

Article

# Integration of Mapping Malnutrition Cases in Toddlers Based on Geographic Information System With Media Communication Information Education in Health

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**Abstract:** In this study, the stunting case incidence mapping system has been further developed, and its integration with Communication, Information, and Education (KIE) media in the health sector. This study aims to increase knowledge about the world of health, especially related to stunting, through the integration of KIE media into data visualization of stunting cases. The results of developing this system integration include a fairly good level of acceptance from the community, as evidenced by the results of User Acceptance Testing (UAT) carried out on health workers and mothers with children under five. Functional testing of the system has also been completed with the conclusion that several features need to be improved. UAT testing obtained results worth 87%, and from functionality testing a success rate reached 90%, but all improvements have been completed. Future studies that can be carried out are to implement this integrated system more widely.

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## 1. Introduction

The prevalence of stunting in Indonesia, which only reached 21.6% in 2023 [1], is still said to be far from the target set by the world organization, the United Nations (UN). Standard indicators in the Sustainable Development Goals (SDGs) set a target of reducing the number of stunted children by 40% by 2025 based on the 2012 baseline [2]. In 2012, the stunting prevalence rate in Indonesia was still at 37%. The target of the Indonesian Government in 2025 is to succeed in reducing the prevalence of stunting to 14%.

The baseline report on the acceleration of stunting prevention program prepared by the Indonesian government still feels that stunting prevention efforts are not optimal and are progressing slowly [3]. Still in the same report, five pillars for accelerating stunting prevention are mentioned. One of these pillars is a national campaign and behavior change with the target of increasing understanding and awareness and encouraging behavior change to prevent stunting. The second of the five pillars is coordinated by the Ministry of Health together with the Ministry of Communication and Information.

The main strategies in this second pillar include, consistent and sustainable behavior change campaigns for the general public; interpersonal communication according to the target context; ongoing advocacy to decision makers; and developing the capacity of program managers. The indicators used to measure the success of implementing this second pillar are the percentage of people who assess stunting as 10 important problems in children's nutrition and health; implementation of consistent and sustainable behavior change campaigns at the central and regional levels; the issuance of regional policies that include public campaigns and behavior change communication; and implementing training for organizers of effective and efficient behavior change campaigns and communications.

The activities in this study seek to implement the first of four strategies from the second pillar, namely a consistent and sustainable behavior change campaign for the general public, by utilizing the integration of geographic information systems for stunting cases with information and education communication media in the health sector, especially stunting. Before this study began, a system was developed that displays digital maps as a form of visualization of the number of stunting cases in one of the sub-districts in Jember Regency, East Java [4]. In previous studies, an application for early detection of cases of malnutrition which was the cause of stunting was developed based on a geographic information system. Then the continuation of the study is an evaluation using the COBIT 5 Framework method [5]. The evaluation was carried out with the respondents, heads of community health centers, midwives and posyandu officers. The results of the evaluation obtained are in the form of suggestions for further improvements in terms of vulnerability to errors and increasing the ability of internal parties to control the system to handle errors [5].

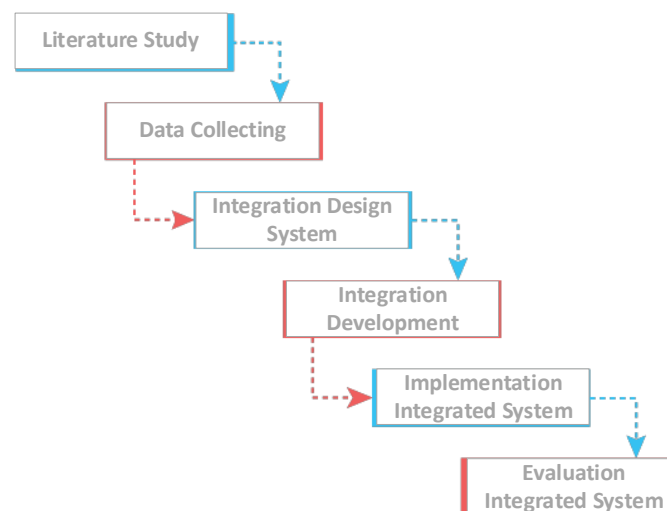
Previously, studies related to communication media, information and education in the health sector had widely discussed their application. Communication, information and education media have been developed for communities in volcanic disaster areas [6]. The results of this study stated that there had been no special IEC health education at the time of the volcanic eruption. Existing programs are generally still carried out with a traditional approach, and the community believes that by carrying out powerful rituals it will provide protection and safety from the dangers of volcanoes [6]. In a case study of sex workers, exposure to IEC media on HIV and AIDS was correlated with the level of knowledge of sex workers [7]. The IEC media in this study used media in the form of leaflets. Leaflet and sticker media are health communication media that shape and change the knowledge of female sex workers. Exposure to KIE leaflet and sticker media was measured by the frequency and duration of female sex workers using the media. For knowledge, the causes, symptoms or signs, treatment methods, transmission methods and prevention methods for HIV and AIDS are measured [7].

