Spatial analysis on the impact of socioeconomic vulnerability to drug abuse prevalence in Indonesia 2015

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Abstract. An environment socioeconomic situation can affect drug abuse. Studies on the impact of socioeconomic vulnerability can be used in planning risk management policy on drug abuse that is more precise, effective, and efficient. This research aims to learn the impact of socioeconomic vulnerability (education level, unemployment rate, income level, gender ratio, poverty rate, and access to health service) on drug abuse prevalence and to identify the index of socioeconomic vulnerability to drug abuse in each province in Indonesia, which can be used to analyze drug abuse risk. Methods used in this research are multiple linear regression statistical test and spatial analysis. The result show that F-test sig<0.05 mean that socioeconomic factor simultaneously effect prevalence; the t-test result shows only income level have sig<0.05 and there are 2 level of socioeconomic vulnerability index: high (9 provinces) and moderate (25 provinces), while the drug abuse risk level is in 3 level: high (5 province), moderate (9 province), and low (20 province). The conclusion is that socioeconomic factor (education, unemployment, income, gender ratio, poverty rate, and access to health service) are influence to the level of drug abuse prevalence in Indonesia, which the most significantly influence is income level.

Keywords: drug abuser prevalence, spatial analysis, socioeconomic vulnerability

1. Introduction
There is no regency or city in Indonesia that is free from drug abuse and trafficking. The drug abuse prevalence and the types of drugs that are used for the first time also vary among the provinces [1]. These variations show that environment situations affect drug abuse. One of the factors that influence the environment situation is socioeconomic factor. Socioeconomic vulnerability to drug abuse is defined as economic activities, related situations or factors of the society that may lead to drug abuse. This vulnerability is reflected in many factors, such as education level, unemployment rate, income level, gender ratio, poverty rate, and access to health service [2, 3, 4]. According to the Statistics Indonesia (BPS) [5], this factor in Indonesia vary from one province to another. Base on that statement we could hypothesis that socioeconomic factor (education, unemployment, income, gender ratio, poverty rate, and access to health service) are influence to the level of drug abuse prevalence in Indonesia.

Analyzing socioeconomic vulnerability of a certain area to drug abuse will result in knowledge that can be used by instances or institutions that are active in drug abuse prevention and eradication. The knowledge can then be used as material in planning risk management policy that is more specific, effective and efficient. Based on the definition of disaster in the Regulation of the Head of National
Disaster Mitigation Agency (BNPB) No. 02 Year 2012 [6], drug abuse is categorized as a disaster that is caused by human factor and causes casualties, property damage, and psychological impact. The risk of a disaster can be assessed and mapped using knowledge on its hazard and vulnerability [7]. Thus, the risk of drug abuse can be viewed from the relation between drug abuse prevalence, which is the hazard, and the socioeconomic vulnerability to drug abuse.

This research aims to learn the impact of socioeconomic vulnerability (education level, unemployment rate, income level, gender ratio, poverty rate, and access to health service) on drug abuse prevalence and to identify the index of socioeconomic vulnerability to drug abuse in each province in Indonesia, which can be used to analyse drug abuse risk.

2. Theoretical Review
Vulnerability are conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. Hazard is defined as a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation [7]. Socioeconomic vulnerability can be assessed using several indicators, including education level, unemployment rate, income level, gender ratio, poverty rate, and access to health services [2, 3, 4].

Vulnerability can be described using indexes and maps, where vulnerability is the result of Exposure times Sensitivity. The “assets” that are exposed include human lives (social vulnerability), economic territory, physical structure and ecological / environmental area. Sensitivity is determined indirectly through different weighting for each ‘asset’ or type of threat [6]. Spatial analysis is used to assess the data and components in an area. This analysis uses overlay process and other analysis techniques to seek answer or acquire useful knowledge or information [8].

3. Research Methods
This research uses literacy study method with quantitative approach that will provide details from the data of socioeconomic vulnerability that are related to drug abuser prevalence in each province in Indonesia in 2015. The dependent variable is the prevalence of drug abuser, which data is obtained from the National Narcotics Board (BNN). The independent variable is socioeconomic vulnerability that is related to drug abuse, using several indicators, which are education level, unemployment rate, income level, gender ratio, poverty rate and access to health services. Data for the independent variable are obtained from the Statistics Indonesia (BPS).

