

Your choices:

Test chosen: Sample size for unpaired t test
Expected SD of each group = 65
Significance level (alpha) = 0.05 (two-tailed)

Detailed explanation:

You requested a detailed explanation for $N = 25$ and power = 80%.

Assume that the true difference between means is 52.68. Now imagine that you perform many experiments, with $N = 25$ per group in each experiment. Due to random sampling, you won't find that the difference between means equals 52.68 in every experiment. Instead, you'll find that the difference between means will be greater than 52.68 in about half the experiments, and less than 52.68 in the other half.

In 80% (the power) of those experiments, the P value will be less than 0.05 (two-tailed) so the results will be deemed "statistically significant". In the remaining 20% of the experiments, the difference between means will be deemed "not statistically significant", so you will have made a Type II (beta) error.

Summary: A sample size of 25 in each group has a 80% power to detect a difference between means of 52.68 with a significance level (alpha) of 0.05 (two-tailed).

Alternative explanation using confidence intervals:

If you perform many experiments with $N = 25$ in each group, you expect that in 80% of these experiments (the power), the width of the 95% confidence interval for the difference between means will extend 52.68 or less in each direction. In the remaining 20% of the experiments, you will expect the 95% confidence interval to be wider than that.

Table of tradeoffs:

For any combination of sample size (N) and power, this table shows the difference between means that can be detected.

N per group	Power				
	99%	95%	90%	80%	50%
3	289.41	243.40	218.87	189.17	132.34
4	232.76	195.76	176.03	152.14	106.43
5	200.19	168.36	151.40	130.85	91.54
6	178.37	150.01	134.89	116.59	81.56

7	162.44	136.61	122.84	106.17	74.28
8	150.14	126.27	113.54	98.13	68.65
9	140.28	117.97	106.08	91.69	64.14
10	132.14	111.13	99.93	86.37	60.42
12	119.37	100.39	90.28	78.02	54.58
14	109.72	92.27	82.97	71.71	50.17
16	102.08	85.85	77.20	66.72	46.68
18	95.84	80.61	72.48	62.65	43.83
20	90.63	76.22	68.54	59.24	41.44
25	80.59	67.78	60.95	52.68	36.85
30	73.29	61.64	55.42	47.90	33.51
35	67.67	56.91	51.17	44.23	30.94
40	63.17	53.13	47.77	41.29	28.88
50	56.34	47.38	42.61	36.83	25.76
60	51.34	43.17	38.82	33.55	23.47
70	47.47	39.92	35.90	31.02	21.70
80	44.36	37.30	33.54	28.99	20.28
90	41.79	35.14	31.60	27.31	19.11
100	39.62	33.32	29.96	25.89	18.12
150	32.29	27.16	24.42	21.10	14.76
200	27.94	23.50	21.13	18.26	12.77
300	22.79	19.17	17.23	14.90	10.42
400	19.73	16.59	14.92	12.89	9.02
500	17.64	14.84	13.34	11.53	8.07
1000	12.47	10.48	9.43	8.15	5.70

If you want to use unequal N:

Instead of using 25 subjects in each group, you can use unequal N. Substitute any of the following experimental designs, without losing any statistical power. Note that total sample size increases if you use unequal N (you must increase N for Group B more than you decrease N for group A). This can make sense if treatment A "costs" more (considering expense, hassle and risk) than treatment B. Even though the total sample size goes up, choosing unequal N may reduce the total cost (or risk) of the experiment.

Sample size

Group A	Group B	Ratio	Total	When to choose
25	25	1.000	50	If the "cost" of treatment A is 1.0 times the "cost" of treatment B.
23	29	1.250	52	If the "cost" of treatment A is 1.6 times the "cost" of treatment B.
21	32	1.500	53	If the "cost" of treatment A is 2.3 times the "cost" of treatment B.
19	38	2.000	57	If the "cost" of treatment A is 4.0 times the "cost" of treatment B.
17	51	3.000	68	If the "cost" of treatment A is 9.0 times the "cost" of treatment B.
16	64	4.000	80	If the "cost" of treatment A is 16.0 times the "cost" of treatment B.
15	75	5.000	90	If the "cost" of treatment A is 25.0 times the "cost" of treatment B.

You cannot reduce the sample size of Group A to fewer than half the number needed if you choose equal sample size (without losing statistical power).