Next, KIE media discussed its influence on cases of exposure to pornography in teenagers. The IEC media in this case study are leaflet and video media. The results of the study showed that there was a change in students' knowledge before and after the IEC intervention with leaflets, namely those with good knowledge were 3.3% to 43.3%, while those with sufficient knowledge were 50.0% to 53.3%, and those with poor knowledge were 46.7% to 3.3% (Tindoan, 2018). The research results for video media showed that there were changes in students before and after the counseling, namely those with good knowledge were 20.0% to 90.0%, while those with sufficient knowledge were 63.3% to 10.0%, and 16.7%. less knowledgeable becomes no less knowledgeable [8]. Finally, maternal and child health books were used as IEC media by involving mothers with toddlers as the research population [9]. The results of the analysis using the chi square test showed that there was a significant relationship between increasing maternal behavior and the effectiveness of using maternal and child health books ( $p=0.002$ ) [9].

Therefore, in this study digital communication, information and education media were developed which were integrated with digital map visualization which provides data on the distribution of malnutrition conditions for children under five. Where the visualization in the form of a geographic information system has been previously developed and evaluated. The aim of this study is to provide a form of content variation from IEC media which usually uses leaflets, stickers, videos and books. The IEC media used in this study is digital media such as articles complete with images, then also videos that have been uploaded and verified for publication in the system. All KIE media in this system integration are digital media, and can be developed further if needed. So that in the future this system will become even more flexible to adjust the content of the KIE media in it. In this study, the stunting case incidence mapping system has been further developed, and its integration with Communication, Information, and Education (KIE) media in the health sector. This study aims to increase knowledge about the world of health, especially

related to stunting, through the integration of KIE media into data visualization of stunting cases.

## 2. Materials and Methods



**Figure 1.** Research stages

Figure 1 above shows the stages of this study. In total there are six stages in this activity, the first stage is literature study, the second is data collection, then continues with system integration design and development. After that, the integrated system is implemented and then evaluated. Overall, each of these stages is carried out to achieve the objectives of this study and if obstacles or deficiencies are found in the results of each stage, iterations will be carried out in the previous stage.

Before carrying out this study, there were several studies that had studied several communication, information and education media that contained content about stunting. The first study used video as an IEC medium. The video contains material about counseling by Undergraduate Nutrition students as communicators and was uploaded to YouTube. The message conveyed was information about stunting, the communicants (respondents) were students from non-health study programs. Feedback is obtained through filling out questionnaires before and after watching videos distributed via mobile messaging applications. The results show that there is a significant difference between respondents' understanding and the increase in test scores before and after watching the counseling video. Counseling using videos uploaded to YouTube can be used as a medium for conveying messages about stunting [10].

Next, health promotion media is used to increase mothers' knowledge about stunting. Mothers' lack of knowledge about stunting is one of the causes of ineffective promotional media. The results of this study show that health promotion media that can be used to increase knowledge about stunting among mothers of toddlers include leaflets, posters, flipcharts, flyers, videos and WhatsApp social media. These media can be used singly or in combination. Absorption of the information conveyed depends on the type of senses involved in the process of receiving the message. Absorption is greatest with the visual sense. Therefore, visual media needs to be used optimally. The use of health promotion media in combination can increase the absorption of the information conveyed because more senses are involved [11].

Furthermore, in 2022 there will be a study which aims to test innovations in public nutrition education based on social media marketing on YouTube, Facebook, Instagram, TikTok and Twitter and measure their effect on cognitive, affective and behavioral changes. Overall results for all social media, there was an increase in knowledge of 13.88

points, attitudes of 2.30 points and behavior of 5.81 points. In the three variables, by adding up the delta changes, the social media with the highest increase was TikTok (36.75), followed by Instagram (22.29), Twitter (20.25), YouTube (16.66) and Facebook (12.61). The social media that produces the most changes in target knowledge is TikTok, while changes in target attitudes and behavior are most effective through social media Instagram [12].

