Assignment 2_MT5763

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Luxuriant's effectiveness Analysis for hair growth

Abstract

To analyse the effects of *Luxuriant* for treating male pattern baldness, we have conducted a trial with 4 groups, with patients suffering from baldness. 3 of the groups were given a specific brand's treatment: *Luxuriant*, *BaldBeGone* and *SkinheadnNoMore*, and the 4th group was the placebo group. The results of this trial show that, although the Luxuriant group showed significantly more growth than the placebo group, the rivals *BaldBeGone* and *SkinheadNoMore* heavily outperform our product.

Introduction

A clinical trial was conducted, for the purpose of testing *Luxuriant's* efficacy for treating male pattern baldness. The trial consisted of patients suffering from male pattern baldness, divided into 4 groups, each treated with one of the three brands, *Luxuriant*, *BaldBeGone* and *SkinheadnNoMore* or the placebo group with no effective treatment. All the participants were shaved, then measured for their hair growth after a month. The study's research questions were: 1. *Is Luxuriant causing growth?* 2. *How does Luxuriant's effectiveness compares with other brands?* 3. *Does age effect hair growth?*

Analyis Description

Firstly, we analysed if the treatment actually caused growth. To this end, a comparison of Luxuriant's and placebo group's hair growth was carried out. We had to check the null hypothesis that the treatment and non-treatment growth were exactly the same. To this end, we conducted a non-parametric Wilcoxon test. The reason for this was, the sample was not independent, leaving us with only paired t-test as an option. Furthermore, the data was not normally distributed, hence violating one of the assumptions for a t-test. The Wilcoxon test showed that there is a significant difference between the the two means (of hair growth) of the two groups. Furthermore, it is evident from the mean scores (luxuriant=144.7>placebo=56.3), luxuriant caused significant growth among patients.

Secondly, we conducted a comparative analysis of our brand with BaldBeGone and SkinheadNoMore. For this purpose, an Anova analysis was carried out, testing the null hypothesis that all the 3 brands' growth means are the same. The test rejected the null hypothesis, this means there was at least one group that had a different growth mean (higher or lower). For further analysis, a Tukey's HSD test was used to check pairwise difference between the 3 brands. Luxuriant was heavily under-performing in comparison to its rivals, BaldBeGone was 17.44mm, and SkinheadNoMore had 5.741mm higher mean growth.

