International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN:2347-6567

IJAMSCR |Volume 11 | Issue 3 | Jul - Sep - 2023
www.ijamscr.com

Research article *Child Health*

Child Health Detection System Along with the Recommendations Using K-Nearest Neighbor Artificial Intelligence

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Published on: 03.07.2023

ABSTRACT

Background: Children under 5 years of age were very vulnerable to disease. Therefore, child health is one of the main focuses in the health sector. The main triggers for under-five mortality were preventable and treatable diseases. There were 5 diseases mostly experienced by under-five children, namely pneumonia, diarrhea, malaria, measles and malnutrition. In Indonesia, child health detection is still performed manually by midwives using the IMCI cards, but during the Covid-19 pandemic, child health detection is not actively performed. The K-Nearest Neighbor Artificial Intelligence System can be used for child health detection.
Objective: To develop a child health detection system along with the recommendations using k-nearest neighbor artificial intelligence.
Methods: Research and Development (RnD) and system accuracy test. The study subjects involved secondary data of 1000 IMCI register data. Data were tested using the intra-class correlation coefficient and the K-Nearest Neighbor algorithm.
Results: The results of the child health detection system using k-nearest neighbor artificial intelligence obtained a system accuracy rate of 100% and the sick child health recommendation system using k-nearest neighbor artificial intelligence obtained a system accuracy rate of 89.3%. It was proven that k-nearest neighbor artificial intelligence was able to develop a child health detection system along with the recommendations which can be used by parents.

Keywords: *children health detection, k-nearest neighbor.*

INTRODUCTION

Human health comes foremost when it comes to supporting activities carried out by humans, particularly children. The health index for children under the age of five was displayed in the graph below (AKABA). Diseases that were mainly preventable and treated were the leading causes of mortality in children under the age of five. Pneumonia, diarrhea, malaria, measles, and malnutrition were the five most prevalent diseases in children under the age of five that may be avoided and treated. As a result, reducing morbidity and mortality in children under the age of five was a high priority that must be improved.[1,2]

Reduced AKABA is one of the SDG targets in the 2020-2024 health development strategy plan. Several strategies were developed to meet the SDGs' objectives, including improving the health of children under the age of five, improving community nutrition, and improving disease control. 3 To improve the health of children under the age of five, health workers, particularly midwives who work at the public health center as the front line of public health services, must improve their skills in dealing with sick toddlers. The IMCI approach helps to develop these abilities.[4,5]
Of the ASEAN countries in 2015 Indonesia was the fifth highest country with under-five mortality as many as 26 per 1,000 live births.[6] Based on the results of the 2017 IDHS, the number of under-five deaths was 32 per 1,000 live births.[7]

The most common causes of under-five mortality were diarrhea (25.2%), pneumonia (15.5%), dengue hemorrhagic fever (6.8%), measles (5.8%), the incidence of malnutrition (5.4%) and the incidence of malnutrition (13%).[8]

In Central Java in 2019 the AKABA was 9.6 per 1,000 live births. The main causes of under-five mortality were diarrhea by 39%, pneumonia by 33.1%, fever by 17.4% and diphtheria by 10.6%. [9] As for the City of Semarang in 2018, the AKABA was 7.46 per 1,000 live births or 187 cases out of 25,074 live births. Based on the causes, most of the under-five deaths were caused by other reasons as much as 48%. Other causes referred to were diarrhea by 5%, ARI by 30%, and malaria by 3%. [10]

In addition to these diseases, there were new diseases that were similar to pneumonia. This disease was called Covid-19 which was caused by a Corona virus called SARS-Cov 2.[11] Covid-19 was at risk of being transmitted to the elderly, chronic disease sufferers and smokers. But apart from that, toddlers were also a group that has a risk of being infected.[12] The Director of Prevention and Control of Mental Health and Drug Problems stated that on July 19, 2020 there were 7,008 Indonesian children infected with Covid-19, 8.6% were given treatment, 8.3% were declared cured, and 1.6% died.[13]

To find out the health condition of toddlers, a toddler's health detection is carried out. IMCI is a first-level health management tool used by midwives to detect the health of children under five and provide treatment in order to prevent under-five mortality.[14] However, due to the Covid-19 pandemic, toddler health detection services have become hampered. To break the chain of spread of the Covid-19 virus, direct communication between health workers and the community is recommended not to be carried out so that it is shifted to communicating through the media.[15] Media that can be used as a new innovation in health communication is artificial intelligence which has components for detecting toddlers' health and recommendations to make it easier for parents and health workers.

At this time there has been research on disease detection in toddlers using an expert system, but nothing has been done using artificial intelligence independently by parents and screening for Covid-19 in toddlers. In Indonesia, the detection of under-five health was still done manually by midwives using IMCI. So that during the Covid-19 pandemic, the detection of toddlers' health was not actively carried out. Artificial intelligence can be used to provide information and make decisions based on how the human brain works, making it faster and more precise. When compared to manual systems, artificial intelligence diagnoses diseases faster and makes the best decisions and offers the best solutions based on the signs and symptoms encountered. Using remote health workers to provide health consultations, health detection, diagnosis, and medical actions for toddlers during the Covid-19 pandemic could be a viable option.

