Design of baby growth monitor system in the Posyandu for nutrition status analysis

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Abstract. Generally, the reporting and recording a nutrition status of infants and baby, which conducted at the Posyandu, is still using the manual system. The problem in the manual system is that the local Health Office cannot monitor the status of infants at the Posyandu. Therefore to support government programs, especially in maternal and child health, an application system is needed that helps to monitor the growth and development of infants and baby. The purpose of this study is to design a system to monitor the infant and baby growth at the Posyandu for Health Office of Surabaya, which further it can be accessed online. This research method was Retrospective and perspective designed, where the development of the growth of infants and baby can be monitored and analysed for its impact. The population and samples were taken from infants and baby in the local Posyandu. The growth monitoring of infants and baby used indicators of nutritional status with the index of weight for ages (BB/U), weight for length (BB/TB), and length for ages (TB/U). In this research, the designs of baby growth monitoring system can be applied well at many Posyandu. In this study, the MySQL and PHP database system data can be integrated into other database systems to support existing reporting systems. Furthermore, this research application can be applied to monitor baby growth in the city and this country.

1. Introduction

Information systems are a combination of components that work together to collect, process, store and provide information to support decision making, coordination, control, problem analysis and virtualization in an organization [1]. The information system is a network of interconnected, gathered procedures to carry out an activity or complete a certain goal. Therefore, the information system is a collection of interconnected components with its task to process data into information to be used for certain purposes. So it can be concluded that the information system is a collection of interconnected components and processing data into information so that the information can be used for specific purposes,one of them is the monitor of the growth and development of infants in Posyandu. This monitor system uses a web-based information system that can inventory all data on the growth and development process of babies. Expectations of this system can be used later to assist Posyandu activities and assist community service activities, especially baby growth and development monitor. Furthermore, the data can be integrated into the database system of nutrition services at the Puskesmas, especially monitor the incidence of malnutrition, stunting in infants from 0 months to 12 months.

In Indonesia, the average coverage of children under-5 years measurement is 49.4% with an indicator big as 65%. Meanwhile, KMS (*Kartu Menuju Sehat* – Growth Chart) is only used by 30.5% of the total population of children under 5-years [2]. KMS coverage and monitoring is an indicator to determine the growth and development of children under 5-years. Impaired growth during pregnancy can lead to low birth weight. Research in Nepal shows that babies with low birth weight have a higher risk of stunting [3].

In the course of developing the nutritional conditions of children, according to the Indonesian Ministry of Health, nutrition conditions in Indonesia have improved in the last five years. This can be seen from the results of the 2018 Basic Health Research (Riset Kesehatan Dasar - Riskesdas), which showed that the prevalence of malnutrition, stunting, and excess nutrition had declined compared to 2013. Malnutrition dropped from 19.6% to 17.7%, and stunting decreased from 37.2% to 30.8%. However, according to the health policy observer and Chair of the Indonesian Health Economics Association (IHEA), Prof. Hasbullah Thabrany, regardless the fact that nutrition problems have decreased in number, the basic concern is the risk of non-communicable diseases, malnutrition and stunting that are correlated with the level of Intelligence Quotient (IQ) [4]. The research results showed that small born length (OR=4,091; CI=1,162-14,397), the absence of breastfeeding (OR=4,643;CI=1,328-16,233), low family income (OR=3,250; CI=1,150-9,187), mother's low education (OR=3,378; CI=1,246-9,157), and low knowledge on nutrient (OR=3,877; CI=1,410-10,658) are among the factors related to stunting among the children under-7 years [5]. On the other hand, overweight and obesity are other issues needed to be addressed [6]. Based on Riskesda data by the Ministry of Health of the Republic of Indonesia, the prevalence of overweight and obesity in children aged 5–12 years reached 18.8% in 2013 [2]. Overweight and obesity not only affect physical health, but also mental condition.

Several studies on the condition of children under-5 years who are suffered from malnutrition, stunting and overweight and obesity, there are several advantages in implementing computer-based, website and phone applications. However, it is still not widely used in supporting health programs. Scholars from Bangalor, India, Sohas Hola, Mahima M Katti, developed the design of Android-Based Mobile Application Development [7]. An open-source application is recommended for nutritional status measurement. However, the web-based database processing system to store high-capacity data is still needed to monitor continuous development monitoring. Therefore, a study on database development is still important, especially in monitoring infant's growth in Posyandu to support the attempt of developing the health of mothers and their children in Indonesia.