Lastly, we checked the effect of age on hair growth, using linear models. We used the brands as a factor variable, the hair growth as response and age as an explanatory variable. The linear model showed that there is no significant effect of age on growth, as the parameter value was -0.067 and the parameter's p-value 0.59, proves no significant effect on growth.

```sashtml
# Importing baldy.csv data.
PROC import out= Najmi050.baldy
dbms=csv replace
file="/home/u59691081/sasuser.v94/SasFolder/New Folder3/Baldy.csv";
getnames=yes;
datarow=2;
run;
DATA najmi050.baldy_mm;
SET najmi050.baldy;
Luxuriant=luxuriant*25.4;
placebo=placebo*25.4;
baldbegone=baldbegone*25.4;
skinheadnomore=skinheadnomore*25.4;
RUN;
# Checking contents.
proc contents data=najmi050.baldy_mm;
run;
# Checking numeric variables.
proc univariate data=najmi050.baldy_mm;
run;

# Task 1: Comparing Luxuriant with placebo.

#Extracting subset of required data.
data najmi050.LuxuriantVsPlacebo;
set najmi050.baldy_mm;
keep luxuriant placebo;
run;

#Double transposing, to get factor variable.

#First transpose converts data into two rows of brands, each having their own 100 columns of hair growth
proc transpose data=najmi050.luxuriantvsplacebo out=temp;
by rows:;
var luxuriant placebo;
run;
#Second  transpose gets data into two columns, brand names as factor variable and 2nd column hair growth
#Therefore, each row is a subject that has used a particular brand and his hair growth.
proc transpose data=temp out=want;
    by _name_;
    var col:;
run;
proc print data=want;
run;

#Saving data to permanent library and renaming the columns to brand and growth_mm.

data najmi050.LuxuriantVsPlacebo;
set work.want;
```

```
rename _name_=LUXorPlacebo col1=growth_mm;
run;

proc print data=najmi050.LuxuriantVsPlacebo;
run;

#Conducting a two sample ttest to check difference between the two groups' growth.

proc ttest alpha=0.05 data=najmi050.luxuriantvsplacebo sided=2;
class LUXorPlacebo;
var growth_mm;
run;

#The F-test for equality variance (p<0.0001) shows that there is enough evidence to reject the null hyp
#the variance of the two groups is equal.
#Therefore, options are to either use the un-pooled Satterthwaite method,
#provided the normality assumption holds or go for a non-parametric test.
#Although, the QQplot for placebo shows deviation from the normal straight line,
#to confirm our suspicion we conduct a normality test.
#Additionally, a regular t-test would not be valid to begin with, as the sample given is a dependent sa
proc univariate data=najmi050.luxuriantvsplacebo normaltest;
run;

#According to Shapiro-wilk test, the assumption that data is normal, doesn't
#satisfy, p-value<0.0001.
#To this end, we use non-parametric tests to test growths are equal.
proc npar1way wilcoxon data=najmi050.luxuriantvsplacebo;
class luxorplacebo;
var growth_mm;
exact;
run;

#The p-value <0.0001, lower than the 0.05 significance level.
#Therefore, we conclude that the placebo and luxuriant have significantly
#different growth rates. It is evident from the mean scores (luxuriant=144.7>placebo=56.3), luxuriant
#is causing more growth, in comparison to placebo.

proc univariate data=najmi050.baldy_mm;
run;

#Task 2: Luxuriant vs all other brands.

#Extracting subset of data for analysis.

Data Najmi050.LUXVSALLBRANDS;
set najmi050.baldy_mm;
keep luxuriant baldbegone skinheadnomore;
run;
#Double transposing, to get it into a factor variable form.

#1st transpose converts the data into 3 rows, each corresponding to brands,
#with each having 100 columns.
proc transpose data=najmi050.luxvsallbrands out=temp;
by rows:;
```

```
var luxuriant baldbegone skinheadnomore;
run;
#Sorting data according to brand.
proc sort data= temp;
by _name_;
run;
#Tranposing data again to get 400 rows and 2 columns.
#1st column is a factor variable with brand names and the 2nd column
#contains the values of growth in mm of a subject that used that brand.
proc transpose data=work.temp out=need;
by _name_;
var col:;
run;
#Transferring data to luxvsallbrands in the permanent library.
data najmi050.luxvsallbrands;
set need;
run;
#Renaming columns with brand and growth_mm.
data najmi050.luxvsallbrands;
set najmi050.luxvsallbrands;
rename _name_=Brand col1=Growth_mm;
run;

#Conducting an anova analysis to test whether there is difference in mean
#in any one of the 3 brand's growth, followed by a Tukey's HSD to analyse pairwise differences.
proc anova data=najmi050.luxvsallbrands;
class brand;
model growth_mm=brand;
means brand/tukey cldiff;
run;
#P-value<0.0001 for anova shows that our null hypothesis should be rejected and there is a significant
#between the growth rate of atleast one brand compared to the others.
#From the Tukey's HSD it is clear that that there are significant differences between all the brands. W

#Task3: analysing the effect of age on hair growth
#Dividing into two separate data sets, one for growth data, one for age data.

#Extracting growth data set.
data najmi050.Growths_set;
set najmi050.baldy_mm;
keep luxuriant placebo baldbegone skinheadnomore;
run;

#Double transposing growth set, to get into factor variable form for analysis.
#First transpose converts 4 rows of brands, with 100 columns of growth data.
proc transpose data=najmi050.growths_set out=temp;
by rows:;
var luxuriant placebo baldbegone skinheadnomore;
run;
#Sorting the data by brand name.
proc sort data=temp;
by _name_;
run;
#2nd transpose to get into factor variable form, 1st column is brand names and 2nd is growth in mm.
```

```
proc transpose data=temp out=need;
by _name_;
var col:;
run;
#Saving from temperory to permanent library and renaming columns to brand and growth_mm.
data najmi050.Growths_set;
set need;
rename _name_=brand col1=growth_mm;
run;

#Extracting 2nd set, with ages and agebrand.
data najmi050.age_set;
set najmi050.baldy_mm;
drop luxuriant placebo baldbegone skinheadnomore;
run;

#Renaming the columns to brand names.
data najmi050.age_set;
set najmi050.age_set;
rename ageluxuriant=luxuriant ageplacebo=placebo agebaldbegone=baldbegone ageskinheadnomore=skinheadnom
run;

#Double transposing again to get factor variable form.

#1st transpose to get 4 rows with 100 columns of ages.
proc transpose data=najmi050.age_set out=temp;
by rows:;
var luxuriant placebo baldbegone skinheadnomore;
run;

#Sorting the data set by brand-name.
proc sort data=temp;
by _name_;
run;

#2nd transpose to get factor variable form.
proc transpose data=temp out=need;
by _name_;
var col:;
run;

#Saving data to permanent library and renaming columns to brand and ages.
data najmi050.ages_set;
set need;
rename _name_=brand col1=ages;
run;

#Merging the two data sets side by side.
data najmi050.Merged_Growth_Ages;
merge najmi050.growths_set najmi050.ages_set;
run;

#Fitting a linear model similar to R's: growth~ages.
proc glm data=najmi050.merged_growth_ages;
```

```
class brand;
model growth_mm=ages/ solution clparm;
run;
#From this analysis we conclude that, age doesn't effect the growth. As it
#is evident from a very small parameter estimate (-0.067).
#Furthermore, the p-value for the t-test 0.5919 which is indicative
#that no evidence can be found against the null hypothesis:
#hair growth and age are equal.
```

Including Plots

You can also embed plots, for example:

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.