Development and Implementation of the "Keluarga Carade" App: Optimising Information Technology-Based Stunting Surveys to Support Public Health Efforts

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KEYWORDS
information technology; keluarga carade; stunting; public health; UTAUT model.

ABSTRACT
Stunting represents a persistent malnutrition issue that impedes children's physical and cognitive development, with potentially lasting impacts throughout their lives. This study aims to develop and implement the Keluarga Carade app, a real-time information technology-based stunting survey system intended to assist surveyors in collecting public health data in Jeneponto Regency. The app was constructed using the Laravel framework and MySQL for data storage, offering features such as family data management, prospective bride data management, questionnaire data input, survey result evaluation, and coordinate point visualization. The study adopted the Unified Theory of Acceptance and Use of Technology (UTAUT) model to evaluate user acceptance, focusing on four variables: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). Data collection was carried out using a Likert-scale questionnaire with a sample of 32 public health surveyors selected through purposive sampling, and the data were subsequently analysed for validity, reliability, and correlation. The findings confirmed the validity and reliability of all variables, with strong positive correlations observed, highlighting the app's ease of use, functionality, and effectiveness in supporting stunting survey activities. The Keluarga Carade app demonstrates the potential to optimise stunting monitoring by facilitating efficient data collection and analysis, thus supporting public health efforts to combat stunting. Future research may explore the app's long-term impact on reducing stunting rates and its integration within broader public health frameworks.

1. Introduction

Stunting reflects physical and mental growth failure arising from chronic malnutrition (Sinurat et al., 2018) , which results in children growing shorter than their age (Indriasari et al., 2023). The long-term impact of stunting can create consequences that affect a person's entire life. The prevalence of this nutritional problem is directly linked to the contribution of malnourished children to the education sector (Sinurat et al., 2018). Moreover, evidence is mounting on the importance of considering children's development and education in the early years, fuelling efforts to find strategies that improve developmental outcomes and readiness to learn (Black et al., 2017).

Previous studies have shown that various factors are associated with stunting, including parental education, developmental age of the child, developmental birth order, lack of sanitation facilities, breastfeeding period, the incidence of diarrhoea, and wealth index (Khan et al., 2016; Mahmood et al., 2020). Structured health visits have also fostered close relationships between healthcare providers and children and families. These can help with stunting prevention measures such as appropriate observation, screening, anticipatory referrals, pregnancy counselling, and health counselling (Karim & Ariatmanto, 2024).

In addition, child weight and sex, marital status, parity, pregnancy intentions, health-seeking behaviour, and socioeconomic status also play an important role in stunting risk (Aguayo et al., 2015, 2016; Chirande et al., 2015). Factors such as low birth weight, not receiving complementary feeding for 6-8 months, short mothers, and unsanitary household conditions also significantly impact the incidence of stunting in children (Aguayo et al., 2015, 2016; Chirande et al., 2015).

Other factors such as maternal age, education, body mass index (BMI), parity, maternal health conditions, and socioeconomic environment can also influence the risk of stunting in children (Martínez et al., 2019). Household food insecurity, feeding patterns, household hygiene, and environmental conditions are significantly associated

with stunting (Shinsugi et al., 2016). The importance of the learning environment at home not only extends to early childhood competence but also affects academic achievement at the primary school level (Niklas & Schneider, 2017). Therefore, monitoring children's health is crucial in shaping individual development, family dynamics, and the future of communities and populations (Karim & Ariatmanto, 2024).

Based on the results of interviews with the Jeneponto district health office, they complained that the data collection or stunting survey was still manual, so a real-time stunting survey system was needed. This system made monitoring, evaluating, and making decisions easier, especially in the Jeneponto district health office.

Several studies have been conducted related to the use of information technology in stunting prevention efforts. Research (Pratiwi & Restanti, 2018) developed an Android-based app called "Status Gizi Balita" to improve mothers' knowledge in monitoring the nutritional status of children aged 12-24 months. This study used a pseudo-experimental method with a pre-post-test design. It showed that the use of this app had a significant effect on increasing mothers' knowledge in monitoring their children's nutritional status. The research (Rivaldi et al., 2018) focused on designing an app for recording the health development of children under five years old and pregnant women at Puskesmas Sumbersari, Parigi Moutong Regency, Central Sulawesi. The developed app can record demographic data and health check results and regularly display graphs and tables of maternal and child health development, providing practical solutions for continuous health monitoring. (Arisyahputra, 2019) Designed an Android-based child growth and development monitoring app using the Prescreening Developmental Questionnaire (PDQ) method. This app allows parents to more easily know the condition of their baby's growth and development, supporting proactive monitoring of children's health.

