# Modeling the Human Development Index Seen from the Aspect of Public Health in East Java

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## Abstract

The country should invest in health development to raise the standard of its human resources. The human development index (HDI) of a state can be impacted by health development as determined by the public health development index. Finding a prediction model for HDI in terms of public health development indicators was the aim of this study. The method used here is that for each district and city in East Java Province in 2018, secondary data on HDI and public health development indicators were collected. The Statistics Indonesia and the Health Research and Development Agency provided secondary data. Multiple linear regression analysis was performed on the data using the SPSS 26 program. Results show that the variables of toddler health, reproductive health, health services, health behavior, non-communicable diseases, and environmental health are significantly related to HDI, while the prediction for HDI based on linear regression model of this study is HDI = 44.831 + 20.347* indicators of health service indicators + 42.511* indicators of health behavior – 12.208* indicators of non-communicable diseases. Based on this model, it is necessary to pay more attention to health services, health behavior, and trends in non-communicable diseases in the community in order to increase the HDI rate in East Java Province.

**Keywords:** HDI; public health development indicators; linear regression model

## Introduction

Health as the foundation of human life is able to describe the condition of a person or community seen from the perspective of physical, mental, and social well-being and avoiding illness or disability (Permono, et.al., 2020; World Health Organization (WHO), 2023). Health is an important factor to support the smooth activities of everyone so that health becomes the main capital in the national development of a nation (Anggraini, et.al., 2017; Basuki, 2020). Thus, health and society cannot be separated to review the success of the country's development.

The Center for Disease Control (CDC) states that public health has the aim of protecting and improving the health of people and their communities through the promotion of healthy lifestyles, the prevention of disease and injury, and detecting, preventing, and responding to infectious diseases in populations, countries, or regions around the world (CDC, 2023). To measure the health status in the community, the Indonesian Government determines the level of public health as the capital for implementing national development through the development and guidance of higher-quality human resources (Basuki, 2020).

The quality of human resources in a country can show the extent of a country's level of development because development serves as a tool to achieve the nation's national goals (Larasati, 2018; Fitriyah, et.al., 2021). The United Nations Development Program (UNDP) describes that the dimensions of development consist of two aspects. First, the improvement of human capabilities includes increasing the time to live longer and healthier, increasing knowledge, and increasing decent living standards. Second, the creation of conditions that enable human development (Sugiyono, 2020; UNDP, 2022).

The implementation of human development includes three dimensions, specifically health, education, and income, which are then developed into (1) living a long and healthy life, (2) gaining access to education, and (3) having access to sources of fulfillment of life's needs (Damayanti, 2018; Sugiyono, 2020). Development is carried out and to be considered success if all levels of society are involved according to their respective potential and abilities (Muttaqien, et.al., 2019). Through the success of this development, the level of welfare of the Indonesian people can be known. One way to measure the level of development in a country or region is to use the Human Development Index (HDI) (Damayanti, 2018; Fitriyah, et.al., 2021; Larasati, 2018).

