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SCORING PREDICTORS OF STUNTING BASED ON THE EPIDEMIOLOGICAL TRIAD

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ABSTRAK

Scoring predictor stunting ditujukan untuk melakukan prediksi atau penilaian risiko terhadap anak mengalami stunting. Pendekatan trias epidemiologi mencakup tiga elemen penting yaitu host, agent dan environtment yang terkait dengan stunting. Langkah-langkah dalam pengembangan scoring predictor stunting meliputi identifikasi variabel dan data, analisis data untuk memahami hubungan antar variabel, pengembangan model prediktif, dan validasi model untuk memastikan kinerja dan akurasi model. Setelah model dikembangkan, implementasi dan evaluasi model menjadi penting dalam mengaplikasikan model dalam skala yang lebih luas, serta memantau kinerja dan efektivitas model dalam mencegah dan mengatasi stunting. Tujuan akhir dari scoring predictor stunting adalah untuk mengurangi prevalensi stunting dan meningkatkan kualitas hidup anak-anak dengan mencegah dampak buruk yang mungkin ditimbulkan oleh kondisi gizi yang buruk ini dalam jangka Panjang

ABSTRACT

The scoring predictor of stunting is intended to predict or assess the risk of a child experiencing stunting. The epidemiological triad approach includes three important elements, namely the host, agent, and environment related to stunting. The steps in developing a scoring predictor of stunting include identifying variables and data, analysing data to understand the relationships between variables, developing predictive models, and model validation to ensure model performance and accuracy. After the model is developed, implementation and evaluation of the model become important in applying the model on a wider scale as well as monitoring the performance and effectiveness of the model in preventing and overcoming stunting. The ultimate goal of the scoring predictor of stunting is to reduce the prevalence of stunting and improve the quality of life for children by preventing the adverse effects that this condition of malnutrition may cause in the long term.

INTRODUCTION

A scoring predictor is a statistical analysis method or predictive model used to estimate the risk or probability of occurrence of a health or disease event based on existing epidemiological data [1]. This model can take advantage of various risk factors, population characteristics, and other related variables to build a score or predictive value that provides insight into the level of individual or group risk of a particular disease or health condition [2,3]. The risk score generated by the scoring predictor provides guidance for health workers in identifying individuals or groups at high risk of developing certain diseases.

Scoring predictors in epidemiology are important tools for identifying risk factors and classifying community or individual risk levels more precisely. With the help of scoring predictor models, health experts can plan more effective and targeted interventions for disease prevention and control, as well as carry out more accurate epidemiological monitoring [4]. Scoring predictor with the epidemiological

triad approach is an analytical method that utilises the concept of the epidemiological triad to predict a person's risk or probability of developing a particular disease or health condition [5]. The epidemiological triad approach involves three important elements: the causative agent, the host or susceptible individual, and the environment [6].

The causative agent in the epidemiological triad refers to the factors that cause or contribute to the occurrence of disease. In scoring predictors, causative agents can be variables such as viruses, bacteria, or other environmental factors associated with certain diseases or conditions [6]. Host or susceptible individuals are the second factor in the epidemiological triad, which emphasises the importance of individual characteristics that influence the likelihood of disease. In scoring predictors, susceptible hosts or individuals include variables such as age, sex, immunisation completeness status, medical history, and genetic factors that can influence disease risk [6,7]. The environment includes all the external factors that affect the host and causative agents.

By integrating these three elements, scoring predictors use relevant data to develop predictive models that can estimate a person's risk or probability of developing a disease or health condition based on a combination of causative agents, host characteristics, and the existing environment [8]. This approach helps health professionals identify high-risk groups and design appropriate interventions to prevent or reduce the impact of the disease or condition.

The scoring predictor of stunting is intended to predict or assess the risk of children experiencing stunting [9]. Stunting is a chronic nutritional problem that occurs in children due to malnutrition, especially protein and energy, during the growth period [10,11]. This can cause a child to have a shorter height than the normal height that they should have at a certain age [8].

The scoring predictor of stunting based on the epidemiological triad approach is an analytical method that uses the concept of the epidemiological triad to predict the risk or probability of a child experiencing stunting (height being shorter than it should be at a certain age). This approach includes three important elements in the epidemiological triad associated with stunting. The causative agents of stunting refer to the factors that cause or contribute to stunting. In this case, the causative agents of stunting include insufficient nutritional factors during the growth period, including deficiencies of protein, energy, vitamins, and minerals needed for optimal growth and development of children [6]. Vulnerable hosts or individuals in the context of scoring predictors of stunting are children who are at risk of experiencing stunting. Factors considered in this risk assessment include the child's age, gender, immunisation status, nutritional status from birth, history of previous growth, and genetic factors that affect children's growth [6,7]. The environment in the scoring predictor of stunting includes external factors that affect children's growth, including access to nutritious food, good sanitation and hygiene, access to health services, as well as social and economic environmental conditions [12,13].