Research has been done by (Selviyanti et al., 2022) developing "Smart Ting," an Android-based app that uses the ESDLC (Expert System Development Life Cycle) expert system development model. This app is designed to make it easier for health cadres and parents to monitor the growth and development of toddlers and map stunting in infants in Jember. It also accelerates the distribution of stunting-related information between interested parties. Research (Permana et al., 2021) produced a stunting prevention app called "Nutrimo" with anthropometric methods and a Waterfall development system. Nutrimo is considered a user-friendly, informative app and can significantly contribute to the prevention of stunting through regular monitoring of children's nutritional status. (Saito & Kondo, 2023) Focused their research on the "Maternal and Child Health Handbook" through a cross-sectional web-based survey in Jakarta. The study found that the fully Android-based app received very positive scores from respondents, with more than 80% demonstrating its effectiveness in monitoring children's health. Research by (Muna et al., 2021) designing a nutritional status system for early prevention of stunting using the prototype development method. This system has been well received and can provide health solutions related to nutritional status by health standards.

Based on the problems described and supported by previous studies, information technology is needed in stunting prevention, especially in the app of technology-based surveys. Therefore, this research aims to build a stunting survey system known as the "Keluarga Carade" app for the needs of surveyors. This research also aims at variable validity, variable reliability, and testing the correlation between each variable used, namely Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC).

2. Method

2.1. Research Design

The Keluarga Carade app, a stunting survey, was built using the Laravel framework and MySQL as data storage. This research tests the system built through questionnaire responses to users, namely surveyors. The UTAUT model which consists of four variables, namely Performance Expectancy (PE) with indicators Perceived usefulness (PE1), Extrinsic motivation (PE2), Job-fit (PE3), Relative advantage (PE4), Effort Expectancy (EE) variables with indicators Perceived ease of use (EE1), Complexity (EE2), Ease of learning (EE3), Ease of use (EE4), Social Influence (SI) variables with indicators Subjectie Norm (SI1), Social Factor (SI2), Image (SI3), and Facilitating Conditions (FC) variables with indicators Perceived behavioural (FC1), Facilitating conditions (FC2), Compatibility (FC3). Data was collected during the period July to September 2024.

2.2. Population and sample

This study's participants were students selected as public health workers from the Makassar Health College on duty in Jeneponto Regency who were also users of the Keluarga Carade app. Researchers used a purposive

sampling technique to select part of the population, where the selected criteria were surveyors who had received education on the use of the Carade Family App. Thus, the number of participants in this study was 32 out of 35 community health workers.

2.3. Ethics approval

Ethical approval and permission for this study were obtained from the health research ethics committee at the Sekolah Tinggi Ilmu Kesehatan Makassar, with reference number 061/KEPK/STIK/MKS/VIII/2024. All research participants were permitted to participate and voluntarily provided the information needed for this study. All information collected was kept confidential. No names appear in the research results, and the coding system is known only to the researchers.

2.4. Instrument

This research instrument is a questionnaire made with 14 statements based on adopting the UTAUT model; filling out the questionnaire through Google Forms, where participants can answer it through a smartphone app. The list of statements can be seen in Table 1.

Table 1. Statement List

Indicators	Statements
PE1	The Keluarga Carade app was very useful in helping me conduct the stunting survey.
PE2	I feel satisfied using the Keluarga Carade app to collect stunting survey data.
PE3	Using the Keluaga Carade app saves me time compared to the manual survey method.
PE4	The Keluarga Carade app is very effective in facilitating my stunting survey work.
EE1	Using the Keluarga Carade app makes it easier for me to fill in and submit survey data.
EE2	I found it easy to understand how to use the Keluarga Carade app for the stunting survey.
EE3	The Keluarga Carade app is easy to learn and use in stunting surveys.
EE4	The data collection process with the Keluarga Carade app is faster than the manual method.
SI1	I use the Keluarga Carade app because my fellow surveyors also use it.
SI2	I use the Keluarga Carade app because it was suggested by my boss or an authority.
SI3	I trust that I will get help from the team or authorities if I have difficulties with the Keluarga Carade app.
FC1	The interface of the Keluarga Carade app helped me in the survey process.
FC2	The available internet connection supported the smooth use of the Keluarga Carade app during the survey.
FC3	The menus and features in the Keluaga Carade app are easy to understand and support my survey needs.