Education level indicator in this research is using the number of graduates of Primary School (SD), Junior High School (SMP), and Senior High School (SMA) in 2015. Unemployment rate indicator draws data from the percentage of the number of unemployment against the number of work force or known as the Open Unemployment Rate in 2015. Income level indicator is using data of monthly expenditure per capita of population in each province in 2015. Gender ratio indicator is derived from gender ratio data per province in 2015. Poverty rate indicator draws data from poverty percentage per province, to learn the percentage of poor people from the population of an area. Access to health service indicator is using data of ratio of local health center (Puskesmas) per 30,000 people.

The analysis methods used are the statistical analysis and spatial analysis. The first part is the linear regression statistical analysis that is used to determine the impact of the socioeconomic vulnerability on drug abuse prevalence. This analysis is made using statistic software SPSS version 24. Using the following formula:

\[ Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6 \]

Remarks:
Y: the prevalence of drug abuser
bo: constant  
X1: education level; b1: constant of X1  
X2: unemployment rate; b2: constant of X2  
X3: income level; b3: constant of X3  
X4: gender ratio; b4: constant of X4  
X5: poverty rate; b5: constant of X5  
X6: access to health services; b6: constant of X6

The second part is spatial analysis using Geographic Information System (GIS) to compose socioeconomic vulnerability index using ArcGIS 10.3 software, which helps in classifying, scoring and weighting, as well as conducting overlay analysis to create a map. Score for each criteria is obtained from dividing the data value of each indicator into low (0.333), moderate (0.666) and high (1), according to the normal curve. The weighting are determined from statistical test results, by taking into considerations the coefficient value of each indicator. The coefficient value is later converted into percentage, with all socioeconomic vulnerability indicators totaling to 100%. Afterwards, the socioeconomic vulnerability index of each province is calculated using the following formula:

\[ \text{Index} = (X_1 \text{ Weight} \times X_1 \text{ Score}) + (X_2 \text{ Weight} \times X_2 \text{ Score}) + \ldots + (X_6 \text{ Weight} \times X_6 \text{ Score}) \]

The result of the socioeconomic vulnerability index is later categorized into three level: low (0.333), moderate (0.666), and high (1). Than the result is mapped.

The third step is classifying drug abuser prevalence data in each province into low (0.333), moderate (0.666), or high (1) level. The result is then turned into provincial-based drug abuse prevalence map. The fourth step is determining the drug abuse risk level by reviewing the relation between drug abuser prevalence level and index of socioeconomic vulnerability to drug abuse, based on the matrix seen in Figure 1.

| RISK LEVEL | SOCIOECONOMIC VULNERABILITY INDEX |
|------------|----------------------------------|
| LOW        | MODERATE | HIGH |
| DRUG ABUSER PREVALENCE | LOW | MODERATE | HIGH |

Figure 1. Risk level matrix.

**4. Results**

The linearity test result shows a linear pattern for the independent variables. Normality test results using the Kolmogorov-Smirnov test, Histogram of the Residual, and Normal Probability Plot show normal distribution regression model. Autocorrelation test result using Durbin-Watson test shows that this research contains no autocorrelation. The R2 coefficient of determination result reveals that 63.9% variants of the independents variables can explain the dependent variable, which shows strong autocorrelation. The result of heteroscedasticity test using Scatterplot test shows that the curve does not show regulated pattern, which means the regression function of this research does not appear because of different variants. Based on the results of those tests, which are classic assumption test, the criteria to run multiple linear regression test have been met. The result of the multiple linear regression test can be seen in table 1.
Table 1. Multiple regression test.

| Model | Unstandardized Coefficients | Standardized Coefficients | t    | Sig. | Tolerance | VIF |
|-------|-----------------------------|---------------------------|------|------|-----------|-----|
|       | B      | Std. Error | Beta  |      |           |     |
| 1     | (Constant) | .256 | .140 | 1.829 | .079 |     |
|       | Education | .065 | .099 | .094 | .657 | .516 | .650 | 1.539 |
|       | Unemployment | .108 | .070 | .199 | 1.539 | .135 | .796 | 1.256 |
|       | Income | .638 | .099 | .597 | 4.218 | .000 | .667 | 1.500 |
|       | Gender | -.221 | .086 | -.315 | -2.551 | .017 | .877 | 1.140 |
|       | Poverty | -.021 | .104 | -.033 | -2.06 | .839 | .509 | 1.966 |
|       | Access to Health Service | -.119 | .115 | -.174 | -1.030 | .312 | .467 | 2.143 |

