

HH/HLST 2300: Statistical Methods in Health Studies

Winter Term Assignment 1

Assigned: Friday January 15, 2021; Due 5PM Friday January 29, 2021

Submit 1 file for Assignment 1: PDF

PDF document name: LASTNAME_FIRSTNAME_WTAssignment1

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Note1: WT Assignment 1 is worth a total of 40 marks. Therefore, assignments submitted late were deducted 2 marks per day ($40 * 0.05 = 2$)

Note2: If you did not use the proper assignment naming convention, 4 marks were deducted.

As noted in my eClass announcement on Nov 5, 2020, you will be deducted marks if you submit a file other than a pdf file and if that file is named incorrectly. **For WT Assignment 1, the deduction is 4 marks for incorrect file name. The submission file type has been set up in eClass such that the only accepted file type is PDF.**

Other reminders that you should take care to ensure while completing your assignment:

- Questions involving a data file must be answered using SPSS
- HLST 2300 rounding rules apply unless otherwise stated
- Screenshots of any hand-written work and SPSS must be of high resolution and be pasted upright (not sideways) so that they can be easily read and graded
- Answers to questions must directly follow the question asked – do not change the order of the questions
- If you fail to include the SPSS output instructed of you, you will receive zero for any subsequent questions that rely on that output

A researcher has collected data for 158 adult (age ≥ 18 yrs) patients arriving via the Emergency Department (ED) and admitted as an inpatient to Hospital ABC (Excel file: 2300WTassignment1.xls). The data includes the unique patient identifier, sex (female = 1; male = 2), age (years), arrival day of week (DOW) (Sunday = 1; Monday = 2; Tuesday = 3; Wednesday = 4; Thursday = 5; Friday = 6; Saturday = 7), arrival mode (walk-in = 1; ambulance = 2), ED triage level (Resuscitation = 1; Emergency = 2; Urgent = 3), comorbidity level (levels range from 0 – 4 where level 0 represents no significant comorbidity and level 4 represents the group with the largest number of comorbidities), discharge disposition (Discharge Home = 1; Discharged Home with Supports = 2; Transferred to Long-term Care = 3), scores measured at ED arrival, hospital admission and hospital discharge, hospital length of stay (LOS) in days and resource intensity weight (RIW) which is a proxy for hospital resource use.

Before proceeding with any analysis, be sure to:

- Ensure that variables are of correct measure (nominal, ordinal, scale).
- Add labels to all categorical variables. For the variable comorbidity level, add labels Level 0, Level 1,..., Level 4 to the values 0, 1, ..., 4.
- Reduce the number of decimal places to 2 for hospital LOS in the variable view (it will likely show 15 decimal places but only requires 2 decimal places).

1. Are comorbidity levels significantly different between males and females?

- a) State the specific test you used and why that test was chosen (may require copying and pasting SPSS output table for sample size of appropriate variable). **[3 MARKS]**

The specific test used was the Mann-Whitney test because:

- we are comparing two groups (males and females);
- the two groups are independent (you can only be either in the male or female group);
- the variable of interest, comorbidity level, is an ordinal variable.

Some of the typical errors found in Question 1a:

- Did not explain that males and females are the two groups we are comparing. [-1 MARK]
- Did not explain that males and females are independent groups. [-1 MARK]
- Did not explain that comorbidity level is an ordinal variable. [-1 MARK]

- b) Copy and paste the relevant SPSS output table(s) used in reporting results. **[2 MARKS]**

Mann-Whitney Test

Ranks				
	Sex	N	Mean Rank	Sum of Ranks
Comorbidity level	female	98	82.58	8093.00
	male	60	74.47	4468.00
	Total	158		

Test Statistics^a

	Comorbidity level
Mann-Whitney U	2638.000
Wilcoxon W	4468.000
Z	-1.143
Asymp. Sig. (2-tailed)	.253
Exact Sig. (2-tailed)	.255
Exact Sig. (1-tailed)	.127
Point Probability	.001

a. Grouping Variable: Sex

		Percentiles							
		Sex	5	10	25	50	75	90	95
Weighted Average (Definition 1)	Comorbidity level	female	.00	.00	.00	1.00	2.00	3.00	4.00
		male	.00	.00	.00	.50	2.00	3.00	3.95
Tukey's Hinges	Comorbidity level	female			.00	1.00	2.00		
		male			.00	.50	2.00		

Some of the typical errors found in Question 1b:

