Key Answers

Qualifying Examination

for Doctor of Philosophy (Epidemiology and Biostatistics)

2 September 2019

(Duration: 09.00 – 16.00; Total score: 100)

*Students can use books or internet. Communication with anybody else is strictly prohibited.*

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**Part A: Epidemiology** (30 scores)

**Based on the attached article, please answer the following questions:**

**Paper**: Efficacy of endoscopic sinus surgery for chronic rhinosinusitis following primary radiotherapy and concurrent chemotherapy for nasopharyngeal carcinoma

1) What is the main conclusion of this paper? (2 scores)

Answer: ESS appears to effectively manage recalcitrant CRS symptoms in patients previously treated with radiation therapy and concurrent chemotherapy for NPC.

2). What is the magnitude of effect that the author used for answering the primary research question? If there was none or inappropriately reported, please specify what should be reported for the research question? (8 scores)

Answer:

* There is no magnitude of effect presented but the author based the conclusion on the absolute difference in change score and p-value.
* The mean difference between groups in SNOT-22 scores, adjusted for baseline SNOT-22 score, together with its 95%CI, should be reported.

3). What are biases that could make the results invalid? Please specify name and roles of each bias, i.e., the conclusion could be distorted in what ways and by what mechanisms. (10 scores)

Answer:

* Selection bias: Questionable because it is a case-cohort study selecting the study groups based on retrospective chart review without any guards against selecting the control group with a bad prognosis to get the desired conclusions.
* Information bias: Unlikely because both groups were based on the same methods of daa extraction from the same database.
* Confounding bias: This is the main sources of bias. The baseline SNOT-22 score of 45 vs 14 in the surgical and the nonsurgical groups, respectively, could lead to a much smaller magnitude of difference between group post-intervention after adjusted for the baseline score. Therefore, the true treatment effect would be much smaller than being claimed. Given the small sample size and small effect size in this study, the effect of surgical treatment is likely to be inconclusive.

4). Please summarize in one paragraph of less than 10 lines the main points that will improve the quality of this paper- pretending you are writing a letter to the editor of this journal your opinion on this paper. (10 scores)

Answer:

* Add details in METHODS regarding data extraction that could minimize selection bias and information bias.
* Reanalyze the data using ANCOVA as mentioned above.
* Revise the CONCLUSION based on the magnitude of the upper limit of the 95%CI against the 8.9-point in the total score which is the minimal clinically important difference.
* Add the DISCUSSION regarding the limitation of the study design in the way that the study did NOT allow a conclusion of the effectiveness of the ESS due to the incomparable group. Although it is impossible, the appropriate comparable groups should be similar except the ESS, meaning that the study should include patients with CRS post radiation then compared between those with and without ESS.

**Part B: Biostatistics** (30 scores)

5). Based on the article in Part A:

5.1) Please describe methods that were used to obtain the magnitude of effect and comment on their appropriateness. (5 scores)

Answer:

* No magnitude of effect was presented.
* The author based the conclusion on the absolute difference in change score and p-value. The difference of the change score in this study is the most likely affected by the regression to the mean phenomena due to the large difference of the baseline score.
* Thus, the main finding was inappropriate.

5.2) Please describe the other alternatives for statistical analysis and suggestion on their advantages or disadvantages. (5 scores)

Answer:

* The most appropriate method of analysis is to get the mean difference between groups in SNOT-22 scores, adjusted for baseline SNOT-22 score, together with its 95%CI, using the analysis of co-variance (ANCOVA). Such magnitudes can be estimated for 6 and 12 month, one for each time point.
* The overall mean difference between groups in SNOT-22 scores for 6 and 12 months after intervention, adjusted for baseline SNOT-22 score, together with its 95%CI, can be estimated using generalized estimating equations (GEEs) under the linear regression framework, i.e., family is Gaussian, link is Identity, and correlation structure is Exchangeable.

