Tech Rep No PEOD-6) Florida: University of Florida Institute of Food and Agricultural Sciences; 2003. [Google Scholar]20. Naing L, Winn T, Rusli BN. Practical issues in calculating the sample size for prevalence studies. Archives of Orofacial Sciences. 2006;1:9–14. [Google Scholar]21. Algina J, Olejnik S. Sample size tables for correlation analysis with applications in partial correlation and multiple regression analysis. Multivar Behav Res. 2003;38:309–323. doi: 10.1207/S15327906MBR3803_02. [PubMed] [CrossRef] [Google Scholar]22. Bujang MA, Nurakmal B. Sample size guideline for correlation analysis. World Journal of Social Science Research. 2016;3(1):37–46. doi: 10.22158/wjssr.v3n1p37. [CrossRef] [Google Scholar]23. Fleiss J, Cohen J. The equivalence of weighted kappa and the intraclass correlation coefficient as measures of reliability. Edu Psychol Meas. 1973;33:613–619. doi: 10.1177/001316447303300309. [CrossRef] [Google Scholar]24. Bonett DG. Sample size requirements for estimating intraclass correlations with desired precision. Stat Med. 2002;21:1331–1335. doi: 10.1002/sim.1108. [PubMed] [CrossRef] [Google Scholar]25. Zou GY. Sample size formulas for estimating intraclass correlation coefficients with precision and assurance. Stat Med. 2012;31(29):3972–3981. doi: 10.1002/sim.5466. [PubMed] [CrossRef] [Google Scholar]26. Bujang MA, Baharum N. A simplified guide to determination of sample size requirements for estimating the value of intraclass correlation coefficient: a review.
Arch Orofac Sci. 2017;12:1–11. [Google Scholar]27. Cicchetti DV. Testing the normal approximation and minimal sample size requirements of weighted kappa when the number of categories is large. Appl Psychol Meas. 1981;5(1):101–104. doi: 10.1177/014662168100500114. [CrossRef] [Google Scholar]28. Flack V, Afifi A, Lachenbruch P. Sample size determinations for the two rater kappa statistic. Psychometrika. 1988;53:321–325. doi: 10.1007/BF02294215. [CrossRef] [Google Scholar]29. Cantor AB. Sample-size calculations for Cohen's kappa. Psychol Methods. 1996;1(2):150–153. doi: 10.1037/1082-989X.1.2.150. [CrossRef] [Google Scholar]30. Sim J, Wright CC. The kappa statistic in reliability studies: use, interpretation, and sample size requirements.
Phys Ther.
2005;85:257–268.
doi: 10.1093/ptj/85.3.257.
[PubMed] [CrossRef] [Google Scholar]31. Dupont WD, Plummer WD. Power and sample size calculations for studies involving linear regression. Control Clin Trials. 1998;19:589–601. doi: 10.1016/S0197-2456(98)00037-3.
[PubMed] [CrossRef] [Google Scholar]32.
Jan SL, Shieh G. Sample size determinations for Welch's test in one-way heteroscedastic ANOVA. Br J Math Psychol. 2014;67:72–93. doi: 10.1111/bmsp.12006. [PubMed] [CrossRef] [Google Scholar]33. Bonett DG. Sample size requirements for testing and estimating coefficient alpha. J Educ Behav Stat.
2002;27:335–340. doi: 10.3102/10769986027004335. [CrossRef] [Google Scholar]34. Bonett DG. Sample size requirements for comparing two alpha coefficients. Appl Psychol Meas. 2003;27(1):72–74. doi: 10.1177/0146621602239477. [CrossRef] [Google Scholar]35. Bonett DG, Wright TA. Cronbach's alpha reliability: interval estimation, hypothesis testing, and sample size planning. J Organ Behav. 2015;36(1):3–15. doi: 10.1002/job.1960. [CrossRef] [Google Scholar]36. Bujang MA, Omar ED, Baharum NA. A review on sample size determination for Cronbach's alpha test: a simple guide for researchers. Malays J Med Sci. 2018;25(6):85–99. doi: 10.21315/mjms2018.25.6.9. [PMC free article]
[PubMed] [CrossRef] [Google Scholar]37. Buderer NM. Statistical methodology: incorporating the prevalence of disease into the sample size calculation for sensitivity and specificity. Acad Emerg Med. 1996;3:895–900. doi: 10.1111/j.1553-2712.1996.tb03538.x. [PubMed] [CrossRef] [Google Scholar]38. Malhotra RK, Indrayan A. Simple nomogram for estimating sample size for sensitivity and specificity of medical tests. Indian J Ophthalmol. 2010;58:519–522. doi: 10.4103/0301-4738.71699. [PMC free article] [PubMed] [CrossRef] [Google Scholar]39.