HDI is a benchmark for reviewing the extent of successful development of the quality of human life (Fitriyah, et.al., 2021). In addition, HDI is also used to classify countries in the world into developed, developing, and underdeveloped countries (Rahmat, et.al., 2020). Based on the HDI data of countries in the world issued by the United Nations (UN) in 2018, Indonesia's level of human development is at the intermediate human development country level (Damayanti, 2018). In addition, the article written by Larasati (2018) states that Indonesia's HDI level in 2015 was at the Medium Human Development level. Even though Indonesia occupies an intermediate level, the country experiences an increase in HDI every year (Fitriyah, et.al., 2021). According to Statistics Indonesia, there was consecutive national HDI growth in the 2015–2018 period of 0.93%, 0.91%, 0.90%, and 0.82% (Ningrum, et.al., 2020).
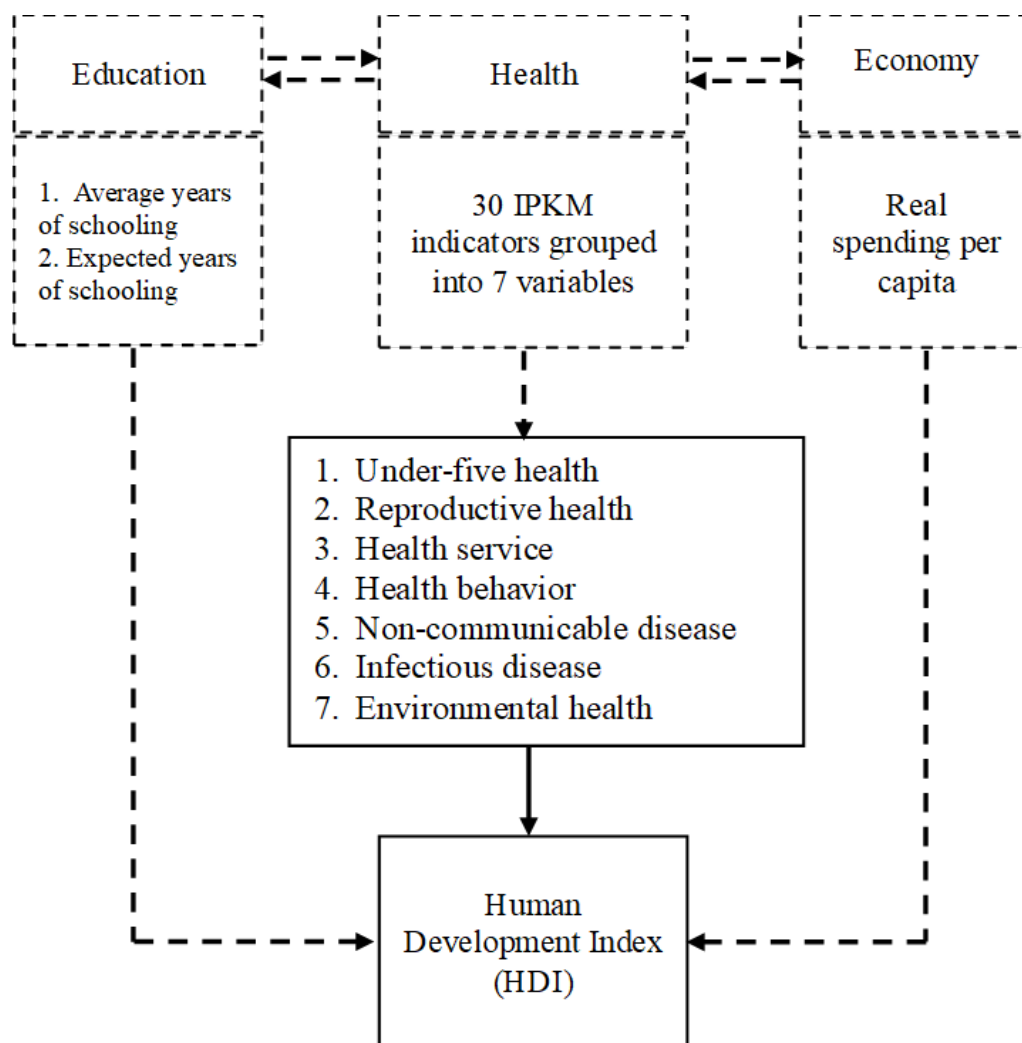
The increase in HDI is influenced by the health dimension. This is because the level of public health is one of the benchmarks for assessing the level of community welfare in a region (Damayanti, 2018). The Public Health Development Indicator (in Indonesian is known as IPKM) is one of the indicators used to assess HDI from the health aspect and to determine the success of development in the field of public health (Fitriyah, et.al., 2021). Rachmat (2019) defines health development as a development which focuses on improving public health status, community nutritional status, promotional and preventive efforts, and the national immunization program. In addition, national health development is related to the third point of the Sustainable Development Goals (SDGs), which aims to ensure good health and well-being for all people at all ages (Sarker, 2021).

