44. Using propensity score bootstrapping

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Using Propensity Score Bootstrapping on Determining the Model of the HIV/AIDS Patients' Assistance

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ABSTRACT

Background: The combination of Propensity Score Stratification (PSS) with a bootstrap method will get an estimate that has better accuracy because the covariates will be more balanced. Propensity score Bootstrapping is used to estimate the response to mentoring HIV/AIDS patients in RSUD dr. H. Moch. Ansari Saleh Banjarmasin South Kalimantan.

Method: The research method used is non-reactive based on secondary data. The study sample was HIV/AIDS patients who had undergone treatment for more than one year at RSUD dr. H. Moch.Ansari Saleh Banjarmasin, South Kalimantan. The response variable is *y*)*y*) CD4 (Cluster of Differentiation) level, while predictor variables (X_j) knowledge, attitude, self-concept, family support, and treatment in the form of antiretroviral therapy.

Results: From the test, the significance of parameters *bootstrap* shows that at the significance level α = 5% indicating all covariates are significant, namely the covariate of knowledge, attitude, self-concept, family support. Estimation of the PSS bootstrap sample is best in the two strata group with a standard error of 0.0127 and a treatment effect of 0.4175.

Conclusion: The ATE (Average Treatment Effect) value in the univariate response using a proportion test with z test statistics showed that antiretroviral therapy and assistance affected Cluster of Differentiation (CD4) levels.

Keywords: *Propensity Score Stratification, Bootstrap, Antiretroviral Therapy*

INTRODUCTION

Based on reports from the hospital of Dr. H. Moch Ansari Saleh Banjarmasin in 2014, of 422 people who were HIV positive, only 138 people underwent regular therapy, and 14 people dropped out. The number of HIV/AIDS patients who do not undergo treatment regularly, probably because of no companion making HIV/AIDS patients are reluctant to conduct therapy in an orderly manner. As is well known if HIV/AIDS patients do not take antiretroviral therapy regularly, the HIV cannot be controlled so that it reduces the immune system which will affect CD4 levels, opportunistic infections and the quality of life of HIV/AIDS patients will decrease [(1)].

The highest risk of HIV-AIDS transmission in Indonesia comes from sexual relations (62.5%) followed by injecting drugs (16.1%), perinatal (2.7%) and homosexuals (2.4%) Until now; no drugs have been found which can kill the HIV. However, with the discovery of drugs that inhibit the replication of HIV known as Highly Active Antiretroviral Therapy (HAART), the death rate of HIV-AIDS patients can lower [(5)].

The study intends to examine the estimation of propensity score boots on CD4 levels of HIV/AIDS patients who received antiretroviral therapy along with mentoring as a treatment group and who only received antiretroviral treatment as a control group. This causal

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research is observational rather than experimental. The estimation method of the propensity score used is the Maximum Likelyhood Estimation (MLE) bootstrapping method. The technique used in the propensity score is a combination stratification method with the method bootstrap to estimate the Average Treatment Effect (ATE) and confounding used only one.

METHOD

This research is a secondary data-based documentation study. To complete the information contained in the research objectives required primary data collection through observational research with a survey approach. Secondary data were obtained from records medical at RSUD dr. H. Moch Ansari Saleh Banjarmasin, covering the characteristics of respondents, antiretroviral therapy, mentoring, CD4 levels. Primary data was also taken through a questionnaire on the respondents include knowledge, attitudes, self-concept, and family support.

The location of this research in Regional General Hospital Dr. H. Moch. Ansari Saleh Banjarmasin Kalimantan Selatan. The research period was 2015 to 2016.

The population of this study was all the status of HIV/AIDS patients in RSUD dr. H. Moch Ansari Saleh Banjarmasin, South Kalimantan, from 2008 to 2016, while the sample is every HIV/AIDS patient, who has undergone treatment for more than six months in dr. H. Moch Ansari Saleh, Banjarmasin, South Kalimantan. After CD4 levels of HIV/AIDS patients were examined for the first time and then examined every six months again.

The variables used in this study consisted of response variables (y)CD4 levels. Predictor variables (x_i) included knowledge, attitudes, self-concept and family support. The treatment variable (Z) as respondents were given antiretroviral therapy and regular and continuous peer assistance. While another variable is the respondents, who were only given antiretroviral therapy without support.

