In a fictional study, the influence of a television program on children's aggressiveness was examined. The number of aggressive responses was measured during an observation period after viewing the television program. Imagine that the known national average for number of aggressive responses typically performed by children who do not watch television is 6.647.   
(a) Perform the six steps of hypothesis testing using the following data and a one-tailed test to determine if there is an increase in the number of aggressive behaviors in children after having viewed the television program using p <.05.  
(b) Compute the effect size and interpret its meaning.   
  
Table: TV and Aggressiveness

|  |  |
| --- | --- |
| Participant | Aggression after viewing the TV show |
| 1 | 9 |
| 2 | 3 |
| 3 | 11 |
| 4 | 12 |
| 5 | 14 |
| 6 | 6 |
| 7 | 12 |

Step 1:

* Is the DV scale? Yes it’s a ratio scale
* Normal? I don't know and N < 30 so I can’t assume
* Random selected? Probably not, can’t randomly assign

Step 2:

R: TV show > known aggression in kids

N: TV show <= known aggression in kids

DV: aggressive acts

Step 3:

M 9.571 um = 6.647

SD (S) 3.87

SE (Sm) 1.46

N 7

Step 4:

df = 6

t critical = 1.94

Step 5:

T found = 2.01

Step 6:

Reject the null

D = .76 close to large effect so the children’s aggressiveness went up significantly and it was a large effect.

Television has been known to have an effect on the popularity of things. For example, popular shows about lawyers have preceded increased applications to law school, and the latest boom in shows about criminal profiling has increased students' interest in forensic psychology. A student double-majoring in psychology and marketing was interested in whether the popularity of a song could be affected by its appearance on a popular television show about a high school singing group. He tracks the sales of music before and after the music is performed on the show. Hypothetical data (in millions) follow:  
  
Table: Sales: Before and After

|  |  |
| --- | --- |
| Sales before TV appearance | Sales after the song was covered on TV |
| 1.3 | 1.7 |
| 0.9 | 1.4 |
| 3.1 | 1.2 |
| 1.6 | 1.8 |

(a) Compute the paired-samples *t* test and make a decision about a two-tailed hypothesis with a *p* level of 0.05 (list all six steps).   
(b) Compute a 95% confidence interval for the mean difference.   
(c) Compute Cohen's *d* as a measure of effect size and interpret its meaning.

Step 1:

* Is the dv scale? Yes, ratio
* Normal? Don’t know N < 30 so can’t assume
* Randomly select? Yes could

Step 2:

R: Difference of after – before =/ no differences expected

N: Difference of after – before = no difference expected

Step 3:

Mdifference = -.200 um = 0

SD 1.14

SE .57

N 4

Step 4:

Df = 3

P < .05

Two tailed test!

T critical + and – 3.18

Step 5:

T found = -.35

Step 6:

FAIL to reject

No differences

CI of the difference

95 percent confidence interval:

-2.014274 1.614274

d = -.18

Mehl (2007) reported in the journal *Science* the results of an extensive study of 396 men and women, comparing the number of words uttered per day by each sex. Volunteer participants wore inconspicuous recording devices that recorded the subjects' daily word usage. Is there any validity to the notion that women talk more than men do? The following fictional data produce results similar to those obtained by Mehl (2007).

(a) Perform all six steps of hypothesis testing on the data to answer this question using p < .01.  
  
Table: Word Usage and Gender

|  |  |
| --- | --- |
| Women | Men |
| 17,214 | 16,322 |
| 15,325 | 14,636 |
| 14,022 | 17,045 |
| 18,643 | 18,873 |
| 15,800 | 13,071 |

Step 1:

* Is the dv scale – yes ratio
* Normal – don’t know N < 30 so can’t assume
* Random select – no, randomly assign – no
* Homogeneity - ? roughly equal sd so yes

Step 2:

R: women > men

N: women < = men

Step 3:

|  |  |
| --- | --- |
| Women | Men |
| M 16201 | M 15989 |
| SD 1779.449 | SD 2229.844 |
| N 5 | N 5 |

Spooled 2017.256

Sdifference 1275.825

Step 4:

P < .01

One tailed test

Df = 5 – 1 + 5 – 1 = 8

T critical = 2.90

Step 5:

T found = 0.1657

Step 6:

Fail to reject

D = .11

CI of the difference =

99 percent confidence interval:

-4069.485 4492.285

A researcher is interested in whether herbal remedies are effective in relieving allergies, and if so, which ones are most effective. The researcher takes a group of 20 allergy sufferers and randomly assigns each one to receive herbal tea, a homeopathic administration of allergens, a traditional antihistamine, or a placebo pill. The dependent measure is the number of allergy complaints by patients during weeks 2 and 3 of the treatments.   
(a) Perform the six steps of hypothesis testing on the following set of fictional data using p < .05.   
(b) List the effect size for the study.   
(c) Figure a post hoc test to determine where group differences lie.   
  