Hsieh FY, Bloch DA, Larsen MD. A simple method of sample size calculation for linear and logistic regression. Stat Med. 1998;17(14):1623–1634. doi: 10.1002/(SICI)1097-0258(19980730)17:14<1623::AID-SIM871>3.0.CO;2-S. [PubMed] [CrossRef] [Google Scholar]40. Knofczynski GT, Mundfrom D. Sample sizes when using multiple linear regression for prediction. Educ Psychol Meas. 2008;68(3):431–442. doi: 10.1177/0013164407310131. [CrossRef] [Google Scholar]41. Tabachnick BG, Fidell LS.
Using multivariate statistics. 6th ed. Boston: Pearson Education; 2013. [Google Scholar]42. Bujang MA, Sa'at N, Tg Abu Bakar Sidik TMI. Determination of minimum sample size requirement for multiple linear regression and analysis of covariance based on experimental and non-experimental studies. Epidemiology Biostatistics and Public Health.
2017;14(3):e12117–1. doi: 10.2427/1211.
[CrossRef] [Google Scholar]43. Borm GF, Fransen J, Lemmens WA. A simple sample size formula for analysis of covariance in randomized clinical trials. J Clin Epidemiol. 2007;60:1234–1238.
doi: 10.1016/j.jclinepi.2007.02.006. [PubMed] [CrossRef] [Google Scholar]44. Bujang MA, Sa'at N, Tg Abu Bakar Sidik TMI, Lim CH. Sample size guidelines for logistic regression from observational studies with large population: emphasis on the accuracy between statistics and parameters based on real life clinical data. Malays J Med Sci.
2018;25(4):122–130. doi: 10.21315/mjms2018.25.4.12. [PMC free article] [PubMed] [CrossRef] [Google Scholar]45. Lachin JM, Foulkes MA.
Evaluation of sample size and power for analyses of survival with allowance for nonuniform patient entry, losses to follow-up, noncompliance, and stratification. Biometrics. 1986;42:507–519. doi: 10.2307/2531201. [PubMed] [CrossRef] [Google Scholar]46. Hsieh FY, Lavori PW. Sample-size calculations for the Cox proportional hazards regression model with nonbinary covariates. Control Clin Trials.
2000;21:552–560. doi: 10.1016/S0197-2456(00)00104-5. [PubMed] [CrossRef] [Google Scholar]47. Schmoor C, Sauerbrei W, Schumacher M. Sample size considerations for the evaluation of prognostic factors in survival analysis. Stat Med. 2000;19:441–452. doi: 10.1002/(SICI)1097-0258(20000229)19:4<441::AIDSIM349>3.0.CO;2-N. [PubMed] [CrossRef] [Google Scholar]48. Barrett PT, Kline P. The observation to variable ratio in factor analysis. Personality Study in Group Behavior 1981. 1:23–33. [Google Scholar]49. Osborne J, Costello A. Sample size and subject to item ratio in principal components analysis. Practical Assessment, Research & Evaluation. 2004;9(11) doi: 10.7275/ktzq-jq66. Article 11. [CrossRef] [Google Scholar]50. Bujang MA, Ab Ghani P, Soelar SA, Zulkifli NA. Sample size guideline for exploratory factor analysis when using small sample: taking into considerations of different measurement scales. Statistics in Science, Business, and Engineering (ICSSBE) 2012; Langkawi, Malaysia.
10–12 September 2012; [CrossRef] [Google Scholar]51. Bujang MA, Ghani PA, Soelar SA, Zulkifli NA, Omar ED. Invalid skewed responses contributes to invalid factor solution in exploratory factor analysis: a validation approach using real-life data. J Behav Health.
2019;8(4):152–160. doi: 10.5455/jbh.20190628084939. [CrossRef] [Google Scholar]52. Kraemer HC, Mintz J, Noda A, Tinklenberg J, Yesavge JA. Caution regarding the use of pilot studies to guide power calculations for study proposals. Arch Gen Psychiatry.