Malnutrition and stunting show the interrelated relationship. Stunting in children is the impact of nutrient deficiency during the first thousand days of their lives. Stunting is a state of height index according to age below minus two standard deviations based on WHO standards. Stunting is the long-term manifestation influenced by a low-quality diet, recurring infectious disease, and environment [2]. Based on the background, this article is aimed at designing research to monitor baby growth by implementing a database-system. The use of database-system will allow wider data service in the future: e-cloud [8]. In general, this article is focused on designing system to integrate with Android-based baby growth monitoring system, especially to identify the children's nutritional status based on body weight for age (BB/U), bodyweight for body height (BB/TB), and body height for age (TB/U).

2. Methods and designs

2.1. Development stages

Survey and system design development were conducted in baby measurement post in Posyandu before the initialization of research. The initial research includes: a) learning input and report system, b) analysing problems with the support of related literature and article journal, c) developing the application system and preparing the infrastructure such as computer, software, and hardware, d) composing the concept framework, e) testing the application, and f) issuing reports. The stages are the following:

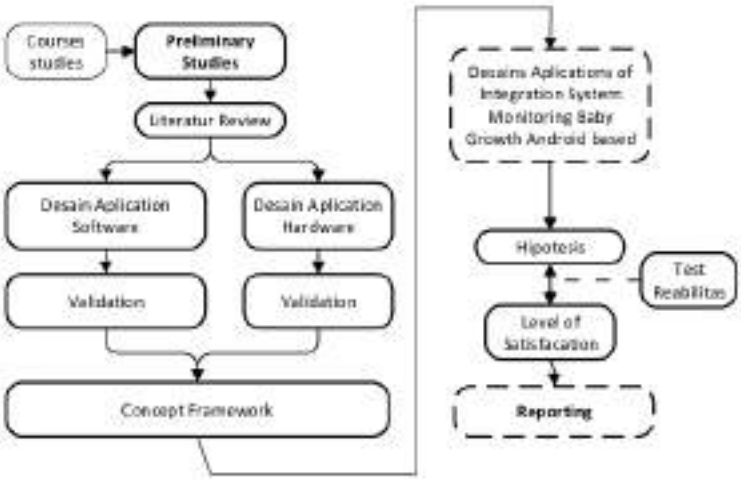

Figure 1. Stages of research.

2.2. Working concept framework

Working concept framework is composed of several methods to support the application system of baby growth monitoring, including: a) user as administrator and operator officer, b) data input that include data of the baby, anthropometry, and the parents, c) media, or the development of database-based application system of baby growth monitoring using MySQL, PHP, and Java Program [9], d) database [10], e) service output, individual, and institution. Later, the data can be developed for multiuser as explained in the following chart [11]:

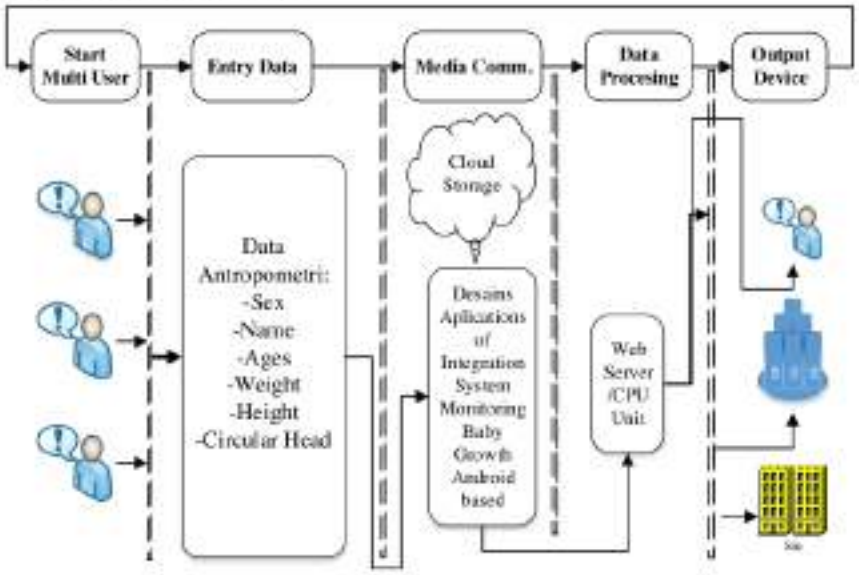

Figure 2. Block diagram system monitoring application design baby growth.