The F-test result shows that independent variables simultaneously impact dependent variable. The t-test result shows that out of six independent variables, only Income Level gives significant impact on dependent variable. After completing the statistical tests, spatial analysis is conducted using scoring and weighting, classifying and creating the map. The regulation for scoring and weighting are shown in Table 2.

Table 2. Regulation for scoring and weighting.

| No | Indicator            | Class (score)          | Weight |
|----|----------------------|------------------------|--------|
|    |                      | Low (0.333)            | Moderate (0.666) | High (1) |
| 1  | Education Level      | 25,634 – 254,552       | 254,553 – 627,942 | 627,943 – 1,554,791 | 5.546 |
| 2  | Unemployment Rate    | 1.990291 – 5.147453   | 5.147454 – 7.504688 | 7.504689 – 9.932363 | 9.215 |
| 3  | Income Level         | 533,891 – 840,695.9   | 840,696 – 1,193,642 | 1,193,643 – 1,773,431 | 54.437 |
| 4  | Gender Ratio         | 94.2 – 101             | 101.1 – 105.5      | 105.6 – 113.2        | 18.857 |
| 5  | Poverty Rate         | 0.003622 – 0.008466   | 0.008467 – 0.014125 | 0.014126 – 0.028520 | 1.792 |
| 6  | Access to Health Service | 0.58 – 1.35      | 1.36 – 2.46        | 2.47 – 5.20          | 10.154 |

Socioeconomic vulnerability index can be calculated by adding the multiplication values between weight and score of each indicator. The result shows that there are nine (9) provinces (26.47%) with high socioeconomic vulnerability index and 25 provinces (73.52%) with moderate socioeconomic vulnerability index. These data are mapped into Figure 2.

Most Indonesian territories are not high vulnerable areas, but without proper supervision, those areas might turn into high socioeconomic vulnerability index areas. Provinces with high level are mostly located in western Indonesia. Only one of such provinces is located in eastern Indonesia, while the other two are in middle Indonesia. Analysis on provinces with high socioeconomic vulnerability index shows that the dominant indicators are unemployment rate and access to health service. Comparing the socioeconomic vulnerability index of those provinces with their Human Development Index (HDI) reveals that only four provinces have high HDI. Thus, we cannot assume that high HDI also means high index of socioeconomic vulnerability to Drug Abuse, because there are several indicators that differ in the measurement.

Upon examining the location of the provinces with high socioeconomic vulnerability index, it is revealed that five out of nine provinces with high socioeconomic vulnerability index are located in Indonesia’s border areas and one of them is bordering the high seas. This shows that provinces located in border areas and close to high seas are more vulnerable to drug abuse.
Unemployment may lead to many issues, including drug abuse. Busaglia and Dijk [9] mentions that unemployed are the manpower resource for organized crimes activities This requires attention because based on the Indonesian Statistics (BPS) projection, Indonesia has now reached the demographic bonus, with the percentage of working age population predicted to be increasing until 2035. In 2010, the number of working age population was 66.5%. The number is predicted to increase to 67.7% in 2020 and 68.1% in 2030. This momentum has to be supported with employment availability; otherwise, the high number of unemployment might be exposed to illegal businesses.

Other than unemployment rate, access to health service also contributes to the high socioeconomic vulnerability index. Easy access to health services is related to the drug abuse vulnerability [4]. Mendoza and Booth [3] states that characteristics of an area, such as the availability of therapy facilities or alcoholic beverages stores, are related to the success of therapy and behavior of substance abuse. Upon examining the provinces with high socioeconomic vulnerability index, 6 out of those 9 provinces have high access to health service indicator, which means population in those provinces is experiencing difficulties in accessing health services, including early health care to drug abuse. Data on drug abuser prevalence shows there are more drug abusers in western Indonesia then other parts of Indonesia. Limited number of drug rehabilitation centers in western Indonesia is hampering the drug abusers from receiving health services. This will eventually increase the vulnerability in the areas. Limited access to health services should be overcome so that drug abuse prevention and drug abuser rehabilitation programs can reach remote areas and benefit all Indonesian citizens.