Efforts to increase HDI are supported by government spending in the health sector, which aims to improve the level or quality of health in a sustainable and continuous manner in the long term so as to affect the productivity of human resources to be higher (Yanti, et.al., 2020). Therefore, as a key indicator which describes the level of public health development at the district or city level, the Health Research and Development Agency of the Indonesian Ministry of Health compiled IPKM. IPKM is a collection of health indicators which can be easily measured to describe health problems including under-five health, reproductive health, health services, health behavior, non-communicable diseases, infectious diseases, and environmental health (Kemenkes RI, 2020).

Based on the above background, it can be seen that HDI cannot be separated from

health sector development. Therefore, it is very important to examine the influence of indicators in the HDI which can have an impact on the level of HDI in East Java Province, know the HDI indicators which have the most influence on HDI, and predict the magnitude of the influence of each HDI indicator on HDI. This study uses 2018 data because it is in accordance with the availability of the latest GPA data, that is from 2018. This research is expected to provide an overview of health sector development and its interventions for the Health Office and the East Java Provincial Government in carrying out public health development programs.

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┌─────────────┐     ┌─────────────┐     ┌─────────────┐
│ Education   │◄--►│ Health      │◄--►│ Economy     │
├─────────────┤     ├─────────────┤     ├─────────────┤
│1. Average   │     │ 30 IPKM     │     │ Real        │
│  years of   │     │ indicators  │     │ spending    │
│  schooling  │     │ grouped     │     │ per capita  │
│2. Expected  │     │ into 7      │     │             │
│  years of   │     │ variables   │     │             │
│  schooling  │     │             │     │             │
└─────────────┘     └─────────────┘     └─────────────┘
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1. Under-five health
2. Reproductive health
3. Health service
4. Health behavior
5. Non-communicable disease
6. Infectious disease
7. Environmental health

Human Development Index (HDI)

Information:
    : The variable being analyzed
    : The variable not analyzed

*Source*: R. Hapsara Habib Rachmat, 2018 in his book '*Perkembangan Pembangunan Kesehatan: Analisis dan Proyeksi tahun 2000-2045*'

**Picture 1.** Outline of Research Theory

## Methods

The Health Research and Development Agency and Statistics Indonesia provided secondary data for this quantitative analysis. There were 38 regencies and cities in the East Java Province to be observed in 2018. HDI data as the dependent variable (Y), toddler health indicators (X1), reproductive health indicators (X2), health service indicators (X3), health behavior indicators (X4), non-communicable disease indicators (X5), infectious disease indicators (X6), and environmental health indicators (X7) are the data required for this study.

SPSS 26 was used for data analysis. Data analysis took the form of multiple linear regression analysis, with the goal of estimating how much the HDI in East Java Province will be influenced by public health development indicators. The multiple linear regression model is as follows.

$$\hat{Y} = \widehat{\beta_0} + \widehat{\beta_1}X_1 + \cdots + \widehat{\beta_k}X_k,$$

Information (Ningrum, et.al., 2020):
  $\hat{Y}$= Human Development Index (IPM)
  $\widehat{\beta_0}$= Constant
  X1 = toddler health indicator
  Xk = independent variable

The collected data is next examined for normality to determine whether the data are normal. Many regression models are constructed using normal data. Also, if the regression model satisfies the requirements for having the greatest Adj R-square value, the lowest SE, the lowest PRESS statistical value, the lowest AIC and SBC, and a CP Mallows value parameter, it is good and may be employed. Several levels of assumption testing, such as the linearity test, residual normality test, homoscedasticity test, multicollinearity test, autocorrelation test, partial test, and simultaneous test, are used when modeling in multiple linear regression analysis. If the multiple linear regression model passes each of the above assumption tests, it may also be used to predict the dependent variable.