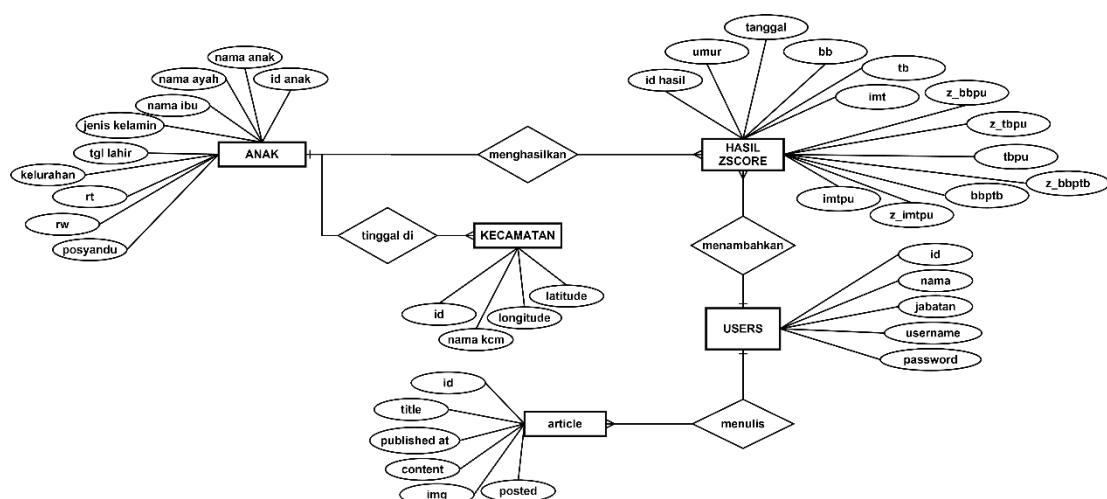
Most recently, in 2023, there was a study that designed an anti-stunting guidebook as a medium for information and education. This study is based on the results of observations carried out through offline bookstores and through online bookstore websites. It was found that there was no anti-stunting food guide book to educate mothers about preventing the dangers of stunting in children, which explained with illustrations and photos by highlighting cooking recipes. to prevent the danger of stunting in children [13]. The information explained in this draft guidebook includes information about the dangers of stunting in children, how to prevent stunting, factors that can influence the occurrence of stunting in children, types of food to prevent stunting in children, and reducing the dangers of stunting in children. Indonesia, so that it can minimize or prevent the occurrence of undesirable things for children and as information for mothers [13].

Based on several previous works, this study proposes an integration between communication, information and education media with a platform that visualizes incidents or cases of malnutrition in toddlers which can cause stunting. It is hoped that this KIE media can contribute to increasing knowledge and awareness not only for mothers but also for the entire wider community. Events or cases of malnutrition in toddlers in this system are visualized in the form of digital maps, while the KIE media contained in this system is in the form of articles, images and videos. The choice of these three media was based on several previous studies which mostly used the same type of media.

This system integration begins with planning the communication, information and education (KIE) media content that will be used. Through the literature study stage, information was obtained regarding KIE media that have been widely used, firstly the media of leaflets, flipcharts, pictures, flyers or posters and secondly in the form of videos [8][10][11][12][14][15][16][17][18]. The results of the literature study stage show that the types of media commonly used are image and video media. As an addition to the integrated system, media in the form of writing or articles is also used to clarify the description of the type of image media.

Developing a system that contains media content uses a trial and error process. The reason the trial and error process was chosen was because there were parameters in the geographic information system that had been developed previously that needed to be adjusted, such as the database structure, user access rights, and digital map visualization displays that were further expanded in scope. Apart from that, this trial and error approach also makes integration completion time more efficient. At this development stage, the results of the integrated system design are also implemented.

The continuation of the development stage is system testing or evaluation. This stage is the most critical stage in the integration process, because if an error message is found then the integration process can be said to have failed. This testing stage uses tools from existing web-based system development frameworks. The object of testing is the performance or execution time of the function or code syntax. Then, to test the functionality, the black-box method is used, with the aim of finding out the functionality of the features added or integrated from communication, information and education media. The last is the analysis and discussion stage, where at this stage the results of the tests that have been carried out are analyzed and then discussed regarding the next follow-up.



**Figure 2.** ERD Database Design

### 3. Results

The result of this research is a system that visualizes with digital maps the data on malnutrition incidents in toddlers which are the cause of stunting cases which is integrated with communication, information and education media in the health sector, especially stunting. The first stage carried out in this study was to explore the type of IEC media that was most effective or most widely used in previous studies. The use of video and image media types with added articles describing the images is the result of this first stage.

