Sample size justification for postural sway study

This program evaluates various sample size calculations for a proposed replication of the postural-sway study in a different population. It was written by Steve Simon on 2024-10-08 and is placed in the public domain.

Scenario 1

- Replicate postural sway study
  - Different populations
  - Same outcome measure
- Research hypothesis, H_0 $\mu_1 - \mu_2 = 0$
- Standard deviations: 9.77, 4.09
- MCID = 4

```
power.t.test(
  n=NULL,
  delta=4,
  sd=9.8,
  sig.level=0.05,
  power=0.9,
  type="two.sample",
  alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 127.1097
          delta = 4
             sd = 9.8
      sig.level = 0.05
          power = 0.9
    alternative = two.sided

NOTE: n is number in *each* group
```

With a sample of 128 patients, we would have 90% power for detecting a 4 unit difference in postural sway, using a two-sided test at an alpha level of 0.05.

Scenario 2, MCID = 2

```
power.t.test(
  n=NULL,
  delta=2,
  sd=9.8,
  sig.level=0.05,
```

```
          power=0.9,
          type="two.sample",
          alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 505.5288
          delta = 2
             sd = 9.8
      sig.level = 0.05
          power = 0.9
    alternative = two.sided

NOTE: n is number in *each* group
```

If we wanted to be able to detect a 2 unit difference, we would need a sample size that is about four times as large.

Scenario 3, MCID=8

```
        power.t.test(
          n=NULL,
          delta=8,
          sd=9.8,
          sig.level=0.05,
          power=0.9,
          type="two.sample",
          alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 32.52648
          delta = 8
             sd = 9.8
      sig.level = 0.05
          power = 0.9
    alternative = two.sided

NOTE: n is number in *each* group
```

If we wanted to be able to detect a 8 unit difference, we would need a sample size that is about four times as smaller.

Scenario 4, sd=4.9

```
power.t.test(
  n=NULL,
  delta=4,
  sd=4.9,
  sig.level=0.05,
  power=0.9,
  type="two.sample",
  alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 32.52648
          delta = 4
             sd = 4.9
      sig.level = 0.05
          power = 0.9
    alternative = two.sided

NOTE: n is number in *each* group
```

With half of the standard deviation, if we wanted to be able to detect a 4 unit difference, we would need a sample size of 32 patients.

Scenario 5, sd=19.6

```
power.t.test(
  n=NULL,
  delta=4,
  sd=19.6,
  sig.level=0.05,
  power=0.9,
  type="two.sample",
  alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 505.5288
          delta = 4
             sd = 19.6
      sig.level = 0.05
          power = 0.9
    alternative = two.sided

NOTE: n is number in *each* group
```

For the double of the standard deviation, if we wanted to be able to detect a 4 unit difference, we would need a sample size of 505 patients.

Scenario 6, alpha=0.01

```
power.t.test(
  n=NULL,
  delta=4,
  sd=9.8,
  sig.level=0.01,
  power=0.9,
  type="two.sample",
  alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 180.2936
          delta = 4
             sd = 9.8
      sig.level = 0.01
          power = 0.9
    alternative = two.sided

NOTE: n is number in *each* group
```

For the significant level of 1% with standard deviation is 9.8, if we wanted to be able to detect a 4 unit difference, we would need a sample size of 180 patients.

Scenario 7, alpha=0.10

```
power.t.test(
  n=NULL,
  delta=4,
  sd=9.8,
  sig.level=0.1,
  power=0.9,
  type="two.sample",
  alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 103.4925
          delta = 4
             sd = 9.8
```

```
      sig.level = 0.1
          power = 0.9
    alternative = two.sided

NOTE: n is number in *each* group
```

For the significant level of 10% with standard deviation is 9.8, if we wanted to be able to detect a 4 unit difference, we would need a sample size of 103 patients.

Scenario 8, power=0.8

```
power.t.test(
  n=NULL,
  delta=4,
  sd=9.8,
  sig.level=0.1,
  power=0.8,
  type="two.sample",
  alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 74.90726
          delta = 4
             sd = 9.8
      sig.level = 0.1
          power = 0.8
    alternative = two.sided

NOTE: n is number in *each* group
```

With the power decrease by 0.1 and a 9.8 standard deviation, if we wanted to be able to detect a 4 unit difference, we would need a sample size of 75 patients.

Scenario 9, power=0.95

```
power.t.test(
  n=NULL,
  delta=4,
  sd=9.8,
  sig.level=0.1,
  power=0.95,
  type="two.sample",
  alternative="two.sided")
```

```
     Two-sample t test power calculation

              n = 130.6025
          delta = 4
             sd = 9.8
      sig.level = 0.1
          power = 0.95
    alternative = two.sided

NOTE: n is number in *each* group
```

With the power increase by 0.15 and a 9.8 standard deviation, if we wanted to be able to detect a 4 unit difference, we would need a sample size of 130 patients.