2006;63:484–489.
doi: 10.1001/archpsyc.63.5.484. [PubMed] [CrossRef] [Google Scholar]53. Leon AC, Davis LL, Kraemer HC. The role and interpretation of pilot studies in clinical research. J Psychiatr Res. 2011;45:626–629. doi: 10.1016/j.jpsychires.2010.10.008. [PMC free article] [PubMed] [CrossRef] [Google Scholar]54. Julious SA. Sample size of 12 per group rule of thumb for a pilot study. Pharm Stat. 2005;4(4):287–291. doi: 10.1002/pst.185. [CrossRef] [Google Scholar]55. Hertzog MA. Considerations in determining sample size for pilot studies. Res Nurs Health. 2008;31(2):180–191. doi: 10.1002/nur.20247. [PubMed] [CrossRef] [Google Scholar]56. Johanson GA, Brooks G. Initial scale development: sample size for pilot studies. Educ Psychol Meas. 2010;70:394–400. doi: 10.1177/0013164409355692. [CrossRef] [Google Scholar]57. Sim J, Lewis M. The size of a pilot study for a clinical trial should be calculated in relation to considerations of precision and efficiency. J Clin Epidemiol. 2012;65:301–308. doi: 10.1016/j.jclinepi.2011.07.011. [PubMed] [CrossRef] [Google Scholar]58. Stallard N. Optimal sample sizes for phase II clinical trials and pilot studies. Stat Med. 2012;31:1031–1042. doi: 10.1002/sim.4357. [PubMed] [CrossRef] [Google Scholar]59. Cocks K, Torgerson DJ. Sample size calculations for pilot randomized trials: a confidence interval approach. J Clin Epidemiol. 2013;66(2):197–201.
doi: 10.1016/j.jclinepi.2012.09.002. [PubMed] [CrossRef] [Google Scholar]60. Teare MD, Dimairo M, Shephard N, Hayman A, Whitehead A, Walters SJ. Sample size requirements to estimate key design parameters from external pilot randomised controlled trials: a simulation study. Trials. 2014;15(1):264–276.
doi: 10.1186/1745-6215-15-264. [PMC free article] [PubMed] [CrossRef] [Google Scholar]61.
Whitehead AL, Julious SA, Cooper CL, Campbell MJ. Estimating the sample size for a pilot randomised trial to minimise the overall trial sample size for the external pilot and main trial for a continuous outcome variable. Stat Methods Med Res. 2015;25(3):1057–1073.
doi: 10.1177/0962280215588241.
[PMC free article] [PubMed] [CrossRef] [Google Scholar]Page 2Summary of published articles related to sample size determination for various statistical testsPublished articlesa.To estimate parameters for populationKrejcie and Morgan (10), Lachin (16), Campbell et al. (17), Bartlett et al. (18), Israel (19), Naing et al. (20).b.To infer the results for larger populationCorrelationCohen (9), Algina and Olejnik (21), Bujang and Nurakmal (22).Intra-class correlationFleiss and Cohen (23), Bonett (24), Zou (25), Bujang and Baharum (26).Kappa agreement testCicchetti (27), Flack et al. (28), Cantor (29), Sim and Wright (30), Bujang and Baharum (11).Independent sample t-test and paired t-testLachin (16), Cohen (9), Dupont and Plummer (31).One-way ANOVACohen (9), Jan and Shieh (32).Pearson's chi-squareLachin (16), Cohen (9), Dupont and Plummer (31).Cronbach's alphaBonett (33), Bonett (34), Bonett and Wright (35), Bujang et al. (36).Sensitivity and specificityBuderer (37), Malhotra and Indrayan (38), Bujang and Adnan (12).Linear regression or Multiple linear regressionCohen (9), Dupont and Plummer (31), Hsieh et al. (39), Knofczynski and Mundfrom (40), Tabachnick and Fidell (41), Bujang et al. (42).Analysis of covarianceBorm et al. (43), Bujang et al. (44).Logistic regressionPeduzzi et al. (14), Hsieh et al. (39), Bujang et al. (44).Survival analysisLachin (16), Lachin and Foulkes (45), Dupont and Plummer (31).Cox regressionPeduzzi et al. (13), Hsieh and Lavori (46), Schmoor et al. (47).Exploratory factor analysisBarrett and Kline (48), Osborne and Costello (49), Bujang et al. (50), Bujang et al. (51).