6) Based on the data set with a description attached at the end of this material, please answer the following questions:

6.1) Plan for data analysis: Please provide a dummy table, the table without number being presented, that is the main finding to answer the research question for this study. (10 scores)

Answer: Treated the outcome “Health perception” as an ordinal outcome

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Predictors | Number | Health perception | | | | Crude POR | Adj.  POR | 95%CI | p-value |
| %Excellent | %Good | %Fair | %Poor |
| Age | x,xxx | xx.x | xx.x | xx.x | xx.x | x.x | x.x | x.x to x.x | 0.xxx |
| Gender |  |  |  |  |  |  |  |  | 0.xxx |
| Male | xxx | xx.x | xx.x | xx.x | xx.x | Ref |  |  |  |
| Female | xxx | xx.x | xx.x | xx.x | xx.x | x.x | x.x | x.x to x.x |  |
| Education year | x,xxx | xx.x | xx.x | xx.x | xx.x | x.x | x.x | x.x to x.x | 0.xxx |
| Marital status |  |  |  |  |  |  |  |  | 0.xxx |
| Never married | xxx | xx.x | xx.x | xx.x | xx.x | Ref |  |  |  |
| Married | xxx | xx.x | xx.x | xx.x | xx.x | x.x | x.x | x.x to x.x |  |
| Separated | xxx | xx.x | xx.x | xx.x | xx.x | x.x | x.x | x.x to x.x |  |
| Divorced | xxx | xx.x | xx.x | xx.x | xx.x | x.x | x.x | x.x to x.x |  |
| Widowed | xxx | xx.x | xx.x | xx.x | xx.x | x.x | x.x | x.x to x.x |  |

\*POR= Proportional odds ratio using multiple ordinal logistic regression.

The interpretation of the POR is that for a one unit increase in the predictor, the odds of having a poor rather than a fair, or a fair rather than a good, or a good rather than an excellent Health perception level, is expected to change by its respective odds while the other variables in the model are held constant.

Answer: Treated the outcome “Health perception” as a dichotomous outcome

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Predictors | Number | %Poor/Fair | Crude OR | Adjusted OR | 95%CI | p-Value |
| Age | x,xxx | xx.x | x.x | x.x | x.x to x.x | 0.xxx |
| Gender |  |  |  |  |  | 0.xxx |
| Male | xxx | xx.x | Ref |  |  |  |
| Female | xxx | xx.x | x.x | x.x | x.x to x.x |  |
| Education year | x,xxx | xx.x | x.x | x.x | x.x to x.x | 0.xxx |
| Marital status |  |  |  |  |  | 0.xxx |
| Never married | xxx | xx.x | Ref |  |  |  |
| Married | xxx | xx.x | x.x | x.x | x.x to x.x |  |
| Separated | xxx | xx.x | x.x | x.x | x.x to x.x |  |
| Divorced | xxx | xx.x | x.x | x.x | x.x to x.x |  |
| Widowed | xxx | xx.x | x.x | x.x | x.x to x.x |  |

6.2) Perform the analysis: Please provide Stata or R commands (Stata do file or R scripts) to obtain the results for the dummy table you’ve provided. (5 scores)

Answer:

\*================================

clear

set more off

cd "C:\ "

\*Data preparation

use QE2019\_Data, clear

replace sex = "1" if sex == "male"

replace sex = "2" if sex == "female"

replace mar = "1" if mar == "never married"

replace mar = "2" if mar == "married"

replace mar = "3" if mar == "separate"

replace mar = "4" if mar == "divorced"

replace mar = "4" if mar == "widowed"

replace health = "1" if health == "excellent"

replace health = "2" if health == "good"

replace health = "3" if health == "fair"

replace health = "4" if health == "poor"

replace age = "89" if age == "89 or ol"

destring \_all, replace

\*Table reported the main findings

\*Treated the outcome "health" as ordinal

tab health

tab sex health, row

ologit health age sex educ i.mar, or

\*Treated the outcome "health" as dichotomous

recode health (3 4 = 1) (1 2 = 0)

tab health

tab sex health, row

logistic health age sex educ i.mar

6.3) Communicate the results: Please write an abstract to report the results. Note that this must be presented with real results obtained from your own analysis. (5 scores)

Answer:

The significant predictors for Health perception include age, duration of education, and marital status. That is, every one year older, the odds of having a poor or fair health increase for 2% (OR: 1.02; 95%CI: 1.01 to 1.03, p<0.001), every one year longer in education, the odds of having a poor or fair health decrease for 16% (OR: 0.84; 95%CI: 0.81 to 0.88, p<0.001), and married couple decease the odds of having a poor or fair health for 40% (OR: 0.59; 95%CI: 0.42 to 0.84, p<0.001).