By integrating the three elements of the epidemiological triad, the scoring predictor of stunting uses relevant data to develop predictive models that estimate the risk of stunting in children based on a combination of the causative agent, host characteristics, and the existing environment. This model helps health experts and researchers identify groups of children who are at high risk of experiencing stunting so that appropriate prevention and intervention efforts can be directed at them. Thus, it is expected to reduce

the prevalence of stunting and improve the quality of health and life for children [8].

Finally, by knowing the risk of stunting in children through scoring predictors, appropriate prevention and intervention efforts can be directed to groups in need, such as providing nutritional supplementation, nutritional assistance, education about healthy eating patterns, and improving the environment that supports growth and child development [14]. The ultimate goal of the scoring predictor of stunting is to reduce the prevalence of stunting and improve the quality of life for children by preventing the adverse effects that this poor nutritional condition may cause in the long term [2].

MATERIALS AND METHODS

The stages of a literature review begin by establishing the objectives and scope that guide the selection of relevant literature concerning stunting scoring predictors. Subsequently, sources of literature are identified through academic databases, scholarly journals, books, and other reputable sources. Among the various sources found, there is a filtration process to select the most relevant and high-quality sources in accordance with the literature review's goals. Following this, a thorough analysis of these sources is conducted, recording the main findings and conclusions from each study. Then, the information from various sources is synthesized, identifying patterns and similarities, as well as pinpointing existing research gaps. Lastly, the literature review is reviewed and edited to ensure coherence, clarity, as well as accurate grammar and spelling.

RESULTS

The results of this literature search yield the steps involved in the development of a stunting scoring predictor. The stages of the scoring predictor encompass the identification of variables and data, data analysis to comprehend the relationships among variables, the development of a predictive model, and the validation of the model to ensure its performance and accuracy. Once the model is developed, the implementation and evaluation of the model become crucial in applying it on a broader scale, as well as monitoring the performance and effectiveness of the model in preventing and addressing stunting.

DISCUSSION

The stages of scoring predictor stunting based on the epidemiological triad approach involve several steps involving data analysis and the development of predictive models.

Identification of Variables and Data. The first step is to identify the relevant variables based on the epidemiological triad concept. These variables can include nutritional factors (e.g., intake of protein, energy, vitamins, and minerals), individual characteristics (age, sex, growth history), and environmental factors (sanitation, access to food, social and economic environment). Next, collect the necessary data for these variables from reliable sources. Following are the steps in identifying variables and data:

Literature Review

Do a literature review first to understand the factors that are known to contribute to stunting. In this literature review, look for previous research, health reports, and guidance related to stunting or child nutrition and growth issues. From here, you can identify the relevant variables that need to be included in the analysis.

Expert Consultation

Discuss with health experts, nutritionists, and epidemiologists who are experienced in stunting. They can help identify important risk factors to consider and provide insight into the variables to include in the analysis.

Survey Data or Secondary Data Sources

Obtain the necessary data from relevant sources. Data can come from national health

surveys, data from hospitals, or other secondary data sources that include information on stunting and relevant variables. Make sure the data obtained contains the information needed for predictive analysis, such as the child's age, nutritional status, growth history, diet, environment, and other factors related to stunting.

Data Cleanup

After the data is obtained, perform data cleaning to address missing or invalid values as well as identify and handle potential outliers. Clean and valid data ensures that predictive analysis and models deliver accurate and reliable results.

Variable Selection

After the data is cleaned, perform variable selection to select the most relevant and influential variables in predicting stunting. This process may involve statistical analysis, such as correlation tests and multivariate analysis, to determine the variables that are closely related to stunting.

Data Processing (Predictive Model)

Process the selected data and identify the variables to prepare the data for predictive model development. This includes coding the variables, dividing the data into training data and test data, and selecting the appropriate analytical method for model development.

By identifying relevant variables and obtaining the necessary data to develop scoring predictors of stunting, we can ensure that the resulting predictive models can provide meaningful information in efforts to prevent and treat stunting in children.

Data Analysis. After the data is collected, the next step is to perform data analysis. This includes cleaning the data to address missing or invalid values, conducting data exploration to understand patterns and relationships between variables, and perhaps also conducting statistical tests to identify significant factors in relation to stunting. The steps of this data analysis include data processing, data exploration, and statistical tests that aim to understand the relationship between variables and evaluate the relationship between variables and stunting.