Before starting the system development stage, the system is first designed to be integrated with the previous system. Figure 2 shows the database design using an entity relationship diagram (ERD). In the design in Figure 2 there is the addition of a new entity. The new entities in question are articles and videos. In the article entity there is an img attribute to indicate the location of the image file regarding KIE media.

Apart from the ERD design in Figure 2, there is also an ERD design which contains unrelated entities and is shown in Figure 3. The new entity related to KIE media integration is the video entity, while other unrelated entities are used as a basis or benchmark in calculating the zscore value. from the malnutrition status of toddlers.

This system integration design not only expands the scope of the design of the database structure, but also adds designs related to user access rights as well. Use case diagrams are used as a design of process cases that can be carried out by certain actors. Figure 4 below shows the design of a use-case diagram for integrating a geographic information system on the distribution of malnutrition among children under five which is the cause of stunting cases with communication, information and education media in the health sector.

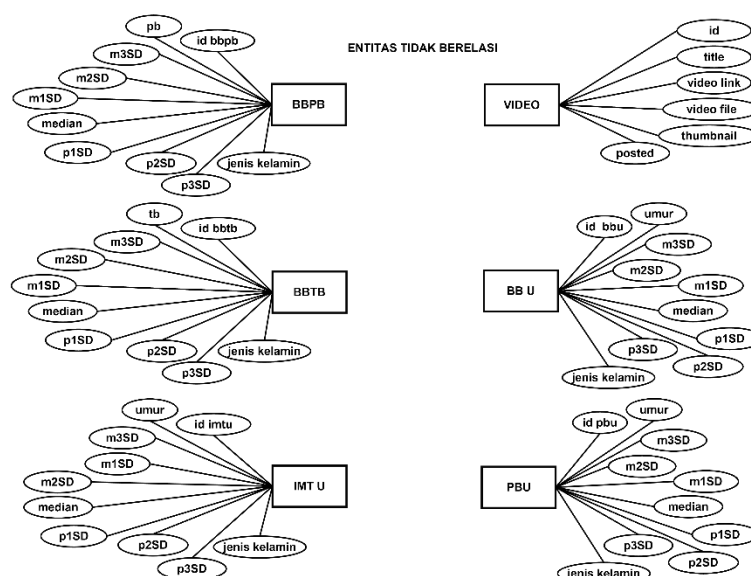


Figure 3. ERD Database Unrelational Design

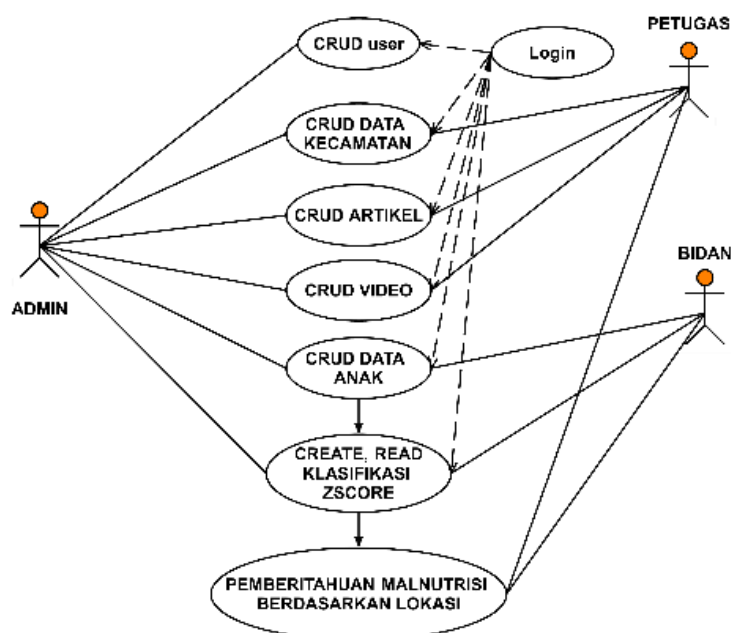


Figure 4. ERD Database Unrelational Design

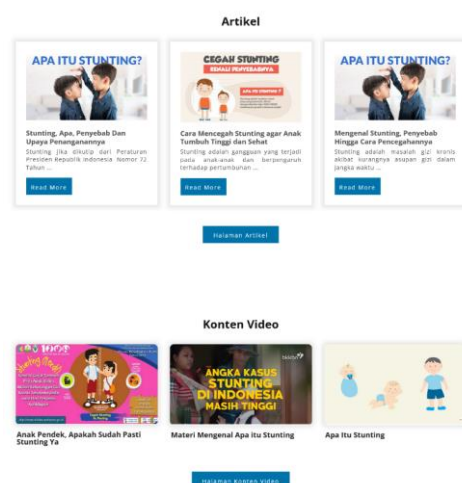
Figure 4 shows that there are three main actors who have access to the system, first is the administrator, then the officer and finally the midwife. This main actor has not changed from the previous system. The most visible change in this use case diagram is the addition of the create read update delete (CRUD) case for articles and videos. The rest of this use case diagram can be said to be the same as systems that have been developed previously. The only changes added to the system include expanding the coverage of digital maps, which previously only covered one sub-district area, and now covers one regency area.

After the integrated system design has been completed, the next stage is the development stage. As discussed in the previous section. This development stage uses a trial and error process. As a result of this process, several new system features have been added that support the use of communication, information and education media. This new feature is shown through the new Media KIE menu with article and video submenus. Figure

5 shows the display of adding article and video data as IEC media. The results of adding articles and videos can be seen from the home page which can be accessed by the general public, without having to log in.

**Figure 5.** Add New Article and Video Data

The system integration development stage has been completed here. Next, the testing phase is first carried out using the black-box method. The black-box method is used to test the functionality of each new feature added or integrated into the old system. The results of black-box testing for the functionality of new features can be seen in table 1. Apart from the black-box method, the php-testing method is also used to test the performance of each function or code syntax.



**Figure 6.** Section Article and Video on Homepage

#### 4. Discussion

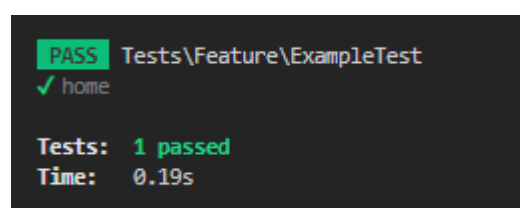
The discussion material for this study was obtained from several test results that have been carried out. The first test carried out is black-box testing, this test has been widely used previously in the development of several integrated software, for example in integrated systems that are implemented in the cleanliness of a location point to indicate an environmentally friendly place [19]. Next, studies applied in the education sector also use the same testing method, namely the integration of systems that manage academic progress data [20].