## Results

Based on the results of the data normality test, it is known that the HDI variable (Y), reproductive health indicators (X2), health service indicators (X3), health behavior indicators (X4), non-communicable disease indicators (X5), and infectious disease indicators (X6) have a normal data distribution. Meanwhile, the toddler health indicator (X1) and the environmental health indicator (X7) have abnormal data distributions. Bivariate analysis is presented in Table 1.

**Table 1. Pearson Correlation Analysis**

| Symbols | Variable | p-value | Coefficient of Correlation |
|---------|----------|---------|---------------------------|
| X1* | the toddler health indicator | 0.000 | 0.625 |
| X2 | reproductive health indicators | 0.000 | 0.665 |
| X3 | health service indicators | 0.000 | 0.741 |
| X4 | health behaviour indicators | 0.000 | 0.669 |
| X5 | non-communicable disease indicators | 0.000 | -0.687 |
| X6 | infectious disease indicators | 0.269 | -0.184 |
| X7* | the environmental health indicator | 0.000 | 0.856 |

*Rank Spearman Correlation
(α = 0.050 dan CI = 95%)

Based on Table 1, the p-value of the independent variable is <0.050 for variables X1, X2, X3, X4, X5, and X7; while variable X6 has a p-value of 0.269> 0.050. This means that variables X1, X2, X3, X4, X5, and X7 are significantly related to Y, but variable X6 is not significantly related to Y. The magnitude of the relationship which occurs between variables X1 and Y is 0.625, included in the strong category with a positive relationship direction. The magnitude of the relationship which occurs between variables X2 and Y is 0.665, which is in the strong category with a positive relationship direction. Furthermore, the magnitude of the relationship which occurs between variables X3 and Y is 0.741, and to be included in the strong category with a positive relationship direction. The magnitude of the relationship which occurs between variables X4 and Y is 0.669, described as the strong category with a positive relationship direction. The magnitude of the relationship which occurs between variables X5 and Y is -0.687, that is in the strong category with a negative relationship direction. The magnitude of the relationship which occurs between variables X6 and Y, that is -0.184, it is included in the very weak category with a negative relationship direction. The magnitude of the relationship which occurs between variables X7 and Y is 0.856, and considered as a very strong category with a positive relationship direction.

X1 and X7 not used in multivariate analysis because the data was abnormal. Data abnormalities are caused by problematic data. Therefore, the independent variables which can be used to form a fit model with the dependent variable are X2, X3, X4, X5, and X6. Based on the results of the fit model using SPSS 26, 5 regression models were obtained, which are presented in Table 2.

**Table 2. Model Fit**

| No | Model | Adj R2 | SE | AIC | CP Mallows | SBC | PRESS |
|----|-------|--------|-----|-----|------------|-----|-------|
| 1 | Cons, X2, X3, X4, X5, X6 | 0.730 | 2.70471 | 81.089 | **6.000** | 90.915 | 335.12 |
| 2 | Cons, X3, X4, X5, X6 | **0.735** | **2.68310** | 79.649 | **5.000** | 87.837 | 321.98 |
| 3 | Cons, X3, X4, X5 | 0.730 | 2.70433 | **79.382** | **4.000** | 85.933 | **308.44** |

By gradually reducing the variables with the highest significance value and more than 0.050 until all variables had a significance value below 0.050, the fit model was created from the linear regression analysis of the entry method.

Based on Table 2, the fit model obtained 4 regression models. Models 2 and 3 meet the same number of 3 criteria, specifically 3 criteria. So, to determine a better model, look at the respective AIC and SBC values. Model 3 is better than model 2 because the AIC and SBC values of model 3 are lower than the AIC and SBC models 2. So, model 3 is used as a good regression model. However, to determine whether model 3 is good and feasible to use, it must meet the following regression assumptions.

1.  Linearity Assumptions
    Straight line relationship between the independent variables and the dependent variable is checked using the linearity assumption test. Table 3 displays the outcomes of the linearity test.