RESULTS

Propensity Score used in this analysis is derived from the following results.

1. **Determination of variables confounding using Chi-square:** This testing is to find out the relationship between antiretroviral therapy and the overall predictor variables obtained *value* = 0.000 smaller than α = 0.05, meaning there is a relationship between antiretroviral therapy and predictor variables, as well as the relationship between antiretroviral therapy and response variable.

2. **Logistic regression model on covariate (x) against confounding (z)**

Table 1: Logistic regression test results concurrently with antiretroviral therapy

Antiretroviral Therapy	Chi-square	Significant
Step	86.882	0.000
Block	86.882	0.000
Model	86.882	0.000

Table 1 shows the significance level used is α = 5 percent and the test statistics used are G test statistics that follow the distribution Chi-Square. P-value = 0.000 <α = 0.05, then the decision taken is that there is at least one predictor variable significant not equal to zero.

Table 2: Logistic regression test results and partial odds ratio antiretroviral therapy

Antiretroviral Therapy	B	Significance	Exp(β)
Knowledge of Good	-2.706	0.000	0.067
Positive Attitudes	-1.754	0.000	0173
Good Self Concept	-1.112	0.031	0329
Family Support	-1.232	0.013	0.292
Constant	3.998	0.000	54,511

Table 2 shows that the four variables namely good knowledge, positive attitude, supportive family support have a significant influence on antiretroviral therapy. This result is demonstrated through a p-*value* less than α (0.05).

Furthermore, the suitability of the model is tested to determine whether there is a difference between the results of the observation and the probability of the prediction. The results of this table are cross-classification of response variables with dichotomous scale. The research shows that the percentage of all observations classified

correctly is 84.0% so that the magnitude of the misclassification is 16.0%. The misclassification value is not too significant, so it can be concluded that the logistic regression model is good enough to classify observations with only antiretroviral therapy (*sensitivity)* percentage of 81.9 percent and the percentage of antiretroviral therapy and assistance (*specificity*) of 85.9 percent.

3. **Estimated value of propensity score:** The propensity score value in this case, is estimated using a model logistic regression. Therefore the logistic regression model is the same as the *propensity score,* so to know the propensity value, the model parameters must be known in advance. The parameters of the logistic regression model are estimated by the Maximum Likelihood Maximum method. The following is a logistic regression model for antiretroviral therapy :

$$g(x) = 3.998 - 2.706X_{1(1)} - 1.754X_{2(1)} + 1.112X_{3(1)} + 1.232X_{4(1)}$$

Based on the estimation of the parameters above, the obtained *propensity score* will be used at the next stage. The model *propensity score* used is as follows.

$$e(x_i) = \frac{\exp(g(x))}{1+\exp(g(x))} \quad \ldots(1)$$

from equation (1) above, the value of propensity is obtained for 150 research subjects ranging from 0 to 1 because it is a limited opportunity.

4. **Estimation of Average Treatment Effect (ATE) or effect of antiretroviral therapy on CD4 levels from HIV/AIDS patients:** Providing antiretroviral therapy has a significant effect on CD4 levels in HIV/AIDS patients as p-value is $0.000 < \alpha = 5\%$. The effect of antiretroviral therapy and assistance on increasing CD4 levels in HIV/AIDS patients is 0.678 in the original data.

The bootstrap data giving antiretroviral therapy has a significant effect on CD4 levels of HIV/AIDS patients. It can be seen from the p-value = $0.000 < \alpha = 5\%$. The effect of antiretroviral therapy and accompaniment on increasing CD4 levels in HIV/AIDS patients is 0.690.