This questionnaire is measured using a Likert scale of 1-7 with interpretation: (1) Strongly Agree, (2) Agree, (3) Somewhat Agree, (4) Neutral, (5) Disagree, (6) Disagree, and (7) Strongly Disagree. A Likert scale measures the opinions, attitudes, and perceptions of a person or group of people about a phenomenon. The pattern of use in the Likert scale, the variables to be measured, are translated into variable indicators. The indicator is then used as a starting point in compiling instrument items as statements. The answer to each instrument item on a Likert scale has gradations from very positive to very negative (Venkatesh et al., 2003).

2.5. Correlation Test

The Correlation Test measures the relationship between two variables where both variables are ranked. Table 2 shows the correlation assessment criteria as a reference.

Table 2. Interpretation of Correlation Coefficient

Coefficient Interval	Relationship Level
0.00 – 0.199	Very Low
0.20 – 0.399	Low
0.40 – 0.599	Moderate
0.60 – 0.799	Strong
0.80 – 1.00	Very Strong

3. Result

3.1 Characteristics of Respondents

This study's respondents totalled 32 out of 35 students selected as health workers to survey public health conditions in Jeneponto Regency. The 32 respondents consisted of 3 men and 29 women. The respondents had been assisted in using the Keluaga Carade app, and they also understood stunting.

3.2 Development and implementation of the Keluarga Carade Family app

The Keluarga Carade app was developed according to the needs of users, namely surveyors. This application contains several features that can be utilised by users, including (a) managing family data, (b) managing

prospective bride and groom data, (c) inputting questionnaire data, (d) searching data, (e) viewing the evaluation of questionnaire survey results, and (f) seeing the coordinates of the survey results. As shown in figure 1.

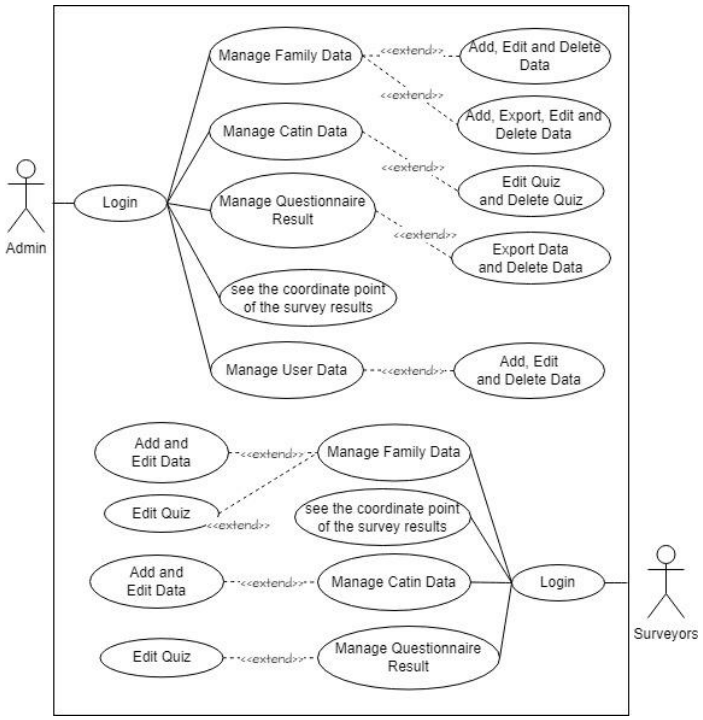

Figure 1. Keluarga Carade app design

The design of the KeluargaCarade app was assessed by 2 experts, namely a public health lecturer and a computer science lecturer. The test results show that the testers can receive the interface and functional design of the application well.