**Table 3. Linearity Assumptions**

| Variables dependent (Y) | Independent Variables (X) | R-Square | Test Decision |
|---|---|---|---|
| HDI | Health service indicators | 0.549 | linear |
| HDI | Health behavior indicators | 0.448 | linear |
| HDI | Non-communicable disease indicator | 0.472 | linear |

2.  Normality residual assumption
    The normality residual assumption test is used to examine the distribution of data derived from residuals produced by independent variables and the dependent variable. According to the residual normality test, the p-value was $0.089 > 0.050$ =. This indicates that the residuals are typically distributed as a result.

3.  Heteroscedasticity test
    The heteroscedasticity assumption test is used to determine if the regression model exhibits heteroscedasticity symptoms. If there are no signs of heteroscedasticity (p-value > 0.050), the regression model is sound. Table 4 displays the outcomes of the heteroscedasticity test.

**Table 4. Heteroscedasticity Assumption with Glejser Test**

| Independent Variables (X) | P-values | Test Decision |
|---|---|---|
| Indicators of health services (X3) | 0.811 | No heteroscedasticity |
| Indicators of health behavior (X4) | 0.825 | No heteroscedasticity |
| Indicators of non-communicable diseases (X5) | 0.378 | No heteroscedasticity |

4. Multicollinearity test

The multicollinearity assumption test is used to determine if the independent variables in the regression model are intercorrelated or collinear. If there are no indications of multicollinearity (Tol>0.10 and VIF1.000), the regression model is satisfactory. The Tol and VIF values shown in Table 5 are used as the foundation for the heteroscedasticity test findings.

**Table 5. Multicollinearity Assumptions**

| Independent Variables (X) | tolerance | VIF | Test Decision |
|---|---|---|---|
| Indicators of health services (X3) | 0.471 | 2.122 | Nomulticollinearity |
| Indicators of health behavior (X4) | 0.837 | 1.195 | Nomulticollinearity |
| Indicators of non-communicable diseases (X5) | 0.468 | 2.136 | No multicollinearity |

5. Autocorrelation test

The autocorrelation test tries to assess if in linear regression there is a link between residual errors in period t and errors in period t-1 (previous). If there are no indications of autocorrelation, the regression model is considered to be successful. The Durbin-Watson value of 2.078 was calculated using the SPSS 26 autocorrelation test results. This number falls between the dU value (1.6563) and the 4-dU value (2.3437). Therefore, the regression model is good and feasible to use.

6. Partial test (tT test)

Partially or separately, the p-value of each independent variable is presented in Table 6. The independent variable affects the dependent variable if the p-value < α.

**Table 6. T Test**

| Independent Variables (X) | P-values |
|---|---|
| Indicators of health services (X3) | 0.002 |
| Indicators of health behavior (X4) | 0.000 |
| Indicators of non-communicable diseases (X5) | 0.088 |

Variables X3 and X4 have an effect on variable Y, while variable X5 has no effect on Y.

7. Simultaneous test (Test F)

Simultaneously or concurrently, the p-value test F = 0.000 <0.050 was obtained. This means that if X3, X4 and X5 are analyzed jointly, all of these independent variables are able to influence the dependent variable.

8. Coefficient of Determination (R-Square)

Variables X3, X4 and X5 contribute to Y by 75.20% and the rest are influenced by other variables.

Based on the results of multiple linear regression analysis, the regression model is obtained which meets the requirements and is feasible to use. The following are the

findings of the regression model used in this study.

$$\hat{Y} = \widehat{\beta_0} + \widehat{\beta_3}X_3 + \widehat{\beta_4}X_4 + \widehat{\beta_5}X_5$$

HDI = 44.831 + 20.347*Indicators of health service indicators + 42,511* Indicators of health behavior -12,208* Indicators of non-communicable diseases

According to the regression model, the HDI variable will increase by 20.347 each time a variable unit of indicators of health services is added, by 42.511 each time a variable unit of indicators of health behavior is added, and by 12.2 each time a variable unit of indicators of non-communicable diseases is added, assuming that other variables remain constant.