- Did not copy and paste the Mann-Whitney Ranks and Test Statistics table or values in the tables are different than those shown. [-1 MARK]
- Did not copy and paste the Percentiles table or values in the tables are different than those shown (or descriptives table with correct IQRs for comorbidity level for each group). [-1 MARK]

- c) Report the results, including showing your calculations for effect size if point estimate not included in SPSS output. **[4 MARKS]**

A Mann-Whitney test was used to test the hypothesis that the distribution of comorbidity levels between females and males was equal because comorbidity level was measured on an ordinal scale. Comorbidity levels in females (Weighted Average Mdn = 1.00, IQR [0.00, 2.00]) were not statistically significantly different than males (Weighted Average Mdn = 0.50, IQR [0.00, 2.00]), $U = 2638.00$, $z = -1.14$, $p = .255$, $r = \frac{-1.143}{\sqrt{158}} = -.09$.

Some of the typical errors found in Question 1c:

- Note, if reported results without producing the corresponding tables (part b) where these results came from, no marks are earned for part c.
- Did not report the median and IQR comorbidity levels for both groups correctly. [-1 MARK]
- Did not report U and z statistics correctly. [-1 MARK]
- Did not report p-value correctly (since we have a two-tailed hypothesis, we will report exact significant (two-tailed)) and state that result was not statistically significant. [-1 MARK]
- Did not show calculation and report r correctly. [-1 MARK]
- Rounding errors. [-0.5 MARKS]

2. Are scores measured at hospital admission significantly different than those at hospital discharge?
- a) State the specific test you used and why that test was chosen (may require copying and pasting SPSS output table for sample size of appropriate variable). **[4 MARKS]**

The specific test used was the paired t-test because:

- we are comparing two groups (admission and discharge);
- the two groups are repeated (same group of patients are being tested in both conditions – admission and discharge);
- the variable of interest, score, is a scalar variable. Since the sample size is large ($n \geq 30$): $n_{\text{score at admission}} = n_{\text{score at discharge}} = 158$, the CLT states that parametric test is robust even if the assumption of normality is not met.

Statistics

		score_admission	score_discharge
N	Valid	158	158
	Missing	0	0
Mean		52.0728	77.1558
Std. Error of Mean		1.15293	1.20517

Some of the typical errors found in Question 2a:

- Did not explain that admission and discharge are the two groups we are comparing. [-1 MARK]
- Did not explain that admission and discharge are repeated groups. [-1 MARK]
- Did not explain that score is a scale variable. [-1 MARK]
- Did not include a table that indicates the number of observations for both admission and discharge scores. [-1 MARK]

b) Copy and paste the relevant SPSS output table(s) used in reporting results. [2 MARKS]

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	score_admission	52.0728	158	14.49212	1.15293
	score_discharge	77.1558	158	15.14881	1.20517

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	score_admission & score_discharge	158	.116	.146

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	score_admission - score_discharge	-25.08291	19.70883	1.56795	-28.17991	-21.98591	-15.997	157	.000

Paired Samples Effect Sizes

			Standardizer ^a	Point Estimate	95% Confidence Interval	
					Lower	Upper
Pair 1	score_admission - score_discharge	Cohen's d	14.82410	-1.692	-1.934	-1.447
		Hedges' correction	14.85963	-1.688	-1.930	-1.444

a. The denominator used in estimating the effect sizes.

Cohen's d uses the square root of the average variance of measures.

Hedges' correction uses the square root of the average variance of measures, plus a correction factor.

Some of the typical errors found in Question 2b:

- Did not copy and paste the Paired Samples Test table or values in the table are different than those shown. Note that if you chose to enter score_discharge – score_admission, this is fine; the mean difference, CI and t values will have the same magnitude but the opposite signs. [-1 MARK]
- Did not copy and paste the Paired Samples Effect Sizes table or values in the table are different than those shown. Note that if you chose to enter score_discharge – score_admission, this is fine; the d value (point estimate) will have the same magnitude but the opposite sign. [-1 MARK]

- c) Report the results, including showing your calculations for effect size if point estimate not included in SPSS output. **[5 MARKS]**

On average, admission scores ($M = 52.07$, $SE = 1.15$) were different than discharge scores ($M = 77.16$, $SE = 1.21$). The mean difference, -25.08 , 95% CI $[-28.18, -21.99]$ was statistically significant $t(157) = -16.00$, $p < .001$; and represents a very large effect, $d = -1.69$.