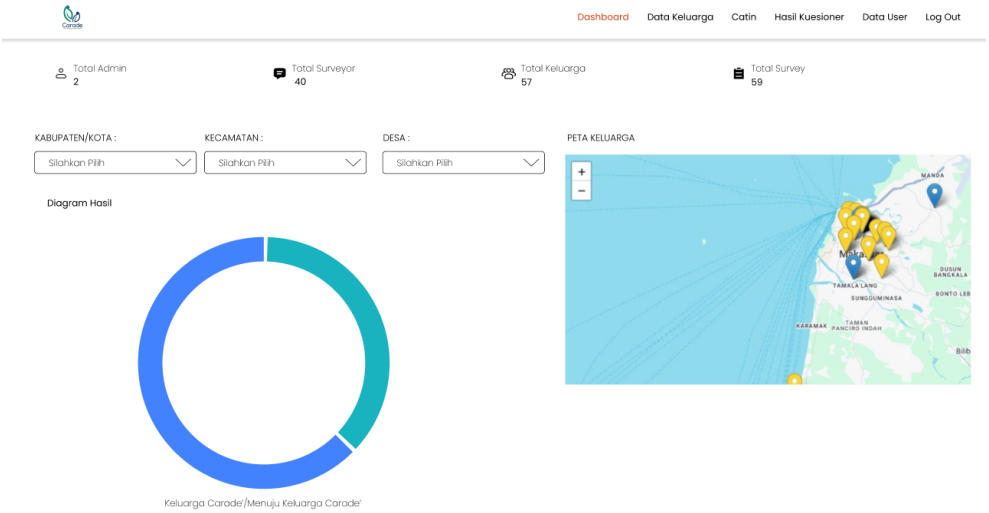

Figure 2. Implementation of the Keluarga Carade app

Figure 2 shows the results of implementing the Carade Family application, which was built using the Laravel framework and MySQL for data storage. Users can access it through the site: https://keluargacarade.my.id/.

3.3 Advantages of the Keluarga Carade app

Users can find out which families have stunting indications and which do not through the process of determining the family category, namely "Keluarga Carade" (no stunting indications) or "Towards Keluarga Carade" (stunting indications). This process begins with inputting questionnaire data for Infants Under Two Years Old

(BADUTA), Primary School Age Children (SD), Adolescent Girls, Pregnant Women, and the family environment. The data is then calculated based on 100% fulfilment of the questionnaire and 50% correct knowledge of the pregnant women and/or adolescent girls. If the results match, the family is categorised as a "Keluarga Carade" (no indication of stunting). Still, if they do not match, they are categorised as "Towards Keluarga Carade" (indication of stunting).

The evaluation of the results of the "Keluarga Carade category (no indication of stunting) or 'Towards Keluarga Carade" (indication of stunting) can also be seen from the district/city, sub-district, and village survey data. In addition, the survey results can also be seen from the map, which is marked with a yellow marker meaning stunting indication and a blue marker meaning no stunting indication.

3.4 Instrument validity test

In this study, each statement item in this questionnaire was tested for validity using the person coefficient test (Pearson Product Moment). A statement item on the questionnaire is declared valid if the r-count value exceeds the r-table (r-count>r-table). In this study, it is known that the r-table value is 0.349, which is obtained from the degree of freedom (df) table of 30 of the 32 questionnaires distributed as a trial.

Table 3. Validity Test of Performance Expectancy Variable

Indicators	R-Value	Description
PE1	0.942	Valid
PE2	0.944	Valid
PE3	0.937	Valid
PE4	0.806	Valid
EE1	0.915	Valid
EE2	0.875	Valid
EE3	0.900	Valid
EE4	0.862	Valid
SI1	0.909	Valid
SI2	0.881	Valid
SI3	0.802	Valid
FC1	0901	Valid
FC2	0.855	Valid
FC3	0.915	Valid

Table 3 shows that the overall calculation for all statement items of the Performance Expectancy (X1), Effort Expectancy (X2), Social Influence (X3), and Facilitating Condition (X4) variables is valid, as the r-value > r-table, meaning that all statements can be used to assess the stunting survey app for surveyor evaluation.

3.5 Reliability Test

The reliability test of the questionnaire in this study was conducted using the Cronbach's Alpha technique. This technique uses instruments with multiple possible answers, such as essays, surveys, or questionnaires.

An instrument is considered reliable if Cronbach's Alpha reliability coefficient is greater than 0.70. Revising or removing low-reliability items is recommended if the coefficient value is less than 0.70. Below is the table of Cronbach's Alpha coefficient calculations:

Table 4. Variable Reliability Test

Variables	Cronbach Alfa	Description
PE	0.929	Reliable
EE	0.905	Reliable
SI	0.818	Reliable
FC	0.864	Reliable

Based on the results of the SPSS calculation in Table 4, the reliability value of the Performance Expectancy variable is 0.929, Effort Expectancy is 0.905, Social Influence is 0.818, and Facilitating Condition is 0.864. This means that Cronbach's Alpha coefficient is> 70%, so this questionnaire is declared reliable.