4.1. Drug abuse risk level
Analysis on drug abuse risk level and its risk mapping can help in giving strong arguments for the government in planning drug abuse mitigation plan in Indonesia. The enormous area of Indonesian territory and the limited human and financial resources in drug abuse mitigation call for a drug abuse risk level analysis in Indonesian territories in order to plan effective and efficient programs. Failure in managing drug abuse risk properly will end in real disturbances on and threats against the national defense and security.

This risk level is determined by relating the drug abuse prevalence level with the index of socioeconomic vulnerability to drug abuse, with the requirements mentioned on figure 1. The result
shows that there are five (5) provinces (14.4%) with high risk level, nine (9) provinces (26.47%) with moderate risk level, and 20 provinces (58.8%) with low risk level. These data are mapped into Figure 3.

Figure 3. Distribution of drug abuse risk level.

The results of the drug abuse risk analysis based on socioeconomic and drug abuser prevalence show that Indonesian territories have various risk level. This research shows that 58.8% of Indonesian provinces are in low risk level, but without proper supervision and management, the risk level may increase. This prediction is based on two factors, which are the haste of drug trafficking, which will impact the drug abuser prevalence, and the Indonesian population socioeconomic conditions, which are very dynamic. Drug abuser risk level will affect Indonesian national resilience because the drug abuser prevalence will impact Indonesian human resources, which is the natural aspect of national defense, while the socioeconomic condition is part of the social aspect of the national defense.

Taking economy point of view, drug trafficking can be considered as a company business, where the business owners are looking for the most profitable location for the production, distribution and market or consumers [10]. Indonesia is in the brink of potential social and economic growth, considering the dynamics of Indonesian demography that is predicted to reach 305 million people in 2035, with 68.1% workforce in 2030. This, however, will also cause several vulnerabilities, including drug abuse.

Drug dealers have already eyed the opportunities in Indonesia’s demography, which can be seen in the high number of students being targeted in drug trafficking. Students are the potential long-term consumers. They will one day have their own income, which means increased purchasing power on drugs. This research reveals that income level has impacts on drug abuser prevalence partially. This mean that income level could led to the higher drug abuse prevalence, but we could not judge that the higher income level the higher the drug abuse risk level. It is because the drug abuse risk level is determined by reviewing the relation between index of socioeconomic vulnerability to drug abuse, which the income level is a part of it and drug abuser prevalence level.

Employment availability should also be anticipated; otherwise, the number of unemployment will soar. This will eventually increase the drug abuse vulnerability. The unemployed will easily be swayed into illegal business, including drug abuse, which will increase the drug abuser prevalence. This will result in the increase of drug abuse risk and will eventually be affecting Indonesian defense and security.
5. Conclusion
The socioeconomic factor (education, unemployment rate, income, gender ratio, poverty rate, and access to health service) influence the level of drug abuse prevalence in Indonesia, which the most significantly influence is income level. Index of socioeconomic vulnerability to drug abuse consists of two level, high (9 Province) and moderate (25 provinces). Provinces with high socioeconomic vulnerability index are Riau Islands, DKI Jakarta, West Java, Bangka Belitung Islands, East Kalimantan, Banten, West Papua, Riau, and North Kalimantan.

Drug abuse risk which can be viewed from the relation between drug abuse prevalence and the socioeconomic vulnerability to drug abuse, in Indonesia is classified into 3 level, which are high (5 provinces) moderate (9 provinces) and low (20 provinces). High levels are in DKI Jakarta, East Kalimantan, North Sumatera, West Java, and Riau Islands.

6. Suggestions
More researches are needed to study the relation between drug abuse and Indonesian territorial condition, including the addition of more socioeconomic vulnerability indicators, in order to obtain more comprehensive knowledge on the cause of drug abuse. Researches with smaller analysis unit, such as regency, district, and village, are also necessary to unveil description or information that are more suitable to the condition of socioeconomic vulnerability to drug abuse in each area.

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