The results of the research data analysis show that the HDI value in every regency or city in East Java Province can be predicted from indicators of health services, indicators of health behavior, and indicators of non-communicable diseases. This is in line with Fathurahman's research (2019), which shows that the public health development index and HDI have a significant influence. Research by Nugroho (2016), which claims that markers of healthy lifestyle behavior deserve attention since they can have an influence on infectious and non-communicable illnesses, also supports this claim. The study's healthy habits also included not smoking, cleaning one's hands, and taking care of one's mouth and teeth (Nugroho, 2016). According to Dharmayanti's research findings from 2018, lifestyle behaviors are a sub-indicator which has the potential to affect the public health development index. In addition, public health development indicators can raise people's life expectancies and the caliber of human resources in order to enhance HDI-measured human development (Fathurahman, 2019). In addition, the value of the public health development index can be used as a basis for planning health development programs and the allocation of regional health budgets (Dharmayanti, 2018).

## Discussion

*Infants and Toddlers Health Indicator Relationship to HDI*

Based on the results of the bivariate analysis, it is known that under-five health indicators are significantly related to HDI in East Java Province. Research by Sugiantari and Budiantara (2013) stated that the variable infant mortality rate, the percentage of infants aged 0–11 months who were breastfed for 4-6 months, and the percentage of toddlers aged 1-4 years who were fully immunized had an effect on life expectancy in East Java. The frequency of breastfeeding is less (<8 per day) in infants, with a risk of 4.073 times experiencing the incidence of malnutrition compared to infants who receive breast milk more than 8 times a day (Subandari, 2015). In addition, research by Ramadhani, et.al. (2020) shows that the proportion of malnourished and underweight children under five has a negative influence on life expectancy. So, if there is a decrease in the proportion of malnourished and underweight children, the life expectancy will experience an increase in value. Research by Febiola, et.al. (2022) states that the incidence of stunting in toddlers has an influence on life expectancy in West Bangka Regency.

*Reproductive Health Indicator Relationship to HDI*

Based on the results of the bivariate analysis, it is known that reproductive health indicators are significantly related to HDI in East Java Province. Research by Husen, et.al. (2021) showed a direct influence of the availability of contraceptives and contraceptive drugs on life expectancy in North Maluku Province, with a contribution to improving life expectancy of

96.4%. Research by Bukit (2019) states that pregnant women who carry out complete examinations can reduce maternal mortality in third-trimester high-risk pregnancies. This is supported by research by Annisaa, et.al. (2022), which states that health checks for pregnant women at least four times during pregnancy can predict HDI in Karanganyar by 99.3%. Pregnancy check-ups can be a facility for pregnant women to monitor their nutritional status. Pregnant women who suffer from nutritional deficiencies, such as chronic energy deficiency, anemia, and disorders due to iodine deficiency, are at risk of giving birth to low-weight babies and have an impact on the development and productivity of children later in life. This will have an impact on the quality of human resources in the future, which can affect the HDI (Villasari, et.al., 2021). HDI in the health sector must continue to be improved through various policies and service strategies, one of which is the Family Planning Program (Husen, 2021).

*Health Service Indicator Relationship to HDI*

Based on the results of the bivariate analysis, it is known that health service indicators are significantly related to HDI in East Java Province. Ismail's research (2021) shows that government spending on health services has a significant effect on HDI in Manado City. In line with this research, Sugiyono (2020) states that excellent health services at low costs can encourage improvements in the quality of public health and have an impact on increasing the HDI component of the health sector.

Indrawati (2018) states that improving the quality of health services is able to intervene in reproductive health problems so as to improve the quality of human development. This is in line with the results found, that is an increase in the coverage of childbirth by health workers in health facilities, the proportion of the adequacy of the number of

doctors, the proportion of the adequacy of the number of Integrated Healthcare Centers (*Posyandu*), and the proportion of ownership of health care insurance can increase the value of the reproductive health sub-index consisting of indicators of the use of long-term contraceptive methods, pregnancy checks, and chronic energy deficiency problems in women of childbearing age (Indrawati, 2018). The ratio of health workers also has a relation with one of the dimensions of HDI, to be spesifically life expectancy. Research by Ramadhani, et.al. (2020) shows that the proportion of villages with an adequate number of midwives per 1,000 population affects life expectancy. In addition, the number of doctors has a direct influence on life expectancy (Felangi & Yasa, 2020).