3.6 Correlation Analysis Between Variables

A correlation test was conducted using the Pearson Correlation method to determine the strength and direction of the relationships between the analysed variables. This test was employed to measure the linear relationship between the variables in this study, namely Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Condition. Table 5 presents the correlation test results, which show the strength of the relationships

between the study variables.

Table 5. Correlation Test

Correlations					
		PE	EE	SI	FC
PE	Pearson Correlation	1	0.920	0.694	0.860
	Sig. (2-tailed)		0.000	0.000	0.000
	N	32	32	32	32
EE	Pearson Correlation	0.904	1		
	Sig. (2-tailed)	0.000		0.000	0.000
	N	32	32	32	32
SI	Pearson Correlation			1	
	Sig. (2-tailed)	0.000	0.000		0.000
	N	32	32	32	32
FC	Pearson Correlation				1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	32	32	32	32

Based on the results of the Pearson correlation test, there is a very strong and positive relationship between the Performance Expectancy variable and Effort Expectancy (r=0.920), Facilitating Condition (r=0.860), as well as a strong relationship with Social Influence (r=0.694). Additionally, the relationship between Effort Expectancy and Social Influence (r=0.780) and Facilitating Condition (r=0.925) shows a very strong correlation. Similarly, Social Influence and Facilitating Conditions have a very strong correlation (r=0.812). All these positive correlations indicate that an increase in one variable tends to be followed by another, with a significant relationship strength at the 0.01 level (2-tailed).

4. Discussion

The results of this study show that the technology-based stunting survey app, Keluarga Carade, developed using the Laravel framework and MySQL as the database, has successfully met the needs of its users, namely the surveyors responsible for collecting and monitoring stunting data. The implementation of this app offers a more effective and efficient solution than the previous manual survey methods. These findings are consistent with previous research (Pratiwi & Restanti, 2018), which demonstrated that using Android-based apps can improve mothers' knowledge in monitoring their children's nutritional status, as well as the research (Rivaldi et al., 2018) that developed an Android-based health recording app for toddlers and pregnant women in community health centres (Puskesmas).

In this study, the results of the validity and reliability testing of the questionnaire, which was adopted from the UTAUT model, show that all variables—Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions—demonstrate high validity and reliability. These findings are consistent with previous studies showing that using technology in health monitoring, such as the "Smart Ting" app (Selviyanti et al., 2022) and "Nutrimo" app (Permana et al., 2021), successfully improves effectiveness in stunting prevention and monitoring children's health.

The use of the Keluarga Carade app also enables real-time stunting monitoring, where the data collected from families can be categorised into "Keluarga Carade" (not indicated for stunting) or "Towards Keluarga Carade" (indicated for stunting). This feature offers an advantage in monitoring compared to traditional methods, where data is often outdated and not integrated. These findings are supported by previous research, such as (Arisyahputra, 2019) that technology-based apps can help parents monitor their children's growth and development more efficiently.

In addition, the correlation test results between variables show a significant and strong relationship between Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. This correlation indicates that the better users perceive the app's benefits and ease of use, the greater the social influence and technical support they experience. This is also consistent with the findings of (Rahmi & Frinaldi, 2020)those who applied the UTAUT model, showing that factors such as ease of use and environmental support greatly influence the adoption and use of new technology.

5. Conclusions

This research successfully developed and implemented the Keluarga Carade application, an information technology-based stunting survey tool for real-time monitoring in Jeneponto Regency. The application addresses surveyors' needs by providing essential features, such as family data management, data management for

prospective brides, questionnaire data input, survey result evaluation, and survey result coordinate visualization. Validity and reliability testing of the questionnaire instrument revealed that the variables of Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions exhibit high validity and reliability, indicating positive user acceptance. Correlation analysis results also demonstrated significant and strong relationships among these variables, suggesting that perceived ease of use, application benefits, and social and technical support are crucial in the application's successful implementation. Consequently, the Keluarga Carade application has the potential for broader adoption in stunting prevention efforts, particularly by facilitating faster, more accurate, and real-time data collection. This research further highlights opportunities for future development in measuring the long-term impact of the application on reducing stunting rates in areas of need and strengthening the integration of information technology within public health sectors.

Acknowledgement

The researchers would like to thank the Ministry of Education and Culture of the Republic of Indonesia for funding this research. The financial support provided played a significant role in advancing and ensuring the success of this research project. The researchers extend their thanks for the financial assistance received, enabling the completion of this study and its contribution to advancing knowledge in this field.

Conflicts of Interest

The authors declare no conflict of interest.

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