Table 3: ATE estimation results for antiretroviral therapy against CD4

Levels of CD4	Sub-Classes	Value of ATE	ATE	Z	p-value
Original	1	0.118421	-0.678876	-11.38	0.000
	2	0.797297			
Bootstrap	1	0.135802	-0.690284	-11.62	0,000
	2	0.826087			

DISCUSSION

Combined antiretroviral (ARV) treatment is the best therapy for human infected patients of Human Immunodeficiency Virus (HIV) to date [2]. The primary purpose ARV administration is to reduce the amount of virus (viral load) so that it will improve the HIV patient's immune status and reduce deaths from opportunistic infections[3]. In 2015, according to the World Health Organization (WHO) antiretroviral has been used in 46% of patients HIV in various countries. The use of ARVs has been managed to reduce mortality related to HIV/AIDS from 1.5 million in 2010 to 1.1 million in the year of 2015. Antiretroviral besides being an antivirus is also useful to prevent transmission of HIV to sexual partners, and HIV transmission from mother to child. Up to finally expected to reduce the number of cases of people new HIV infections in various countries [4].

This study was conducted to determine the effect of antiretroviral therapy on HIV/AIDS patients. The research data contained several covariates involved namely knowledge (X_1), attitude (X_2), self-concept (X_3), family support (X_4), and antiretroviral therapy (Z) as well as three response variables (*outcomes*) namely CD4 levels (Y_1). Based on the result, it is known that four covariates X (X_1, X_2, X_3, X_4) are associated with antiretroviral therapy and are risk factors of CD4 of HIV/AIDS patients.

Logistic regression modeling with more than one predictor variable (simultaneously) needs to be done to examine the multicollinearity relationship between predictor variables. If the connection is very close, it is possible to have predictor variables become insignificant again in testing simultaneously because other predictor variables sufficiently represent it. Concurrent test results showed the significant result.

The principle of propensity score stratification is to divide the subject into several sub-classes based on the propensity score obtained in the previous step. At this stage, the subject is divided into 2 to 5 strata to find strata that prove that the covariates are balanced on all levels and provide an estimate of the standard error value of the smallest Average Treatment Effect (ATE). The distribution of strata was initially carried out on the original data to find the best levels.

Prior estimates with the bootstrap method, first performed at the full data parameter estimation, this is because the criteria for rejection of H_0 using the value *p-value* involving the of the test statistic at complete data. Besides, the significance test of parameters bootstrap shows that at a significance level $\alpha = 5\%$ all covariates are significant, namely the covariate of knowledge, attitude, self-concept and family support.

After their requirements are met, then the next step is to estimate the effect of treatment (ATE) or the impact of antiretroviral therapy on CD4 levels of HIV/AIDS patients. The test was carried out using the Z test, and the results showed that the effect of antiretroviral treatment and accompaniment on increasing CD4 levels in HIV/AIDS patients was 0.678 in the original data.

The *Bootstrap data* giving antiretroviral therapy has a significant effect on CD4 levels of HIV/AIDS patients. The magnitude of the effect is 0.690; thus after bootstrap, it turns out the results are smoother because the fact is stronger.

Based on effect treatment estimates, the provision of antiretroviral therapy and assistance affects increasing CD4 levels. A companion can inspire patients with HIV/AIDS because even though it is incurable but can be extended for life with drugs certain [7]. Antiretroviral therapy is beneficial in reducing the amount of HIV in the body so that CD4 (lymphocytes *cluster of differentiation 4*)can be prevented. After the administration of antiretroviral therapy drugs for six months can usually be achieved the number of undetectable viruses and the number of CD4 lymphocytes increases [8].As a result of this risk of opportunistic infections decreases and the quality of life of patients increases [9].

HIV/AIDS patients who are given antiretroviral therapy and mentoring will have an increase in CD4 levels. Through the need to increase knowledge, a positive attitude is formed which makes the concept of self-good. No less important for the family to support their family support HIV/AIDS patients with HIV feel cared for and being considered in the family.

The lower CD4 count identifies a decreased immune system so that pathogens that cause infection can enter the body together. Giving ARVs can increase CD4 levels, which also means rising immunity to prevent opportunistic infections[6].

CONCLUSION

From the research, it can be obtained estimator propensity score stratification bootstrap. Estimated PSS bootstrap samples are best in the two levels group. The effect of antiretroviral therapy and accompaniment to CD4 levels significantly impact on the HIV patient.

Ethical Clearance: Ethical clearance was obtained from the the Health Research Ethics Committee at the Faculty of Public Health Airlangga University with registration number 161-KEPK dated 14 April 2016. We also wish to thank all the participants who contributed to this study.

Conflict of Interest: Nil.

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