Winoto (2018) showed that health services are able to influence public health improvement, as seen from access and the quality of clinical care. The quality of health services is oriented towards aspects of patient safety, action, compatibility with patient relationships, and cost efficiency (Karim, et.al., 2018). Inequality in health services still occurs in East Java. This can be seen from the infant mortality rate in several underdeveloped areas, which is still relatively high. In addition, inequality is also seen in the uneven distribution of health workers, where most regions have a lower ratio of doctors than the average ratio in East Java (Fadilah, 2018).

*Health Behavior Indicator Relationship to HDI*

Based on the results of the bivariate analysis, it is known that health behavior indicators are significantly related to HDI in East Java Province. Risky health behavior is caused by inaccurate decisions taken when facing health problems, so this risky behavior can have short-term and long-term impacts on the public health situation. Toddlers with mothers who do not apply clean and healthy

living behaviors, such as washing hands with soap, have a 5 times greater risk of suffering from diarrhea than toddlers with mothers who apply clean and healthy living behaviors (Ruhardi & Yuliansari, 2021); adequate physical activity behavior by exercising can increase one's body immunity as a preventive effort in reducing the incidence of non-communicable diseases (Deniati & Annisaa, 2021); and smoking behaviour can contribute to the risk of death related to the respiratory system the most (Rachmawati, et.al., 2018).

Based on the results of multivariate analysis, it is known that health behavior has the greatest influence on the human development index. This is in line with H.L. Blum's theory, which explains that health status is influenced by four factors: lifestyle, environment, health services, and heredity. Among these factors, human behaviour (lifestyle) has the greatest influence compared to other factors. Health behaviour is a preventive effort to prevent disease, reduce the severity of disease, reduce the incidence of disease, and increase life expectancy in the community (Winoto, 2018). Therefore, health behaviour is directly related to changes in people's attitudes and behaviors in health development efforts. Healthy behavior has a direct effect on life expectancy in Bali Province (Felangi & Yasa, 2020). Research by Ardianti, et.al. (2015) shows that clean and healthy living behavior in Jember Regency has a negative effect on life expectancy. So that a decrease in in clean and healthy living behaviour in one unit, a decrease of the life expectancy rate (Ardiyanti, et.al., 2015).

### *Non-Communicable Disease Indicator Relationship to HDI*

Based on the results of the bivariate analysis, it is known that non-communicable disease indicators are significantly related to HDI in East Java Province. These results are in line with research by Nugroho (2016), which states

that indicators of the prevalence of injuries and joint pain make a major contribution to health development so that they can affect human development. In addition, the hypertension indicator makes a sufficient contribution to the achievement of health development. Hypertension can be influenced by several factors, such as age, gender, obesity level, stress level, physical activity, and lifestyle of each individual (Irawan, 2020). Obesity is a risk factor for other life-threatening diseases and adversely affects a person's quality of life (Runtuwe, et.al., 2022). The increasing incidence of obesity has an impact on the quality of public health and the achievement of the human development index (Soraya, 2019). This is because people with obesity tend to experience functional limitations, both physical and social (Runtuwe, et.al., 2022). Another non-communicable disease problem is oral and dental problems. In Indonesia, the most common dental problem is damaged, perforated, or diseased teeth (45.3%). Meanwhile, the majority of oral health problems experienced by the Indonesian population are swollen gums and/or abscesses (14%) (Kemenkes, 2018).