METHODS

This research is Research and Development (R&D). This research has received permission from the ethics commission from Dr. Moewardi General Hospital No. 724/ VII / HREC/ 2021 signed July, 05 2021. Neighborthe In this study, the goal was to design a system and change or improve the existing system, then test the success of the system, and account for it so that it can be used to assist health services, especially in the field of midwifery. The population in this study were all children under five in the city of Semarang, Central Java province. The sample in this study used secondary data, namely IMCI register data at the Kedungmundu Health Center, Ngesrep Health Center and Srondol Health Center from January 2020 to March 2021 as many as 1,000 data.

The instruments used in this study were: interview guidelines used to collect the necessary data, expert feasibility test assessment questionnaires were used so that the assessments given by media experts and material experts were regular and in accordance with system conditions, and a system framework consisting of a framework the under-five health detection system and its recommendations were also the framework for the COVID-19 screening system. To determine the level of accuracy of the under-five health detection system and the accuracy of the under-five health recommendation system, it was necessary to test the accuracy of the system by calculating the percentage of truth. The method used to test the accuracy was the k-nearest neighbor algorithm.[18]

RESULTS

Table 1: Result of Evaluation System

S.No	Accuracy Test	Amount of Data	Average accuracy score using the K-NN method (%)
1.	Toddler health detection	1.000	100%
2.	Recommended sick toddler	1.000	89.3%

From table 1 above, it can be concluded that based on the results of the system evaluation, it can be seen that from 1,000 IMCI register data, the detection of toddler health using artificial intelligence K-NN has an average K-NN score of 100%. It can be concluded that the artificial intelligence of K-Nearest Neighbors was accurate in detecting the health of toddlers. For system evaluation results, the recommendation for sick toddlers using artificial intelligence K-NN resulted in an average K-NN score of 89.3%. The conclusion was that the artificial intelligence of K-Nearest Neighbors was accurate in providing recommendations for sick toddlers.

DISCUSSION

K-Nearest Neighbor Artificial Intelligence System is Accurate in Detecting Toddler Health

The toddler health detection system and its recommendations using artificial intelligence k-nearest neighbor is a system renewal in the form of software on a smartphone. This system

makes parents the target of its use because it helps parents detect the health of their toddlers at home which aims to speed up knowing the health conditions of toddlers based on the signs and symptoms experienced so that they can be handled immediately according to the recommendations. The way this system works is also easy because parents only need to enter the age of the toddler and the signs and symptoms experienced by the toddler into the system, then the results of the diagnosis will come out without requiring a long time.

With advances in technology and the development of today's era, smartphones are not only used as a tool to communicate with each other, but can also be used to solve problems. Smartphones at this time can be used to carry out the work of an expert in their field. Detection of the health of children under five can not only be done by health workers, but parents are expected to be able to do it as well. Users of this system are intended for parents who have toddlers independently. By using this system, it can provide convenience to detect the health of toddlers because it can be accessed at any time and wherever parents are using smartphones.

This system is capable of detecting several diseases that trigger the main AKABA (toddler mortality rate) namely ARI, pneumonia, diarrhea, malaria and measles. So the system will detect the disease according to the input symptoms. In addition, in this system there is a Covid-19 screening so that parents can independently screen their toddlers every week.

In addition to health workers, people living in the environment of toddlers also need a spontaneous system in detecting the health of toddlers so that if a toddler is sick, early help can be given. Parents are the closest people to toddlers so that if toddlers experience signs of illness, parents can immediately carry out health detection to find out the diagnosis of toddler's disease. Early detection of a toddler's health can minimize complications because if a toddler is sick, parents must take action quickly. The system can make it easier for parents to make a diagnosis of disease spontaneously, quickly and in real time because with the system, it can prevent toddlers' condition from getting worse and they can get treatment as soon as possible.

The system built by the researcher can provide good diagnostic results according to the signs and symptoms. It is evident from the results of the accuracy test of the under-five health detection system showing a high level of accuracy, which is 100%. Based on these results, it can be interpreted that it is proven to be able to build a toddler health detection system using K-NN artificial intelligence and can be used properly in detecting the health of toddlers.

The K-Nearest Neighbor Artificial Intelligence System is Accurate in Giving Recommendations to Sick Toddlers

The health detection system and its recommendations using the artificial intelligence of the K-Nearest Neighbor are renewal of previous studies detecting diseases using experts' systems, but giving the solution still manually. While researchers use the K-NN artificial intelligence system to detect and provide toddler health recommendations. With this system used as a health application in providing health solutions and can be used by the general public, especially parents who have toddlers, making it easier for health handling. The recommendation given is to consist of any handling that must be done if a sick toddler. So that parents know the right actions in dealing with the condition of the bank before being taken to the service facility for further examination.

In the system created by the researcher, there are 5 main diseases that are often experienced by toddlers that can be avoided and treated, plus the Covid-19 disease. In fact, there are many types of diseases experienced by toddlers, but the reason for this research is that the public knows which diseases can be avoided so that they are alert to their toddlers and can treat or deal with them quickly. With this, we can reduce the morbidity and mortality of children under five.

The system that has been built has provided appropriate recommendations based on the signs and symptoms inputted by parents and the diagnosis generated by the system. In accordance with the accuracy test of the sick toddler recommendation system, the result was 89.3%. Based on these results, it is concluded that it is proven to be able to build a health detection system and its recommendations using artificial intelligence k-nearest neighbor and the system can be used to provide recommendations for sick toddlers.

CONCLUSION

It is proven to be able to build a toddler health detection system using artificial intelligence k-nearest neighbor with the results of a system accuracy rate of 100%, and that the health recommendation system for sick toddlers uses artificial intelligence k-nearest neighbor with the results of a system accuracy rate of 89.3%.

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