Data processing

The initial stage is to perform data processing to clean the data from missing or invalid values as well as handle potential outliers. If there are missing values, consider imputing data or removing incomplete rows or columns. Make sure the data is ready and clean to proceed to the next stage.

Data Exploration

Perform data exploration to understand the characteristics of the data and identify interesting patterns or trends. You can use visualisation methods such as histograms, scatter plots, or box plots to look at the distribution of the data and see if there is an apparent relationship between the predictor variable and the target (stunting) variable.

Statistic Test

Next, use statistical tests to test the relationship between the predictor variables and the target variable. Statistical tests commonly used in data analysis are the correlation test (eg Pearson or Spearman) to measure the correlation between numerical variables, and the chi- square test or t test for categorical or binary variables.

Multivariate Analysis

If there are many predictor variables, multivariate analysis such as linear regression or other multivariate analysis can be used to identify the influencing variables significant effect on stunting and estimates the effect of each variable [15].

Predictive Models

Based on the results of data analysis, you can develop predictive models using appropriate statistical methods or machine learning techniques. This model will link the predictor variable with the target variable (stunting) and can be used to make predictions on new data.

Model Validation

After the predictive model has been developed, validate the model using data that was not used in model building. This validation is important to ensure that the model has good performance and can generalise well to new data

Interpretation of Results

Finally, interpret the results of data analysis and predictive models with care. Understand what each coefficient or predictor in the model means and identify the variables that have the most influence on stunting prediction. Good data analysis will provide deeper insight into factors related to stunting and assist in the development of accurate and relevant scoring predictors. The results of the data analysis will become the basis for developing appropriate policies and interventions to reduce the risk of stunting and improve children's health.

Predictive Model Development

Using the data that has been analysed, the next step is to develop a predictive model. This model can be a regression model, a classification model, or other machine learning methods that suit the characteristics of the data and prediction purposes. This model will link predictor variables (causative agents, hosts, and environment) with the target variable, namely stunting. This means that predictive models are used to estimate or predict a person's likelihood of experiencing stunting based on relevant predictor variables. Following are the general steps in predictive model development:

Model Method Selection

Determine the predictive model method to be used based on the characteristics of the data and the purpose of the prediction. Several methods commonly used in predictive model development are linear regression, logistic regression, decision trees, and random forest.

Data Sharing

Divide the data into two parts: training data and test data. The training data is used to develop the model, while the test data is used to test the performance of the model that has been built. This division is important to avoid overfitting, which is a condition in which the model fits the training data too well and cannot generalise to new data.

Variable Selection

Select the predictor variables to be included in the model. These variables must be relevant and have a significant effect on stunting based on the results of the analysis of previous data. Make sure the data used is numeric or has been coded correctly if using a method that requires categorical data.

Models Training

Use the training data to train the model. This training process is carried out by optimizing the model parameters so that the model can learn patterns and relationships from the training data and produce accurate predictions.

Model Validation

After the model is trained, use the test data to perform validation. Evaluate model performance using appropriate evaluation metrics such as accuracy, sensitivity, specificity, area under the curve (AUC), or Mean Squared Error (MSE), depending on the type of problem and the method used.