Some of the typical errors found in Question 2c:

- Note, if reported results without producing the corresponding tables (part b) where these results came from, no marks are earned for part c.
- Note that if you chose to enter score_discharge – score_admission, this is fine; the mean difference, CI, t and d values will have the same magnitude but the opposite signs.
- Did not report the mean and standard error for the mean scores for both groups correctly. [-1 MARK]
- Did not report the mean difference and 95% CI of the mean difference correctly. [-1 MARK]
- Did not report t-value and degrees of freedom correctly. [-1 MARK]
- Did not report p-value correctly and state that result was statistically significant. [-1 MARK]
- Did not report d correctly. [-1 MARK]
- Rounding errors. [-0.5 MARKS]

3. Among Friday ED arrivals, are scores measured at hospital admission significantly smaller than those at ED arrival?
- a) State the specific test you used and why that test was chosen (may require copying and pasting SPSS output table for sample size of appropriate variable). **[4 MARKS]**

The specific test used was the Wilcoxon Signed-Rank test because:

- we are comparing two groups (arrival and admission);
- the two groups are repeated (same group of patients are being tested in both conditions – arrival and admission);
- score is a scalar variable but the sample size for Friday arrivals is small ($n < 30$): $n_{\text{score at arrival}} = n_{\text{score at admission}} = 23$, and we're not told if scores are normally distributed in the population

Arrival_DOW = Friday

Statistics^a

		score_arrival	score_admission
N	Valid	23	23
	Missing	0	0
Percentiles	25	37.6100	37.1900
	50	52.2900	47.9300
	75	66.0900	65.2900

a. Arrival_DOW = Friday

Some of the typical errors found in Question 3a:

- Did not explain that arrival and admission are the two groups we are comparing. [-1 MARK]
- Did not explain that arrival and admission are repeated groups. [-1 MARK]
- Did not explain that score is a scale variable. [-1 MARK]
- Did not include a table that indicates the number of observations for both arrival and admission scores, specific to Friday arrivals. [-1 MARK]
- Did not add labels to arrival day of the week (Friday is indicated as a value '6' rather than its appropriate label 'Friday'). [-0.5 MARKS]

- b) Copy and paste the relevant SPSS output table(s) used in reporting results. **[2 MARKS]**

Arrival_DOW = Friday

Descriptive Statistics^a

	N	Percentiles		
		25th	50th (Median)	75th
score_arrival	23	37.6100	52.2900	66.0900
score_admission	23	37.1900	47.9300	65.2900

a. Arrival_DOW = Friday

Wilcoxon Signed Ranks Test

Ranks^a

		N	Mean Rank	Sum of Ranks
score_admission - score_arrival	Negative Ranks	14 ^b	13.50	189.00
	Positive Ranks	9 ^c	9.67	87.00
	Ties	0 ^d		
	Total	23		

a. Arrival_DOW = Friday

b. score_admission < score_arrival

c. score_admission > score_arrival

d. score_admission = score_arrival

Test Statistics^{a,b}

	score_admis sion - score_arrival
Z	-1.551 ^c
Asymp. Sig. (2-tailed)	.121
Exact Sig. (2-tailed)	.124
Exact Sig. (1-tailed)	.062
Point Probability	.002

a. Arrival_DOW = Friday

b. Wilcoxon Signed Ranks Test

c. Based on positive ranks.

Some of the typical errors found in Question 3b:

- Did not copy and paste a descriptives statistics table indicating Friday median and IQR for arrival and admission scores or values in the table are different than those shown. [-1 MARK]
- Did not copy and paste the Ranks and Test Statistics tables or values in the table are different than those shown. Note that if you chose to enter score_arrival – score_admission, this is fine; the row labelled Negative Ranks would have the values in the Positive Ranks row and vice versa. [-1 MARK]

- c) Report the results, including showing your calculations for effect size if point estimate not included in SPSS output. **[4 MARKS]**

The Wilcoxon Signed-Rank test was used to determine whether, among Friday arrivals, scores at admission were significantly smaller than scores at arrival since we had small samples. While scores at admission (Mdn = 47.93, IQR [37.19, 65.29]) were smaller than scores at arrival (Mdn = 52.29, IQR [37.61, 66.09]), the result was not statistically significant, $T = 87.00$ (or 189.00 if score_arrival – score_admission), $z = -1.55$, $p = .062$, $r = \frac{-1.551}{\sqrt{46}} = -.23$.