Based on table 1 and figure 7, black-box testing and the performance of the integrated system obtained good results. The three new features added related to communication, information and education (KIE) media in the form of articles/video content received valid

information in black-box testing. Meanwhile, to access the home page, a very fast execution time was obtained, namely 0.19 seconds.

**Table 1.** Black-box Testing Method Result.

| Scenario                                 | Result   | Conclusion |
|--|--|------------|
| Click button Add article / video content | Success direct to Add New data article / video content | valid      |
| Filling form new article / video content | Success Add New data article / video content           | valid      |
| Accessed Homepage                        | Success showing article / video content                | valid      |



**Figure 7.** Homepage Test Performance

Tests were carried out on health education information communication media experts as well as workers in the health sector and mothers as a form of User Acceptance Test. These respondents gave an average success score of 90% for the integrated health education information communication media system. The majority of failures with an average value of 10% were caused by respondents' lack of understanding of a system in general.

In line with the results of the tests that have been carried out, starting from black-box testing and also performance testing, it is proven that the integration of the malnutrition case mapping system and the health education information communication media system has been completed and can be said to be successful. The results of black-box testing of the features of the health information communication media system in the form of articles and videos show valid results, as well as the results of performance testing which show the fast test time obtained also strengthens the previous valid evidence.

## 5. Conclusions

In accordance with the results and discussions described in the previous section, this study succeeded in developing digital communication, information and education media which was integrated with digital map visualization which provides data on the distribution of malnutrition condition data for children under five. This system integration has been successfully proven by the testing methods that have been carried out, namely black-box and performance testing. Specifically for testing performance, it took 0.19 seconds to access the home page which contains articles and video content related to communication media, information and education in the health sector. The results of developing this system integration include a fairly good level of acceptance from the community, as evidenced by the results of User Acceptance Testing (UAT) carried out on health workers and mothers with children under five. Functional testing of the system has also been completed with the conclusion that several features need to be improved. UAT testing obtained results worth 87%, and from functionality testing a success rate reached 90%, but all improvements have been completed. In the future, this study can be continued to a further testing stage, namely through active involvement of respondents from officers and midwives who are in the field and closer to pregnant women or those with children under five.



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