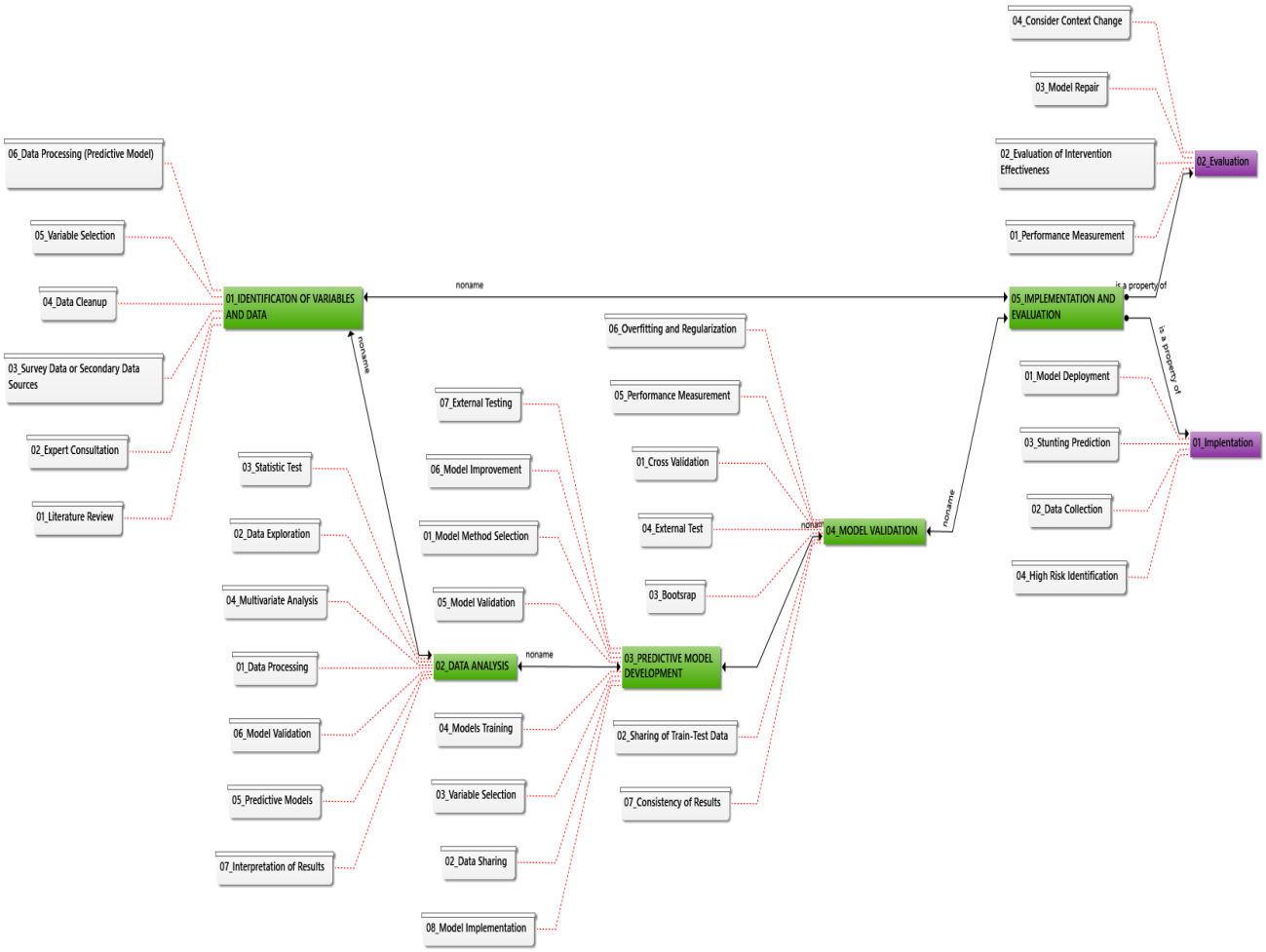

Figure 2. Stages of scoring predictor stunting

Model Improvement

If the model's performance is not satisfactory, consider improving the model by changing parameters, adding or removing predictor variables, or trying a different method.

External Testing

If the model has performed well on the test data, perform external tests on completely fresh and independent data. This aims to ensure that the model can really generalise well to data that has never been seen before.

Model Implementation

After the predictive model is considered good and valid, it can be implemented to score predictors of stunting in the target population. The prediction results can be used to identify children who are at high risk of experiencing stunting and design appropriate interventions.

Developing predictive models requires an in-depth understanding of the statistical methods used as well as expertise in programming and data analysis. With a thorough and mature process, the predictive model can be a powerful tool in supporting efforts to prevent and treat stunting in children.

Model Validation

Once a predictive model has been developed, the next step is to validate it. Model validation is carried out using data that is not used in model development. This is important to ensure that the model has good performance and can generalise well to new data. Model validation is used to test model performance and ensure that the model has the ability to generalise to data that has never been seen before. Here are some commonly used validation methods:

Cross-Validation

Cross-validation is one of the most commonly used validation methods. In cross-validation, the data is divided into several overlapping parts (folds). The model is trained using one part as training data and tested using another part as test data. This process is repeated k times (usually k = 5 or 10) so that all parts of the data are used as test and training data. Finally, the evaluation results from each crossvalidation iteration are taken as an average to provide an overview of the model's performance.

Sharing of Train-Test Data

In this method, the data is divided into two parts, namely training data and test data. The model is trained using training data and tested on separate test data. Evaluation is carried out on the test data to objectively measure the performance of the model.

Bootstrap

Bootstrap is a validation method that takes a random sample and replaces it with training data. This process is repeated several times, and the model is developed at each bootstrap iteration. Model performance is measured based on the average result of each bootstrap iteration.