Table: Herbal Remedies

|  |  |  |  |
| --- | --- | --- | --- |
| Herbal Tea | Homeopathy | Antihistamine | Placebo |
| 2 | 3 | 2 | 5 |
| 4 | 2 | 1 | 3 |
| 0 | 2 | 0 | 7 |
| 2 | 1 | 3 | 4 |
| 3 | 1 | 4 | 8 |

Step 1:

* DV scale – yes, ratio,
* Normal – don’t know N < 30, so can’t assume
* Randomly select – probably not, random assignment = yes
* Homogeneity: they are all small and roughly equal, no one is 2x larger than another

Step 2:

R: tea =/ homeopathy =/ antihistamine =/ placebo

N: tea = homeopathy = antihistamine = placebo

Step 3:

Means:

> summary(review.exam.3.4)

Herbal.Tea Homeopathy Antihistamine Placebo

Min. :0.0 Min. :1.0 Min. :0 Min. :3.0

1st Qu.:2.0 1st Qu.:1.0 1st Qu.:1 1st Qu.:4.0

Median :2.0 Median :2.0 Median :2 Median :5.0

Mean :2.2 Mean :1.8 Mean :2 Mean :5.4

3rd Qu.:3.0 3rd Qu.:2.0 3rd Qu.:3 3rd Qu.:7.0

Max. :4.0 Max. :3.0 Max. :4 Max. :8.0

SDs:

> sd(review.exam.3.4$Herbal.Tea)

[1] 1.48324

> sd(review.exam.3.4$Homeopathy)

[1] 0.83666

> sd(review.exam.3.4$Antihistamine)

[1] 1.581139

> sd(review.exam.3.4$Placebo)

[1] 2.073644

The ANOVA table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | SS | Df | MS | F |
| Between  IV | 43.75 | 3 | 14.58 | 6.01 |
| Within  Error | 38.80 | 16 | 2.43 | xx |
| Total | 82.55 | 19 | xx | xx |

$ANOVA

Effect DFn DFd F p p<.05 ges

2 variable 3 16 6.013746 0.006062759 \* 0.5299818

$`Levene's Test for Homogeneity of Variance`

DFn DFd SSn SSd F p p<.05

1 3 16 2.6 13.2 1.050505 0.3973692

$aov

Call:

aov(formula = formula(aov\_formula), data = data)

Terms:

variable Residuals

Sum of Squares 43.75 38.80

Deg. of Freedom 3 16

Residual standard error: 1.557241

Estimated effects may be unbalanced

Step 4:

P < .05

Df 3, 16

F critical = 3.24

Step 5:

F found = 6.01

Step 6:

Reject the null!

Effect size R2 = .53 (large)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tea  M = 2.2 | Homeopathy  M = 1.8 | 1.000 | P < .05 | Fail  Groups are equal |
| Tea  M = 2.2 | Anti  M = 2 | 1.000 | P < .05 | Fail  Groups are equal |
| Tea  M = 2.2 | Placebo  M = 5.4 | .03 | P < .05 | Reject  Tea < Placebo |
| Homeo  M = 1.8 | Anti  M = 2 | 1.000 | P < .05 | Fail  Groups are equal |
| Homeo  M = 1.8 | Placebo  M = 5.4 | .01 | P < .05 | Reject  Homeo < Placebo |
| Anti  M = 2 | Placebo  M = 5.4 | .02 | P < .05 | Reject  Anti < Placebo |

Pairwise comparisons using t tests with pooled SD

data: longdata$value and longdata$variable

Herbal.Tea Homeopathy Antihistamine

Homeopathy 1.000 - -

Antihistamine 1.000 1.000 -

Placebo 0.030 0.013 0.020

P value adjustment method: Bonferroni

> summary(review.exam.3.4)

Herbal.Tea Homeopathy Antihistamine Placebo

Min. :0.0 Min. :1.0 Min. :0 Min. :3.0

1st Qu.:2.0 1st Qu.:1.0 1st Qu.:1 1st Qu.:4.0

Median :2.0 Median :2.0 Median :2 Median :5.0

Mean :2.2 Mean :1.8 Mean :2 Mean :5.4

3rd Qu.:3.0 3rd Qu.:2.0 3rd Qu.:3 3rd Qu.:7.0

Max. :4.0 Max. :3.0 Max. :4 Max. :8.0