3. Results and discussion

3.1. System development and application

The following figures show the designed interface of the monitoring application system. It includes a menu for username and password and input working stages.

Figure 3. Interface design.

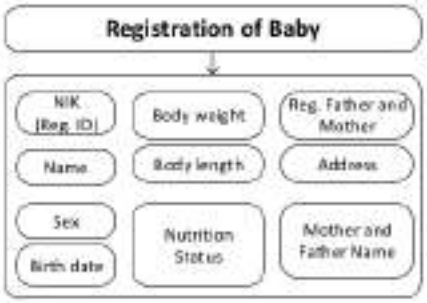

Figure 4. Working stages of data input system.

3.2. Design of infant monitoring menu

The development of the infant monitoring menu is the main activity of the Posyandu, which is the monitoring of infant height and weight measurement. The data is inputted by the entry form of baby examination to be used as the monitoring of infant growth. The following is the design of the infant monitoring menu.

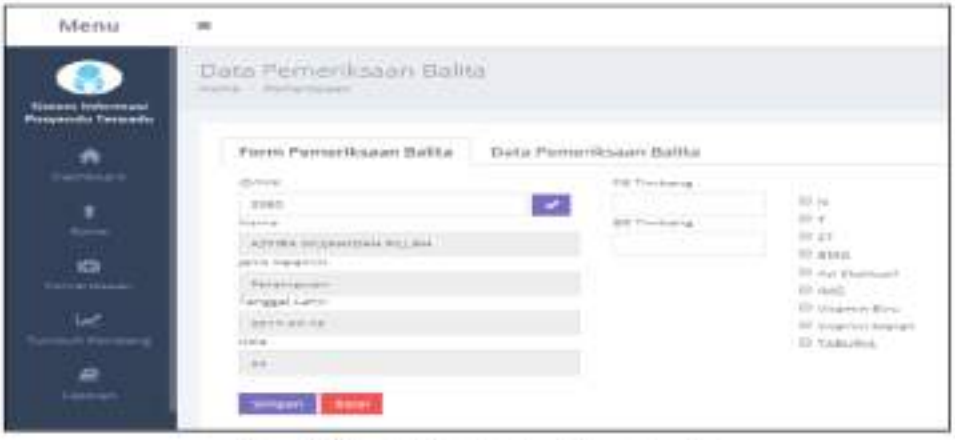

Figure 5. Menu interface toddler's inspection data.

Next, the output of the report design involved baby weight (kg), and age (month). It is shown in the following figure.

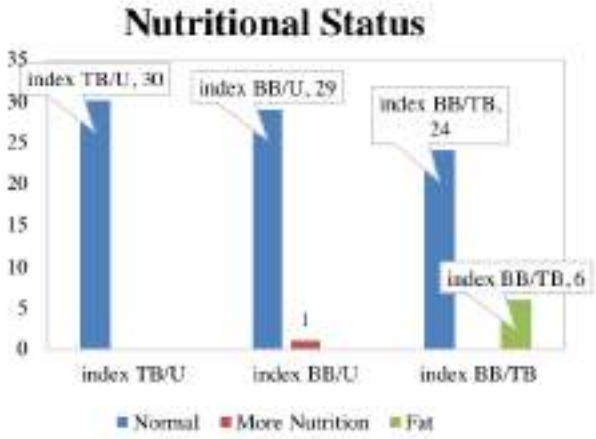

Figure 6. Distribution of children under-5 year for status nutritional in Srikandi Posyandu.

The above figure is the result of the database application system to be downloaded and processed to make a report on the monitoring of baby growth according to nutritional status.