External Test

This method involves testing the model on completely new, independent data that has not been used in training or validation before. The external test aims to test the extent to which the model can generalise well to data that has never been seen before.

Performance Measurement

Choose the appropriate evaluation metric to measure the performance of the model. This metric will depend on the type of problem and the type of model used. Some commonly used evaluation metrics are accuracy, sensitivity, specificity, area under the curve (AUC), and Mean Squared Error (MSE).

Overfitting and Regularization

Always pay attention to the potential for overfitting, which is a condition when the model fits the training data too well but cannot generalise to new data or test data. To overcome overfitting, you can use regularisation techniques such as dropout, L1 or L2 regularisation, or a simpler model.

Consistency of Results

Make sure the model evaluation results are consistent across the various validation methods used. If the results are consistent and the model has good performance on test data and external data, then the model can be considered valid and can be used as a scoring predictor of stunting or for other prediction purposes. Model validation helps ensure that the developed model provides reliable results and can be generalised to data that has not been seen before.

Implementation and Evaluation

After the model has been validated and deemed feasible, it can be implemented to score predictors of stunting in the target population. The prediction results can be used to identify children who are at high risk of experiencing stunting. Furthermore, evaluation of the effectiveness of the implemented models and interventions also needs to be carried out periodically.

Implementation and evaluation of predictive models are the last stages in the process of developing a stunting scoring predictor. Implementation focuses on applying the model to predict stunting in the target population, while evaluation aims to measure the effectiveness and performance of the model that has been implemented.

Implementation

Model Deployment. Predictive models that have been developed are implemented in relevant environments, for example, in health information systems, health applications, or

specific platforms for scoring predictor stunting.

Data Collection. Make sure the data needed to predict stunting is available and integrated with the model. This data must include relevant predictor variables to enable the model to provide accurate predictive results.

Stunting Prediction. Use the model to predict stunting in the target population. Input predictor data (e.g., age, nutritional status, diet, and environment) into the model and obtain stunting prediction results for each individual.

High Risk Identification. Predictive outcome analysis to identify children at high risk of stunting. This identification will assist in directing prevention and intervention efforts to groups in need.

Evaluation

Performance Measurement. Perform model performance evaluations periodically to monitor the model's performance and accuracy in predicting stunting. Use relevant evaluation metrics, such as accuracy, sensitivity, specificity, AUC, or other metrics appropriate to the prediction objective.

Evaluation of Intervention Effectiveness. If any intervention or prevention program is implemented based on the predicted results, an evaluation of the effectiveness of the intervention should also be carried out. Monitor the development of stunting in children who receive interventions to see if the intervention is successful in reducing the risk of stunting.

Model Repair. If the evaluation results show that the model performance is not satisfactory or there are areas of improvement, consider improving the model by changing the parameters or adding predictor variables that are more informative.

Continuous Monitoring and Evaluation. Evaluation of models and interventions must take place on an ongoing basis to ensure that models always provide relevant and accurate results in supporting stunting prevention efforts.

Consider Context Changes. Always consider changes in the context or population that affect the model. If there are changes in population characteristics or risk factors for stunting, ensure that the model is updated as needed.

Implementation and evaluation of an effective stunting predictive model will assist in identifying the risk of stunting earlier and planning appropriate interventions so that the predictive model can make a positive contribution in improving the quality of life and health of children.

CONCLUSION AND RECOMENDATION

The development of a scoring predictor of stunting based on the epidemiological triad approach is an approach that has the potential to be strong in predicting the risk of stunting in children. This approach involves identifying causal agents, hosts, and the environment that contribute to stunting and using these variables as predictive factors in model development [9,16].

The steps in developing a scoring predictor of stunting include identifying variables and data, analysing data to understand the relationships between variables, developing predictive models, and model validation to ensure model performance and accuracy. After the model is developed, implementation and evaluation of the model become important in applying the model on a wider scale as well as monitoring the performance and effectiveness of the model in preventing and overcoming stunting.

By developing policies and interventions based on model predictions, stunting prevention can be carried out in a more targeted and effective manner. Involving related parties, implementing holistic intervention programmes, and monitoring

regularly will help improve the quality of life and health of children and address the problem of stunting in a comprehensive manner.

To increase the effectiveness of stunting prevention efforts, including strengthening the health and nutrition system, educating the public about stunting, ongoing monitoring and evaluation, cross-sectoral collaboration, increasing access to nutrition and health services, ongoing research and development, evidence-based approaches, handling the causal factors related to stunting, policy advocacy, and ongoing counselling for health practitioners and field workers, With these steps, it is expected to reduce stunting rates and improve children's health as a whole.

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