Some of the typical errors found in Question 3c:

- Note, if reported results without producing the corresponding tables (part b) where these results came from, no marks are earned for part c.
- Did not report the median and IQR scores for both groups correctly. [-1 MARK]
- Did not report T and z statistics correctly. [-1 MARK]
- Did not report p-value correctly (since we had a one-tailed hypothesis, we will report exact significant (one-tailed)) and state that result was not statistically significant. [-1 MARK]
- Did not show calculation and report r correctly. [-1 MARK]
- Rounding errors. [-0.5 MARKS]

4. Among ED patients with triage level Urgent, is hospital LOS significantly longer than 8 days?

- a) State the specific test you used and why that test was chosen (may require copying and pasting SPSS output table for sample size of appropriate variable). **[3 MARKS]**

The specific test used was the one-sample t-test because:

- we are comparing one group's LOS (group = ED patients with triage level Urgent) against a specified constant;
- hospital LOS is a scalar variable and since our sample size is large ($n \geq 30$): $n_{\text{urgent_LOS}} = 45$, the CLT states that parametric test is robust even if the assumption of normality is not met.

Triage Level = Urgent

Statistics^a

LOS (days)		
N	Valid	45
	Missing	0
Mean		9.2660
Std. Error of Mean		1.23478

a. Triage Level = Urgent

Some of the typical errors found in Question 4a:

- Did not explain that ED patients with triage level Urgent is the one group we are comparing. [-1 MARK]
- Did not explain that our variable of interest, hospital LOS, is a scale variable. [-1 MARK]
- Did not include a table that indicates the number of LOS observations specific to triage level = urgent patients. [-1 MARK]
- Did not add labels to triage level (Urgent is indicated as a value '3' rather than its appropriate label 'Urgent'). [-0.5 MARKS]

b) Copy and paste the relevant SPSS output table(s) used in reporting results. [2 MARKS]

Triage Level = Urgent

One-Sample Statistics^a

	N	Mean	Std. Deviation	Std. Error Mean
LOS (days)	45	9.2660	8.28317	1.23478

a. Triage Level = Urgent

One-Sample Test^a

Test Value = 8						
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
LOS (days)	1.025	44	.311	1.26600	-1.2225	3.7545

a. Triage Level = Urgent

One-Sample Effect Sizes^a

			Point Estimate	95% Confidence Interval	
Standardizer ^b				Lower	Upper
LOS (days)	Cohen's d	8.28317	.153	-.142	.446
	Hedges' correction	8.42779	.150	-.139	.438

a. Triage Level = Urgent

b. The denominator used in estimating the effect sizes.

Cohen's d uses the sample standard deviation.

Hedges' correction uses the sample standard deviation, plus a correction factor.

Some of the typical errors found in Question 4b:

- Did not copy and paste the One-Sample Statistics and Test tables or values in the table are different than those shown. [-1 MARK]
- Did not copy and paste the One-Sample Effect Sizes table or values in the table are different than those shown. [-1 MARK]

c) Report the results, including showing your calculations for effect size if point estimate not included in SPSS output. **[5 MARKS]**

Results showed that the mean LOS ($M = 9.27$ days, $SE = 1.23$) was longer than the hypothesized value of 8 days. However, the mean difference, 1.27, 95% CI [-1.22, 3.75], was not statistically significant $t(44) = 1.03$, $p = .1555$ and represented a small-sized effect, $d = .15$.

Some of the typical errors found in Question 4c:

- Note, if reported results without producing the corresponding tables (part b) where these results came from, no marks are earned for part c.
- Did not report the mean and standard error for LOS correctly. [-1 MARK]
- Did not report the mean difference and 95% CI of the mean difference correctly. [-1 MARK]
- Did not report t-value and degrees of freedom correctly. [-1 MARK]
- Did not report p-value correctly (since we had a one-tailed hypothesis, p-value of .311 is halved) and state that result was not statistically significant. [-1 MARK]
- Did not report d correctly. [-1 MARK]
- Rounding errors. [-0.5 MARKS]

School of Health Policy and Management

Assignment Attachment Form

Student Name:

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Please check each box after reading, to acknowledge agreement with each statement.

- ☐ I have read and understand the Senate Policy on Academic Honesty found on website at the following York Secretariat website on Academic Honesty.
- ☐ I have read and understood the assignment submission described in the course outline (syllabus)
- ☐ I have read and understood the criteria used for assessment in this assignment
- ☐ I have read and understood and followed the referencing guidelines required for assignments submitted at York University
- ☐ This assignment is entirely my own work, except where I have given documented references to work of others
- ☐ This assignment or substantial parts of it has not previously been submitted for assessment in any formal course of study, unless acknowledged in the assignment and previously agreed to by my Tutorial Leader and Course Director
- ☐ I understand that this assignment may undergo electronic detection for plagiarism and a copy of the assignment may be retained on the database and used to make comparisons with other assignments in the future

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