3.3. ZScore analysis

The Z-Score of the recorded data is then analysed to determine the baby's nutritional status [12]. The following is the example of the Z-Score calculation [13] for 15-months old male baby and 15-months old female baby with the BW/age measurement of 10 kilograms:

$$ZScore = \frac{10-10.3}{10.3-9.2} = -0,27 \gg Good\ nutritional\ status \quad (1)$$

$$ZScore = \frac{Subject\ Individual\ Score - Reference\ Median\ Score}{Reference\ Standard\ Intersection\ Value} \quad (2)$$

Table 1. Standard value of body weight for age (BW/age) in male child < 60 month.

Age (month)	Body Weight (Kg)						
	-3SD	-2SD	-1SD	Median	1SD	2SD	3SD
15	7.4	8.3	9.2	10.3	11.5	12.8	14.9

Nutritional status of 15-month old female baby with bodyweight of 10 kilograms:

$$z\,Score = \frac{10-9.6}{10.9-9.6} = 0.30 \gg Good\ nutritional\ status \quad (3)$$

Table 2. Standard value of body weight for age (BW/age) in female child < 60 month.

Age (month)	Body weight (Kg)						
	-3SD	-2SD	-1SD	Median	1SD	2SD	3SD
15	6.7	7.6	8.5	9.6	10.9	12.4	14.1

The Z-Score analysis is also conducted using software applications. Furthermore, the results of the examination of toddlers' data according to Zscore calculation based on the BB / U index, BB / TB can be seen its distribution in the chart below.

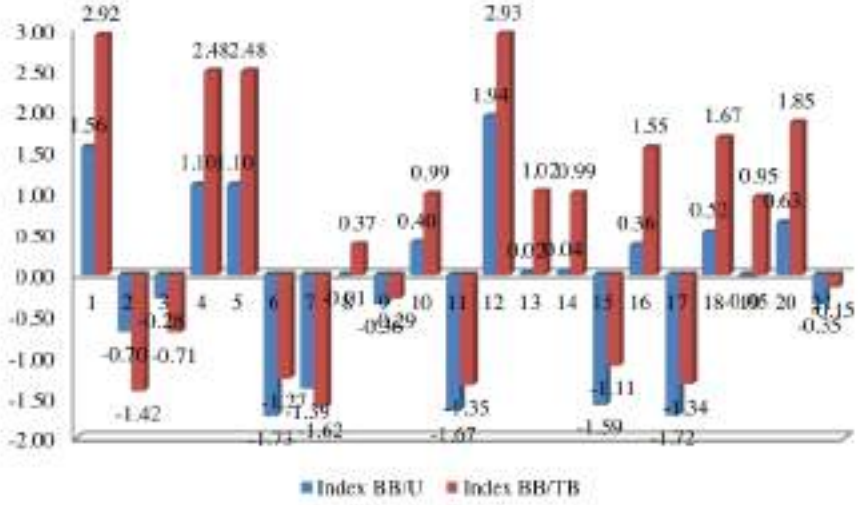

Figure 7. Analysis of body weight for ages (BB/U) and body weight for body length (BB/TB).

The following program code is used to determine the baby's nutritional status:

```
$this->load->model('m_tbref_bb_u');
$w = array(
'umur' => $usia,
'jnskel' => $jnskel);
$data_ref = $this->m_tbref_bb_u->read($w);
$data_x = $data_ref->row();
$m = $data_x->median;
$sd1 = $data_x->sd1;
$_1sd = $data_x->_1sd;
$sd2 = $data_x->sd2;
$_2sd = $data_x->_2sd;
$sd3 = $data_x->sd3;
$_3sd = $data_x->_3sd;
if($bb>$m){
$z = ($bb - $m) / ($sd1 - $m);
} else {
$z = ($bb - $m) / ($m - $_1sd);}
$status = '';
if($z < -3){
$status='Gizi Buruk';
} else if(($z >= -3) and ($z < -2)){
$status='Gizi Kurang';
} else if(($z >= -2) and ($z <= 2)){
$status='Gizi Baik';
} else if($z > 2){
$status='Gizi Lebih';}
```

4. Conclusion

The development of the database-based application using the programming language of PHP and Javascript and application program of XAMPP and MySQL can be used to monitor the baby growth in Posyandu. It can help the government's program in developing the health of mothers and their children. The data-based application system allows faster and more effective measurement of children's nutritional status. The application can later be developed by adding access rights for all members of Posyandu and processing the data of baby nutritional status to produce information for the public on the website and Android devices.

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