### *Infectious Disease Indicator Relationship to HDI*

The infectious disease indicator is measured by theree sub-indicators including pneumonia, diarrhea among children under five and upper respiratory tract infection among children under five (Tjandrarini, 2019). Pneumonia is an acute inflammation of lung tissue caused by microorganisms (bacteria, fungi, and viruses). Pneumonia can cause mild to severe symptoms. Pneumonia is also known as wet lung. In this condition, the infection causes inflammation of the air sacs (alveoli) in one or both lungs. As a result, the alveoli are filled with fluid or pus, making it difficult to breathe (Pratiwi, 2018). Diarrhea is an endemic disease, but it is still the cause of high child mortality worldwide and even

in Indonesia (Wahyuni, 2021). Respiratory tract infections are infections which occur in human breathing. This infection is caused by bacteria or viruses which attack the respiratory tract (Padila, 2019). Although it can occur at any age, ARI is more commonly experienced by toddlers under the age of five with a mortality rate of 40 per 1,000 births toddlers (Widianti, 2020).

Based on the results of the bivariate analysis, it is known that infectious disease indicators are not significantly related to HDI in East Java Province (p-value > 0.050). These results are not in line with research by Nugroho (2016), which states that the indicators of pneumonia prevalence and prevalence of acute respiratory infections contribute greatly to health development so that they can affect human development. Acute respiratory infections in toddlers are the most common cause of death in children in developing countries (Sabri, et.al., 2019). Acute respiratory infections of the lungs are a form of pneumonia. Pneumonia in toddlers is the leading cause of death among children under 5 years old in the world. Research by Pertiwi dan Nasution (2022) showed that maternal education, breastfeeding history, asthma history, house density, and house ventilation influenced the incidence of pneumonia in toddlers. Meanwhile, research by Pratiwi (2018) showed that pneumonia in toddlers was influenced by parents smoking habits, the habit of washing hands after coughing or sneezing, the habit of opening bedroom windows, and the habit of opening living room windows. According to Husna and Pratiwi's research, it is known that parental behavior, health history, and air circulation in the house affect the incidence of pneumonia in toddlers.

The diarrhea indicator in infectious diseases makes a significant contribution to the achievement of health development (Nugroho, 2016). Diarrhea also affects life expectancy in East Java (Amalia & Mahmudah, 2020). Most diarrhea in children

is caused by viral infections. In addition, it can also be due to bacterial infections, parasites, allergies, poisoning, intolerance, and side effects of drugs (Jap, 2021). The incidence of diarrhea is common among toddlers. This is because the immune system of toddlers is still weak and very susceptible to the virus that causes diarrhea (Wahyuni, 2021). Research by Limoy and Iit (2019) shows that the incidence of diarrhea in toddlers is influenced by the mother's employment status. Meanwhile, research by Hartati (2018) states that education, knowledge, and hand washing behavior of toddlers affect the incidence of diarrhea in toddlers.

*Environmental Health Indicator Relationship to HDI*

Based on the results of the bivariate analysis, it is known that environmental health indicators are significantly related to HDI in East Java Province. Improving the environment can increase a country's life expectancy (Felangi & Yasa, 2020). Research by Ramadhani, et. al. (2020) shows that the proportion of households with access to sanitation has a positive effect on life expectancy. This means that if the proportion of households with access to sanitation increases, life expectancy will increase. However, Marita's research (2019) stated that the percentage of healthy homes and households with clean and healthy living behaviors reduced the contribution of IPKM below the national level.

**Conclusions**

Based on the results of data analysis in 38 districts and cities in East Java Province in 2018, it is known that the variables of toddler health, reproductive health, health services, health behavior, non-communicable diseases, and environmental health are significantly related to HDI. Meanwhile, the HDI value in each regency or city in East Java Province

can be predicted from indicators of health services, indicators of health behavior, and indicators of non-communicable diseases. The multiple linear regression model obtained is HDI = 44.831 + 20.347* Indicators of health service indicators + 42.511* Indicators of health behavior -12.208* Indicators of non-communicable diseases. Based on this model, it is necessary to pay more attention to health services, health behavior and trends in non-communicable diseases in the community in order to increase the HDI rate in East Java Province.

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