

# Methods for Development Mobile Stunting Application: a Systematic Literature Review

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**Abstract:** Stunting is a growth disorder in children. Stunting is one of the indicators of failure to thrive in toddlers caused by a chronic lack of nutritional intake in the first 1,000 days of life, from a fetus to a child aged 23 months. Based on data from the Asian Development Bank (ADB), in 2022 the percentage of stunting prevalence occurring in children aged <5 years in Indonesia reached 31.8%. So Indonesia is ranked 10<sup>th</sup> in Southeast Asia. The object of this review is to review the current literature and help researchers to find out what methods have been used in making stunting prevention applications. In a systematic search of the literature using quality databases including SpringerLink, ScienceDirect, and IEEE Xplore. The paper included in this review is a stunting prevention application information system by describing the methods most often used by researchers in making the stunting prevention application information system. There were 41 results based on the exclusion of titles and abstracts, based on the introduction and exclusion of conclusions there were 35 results, so we included 12 results for the full-text exclusion in the final analysis. So that the popular method used by researchers in Android-based stunting applications is the prototype method. Compared to other methods, prototyping is more suitable for systems that are made based on user needs.

**Keywords:** Application, Information System, Method, Stunting, Systematic Literature Review

## INTRODUCTION

Stunting is a failure in physical and mental growth resulting in chronic or recurrent malnutrition (Beer et al., 2015; Sinurat et al., 2018). Stunting has the potential to have far-reaching consequences that impact a lifetime. The prevalence of malnutrition is directly related to the contribution of malnourished children to education (Sinurat et al., 2018). In addition, the growing body of evidence regarding the importance of considering children's development and education in the early years has emphasized efforts to find ways to improve developmental outcomes and development readiness (M. M. Black et al., 2017). The learning environment that is carried out at home is proven to be able to predict not only competence in early childhood but also the final results of elementary school (Niklas & Schneider, 2017). Thus, supervision of children's health is so important in the development of children, families, communities, and the future of the population (Hagan, n.d.).

Previous studies on factors related to stunting have proven that parental education, age of child development, development of birth order, lack of sanitation facilities, breastfeeding period, the occurrence of diarrhea, and wealth index has a relationship with stunting (Khan et al., 2016; Mahmood et al., 2020). Likewise, healthy visits to children in a structured manner develop a strong bond between health service providers and children and families, anticipate planning related actions in prevention such

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as proper observation, screening, anticipatory direction, pregnancy, and counseling(Hagan, n.d.). In 2014 there were 462 million underweight adults, 2 billion were deficient in micronutrients, and 1.9 billion were overweight (obese)(“Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19·2 million participants,” 2016).

Stunting cases usually start in the womb and increase, at least during the first 2 years from birth. The first 1000 days between design and a child's second birthday are a very important window of opportunity in the intervention(R. E. Black et al., 2013). The question is whether improvement in nutrition after the first 1000 days can provide recovery in growth, and reduced cognitive development related to early malnutrition. Here is evidence from observational studies(Bhargava, 2016; Fink & Rockers, 2014; Georgiadis et al., 2017). Length and height are the best predictors of stunting. Stunting is defined as length or height at age  $\geq 2$  based on population median reference(Beer et al., 2015).

Understanding the long-term performance after childhood malnutrition is so important because better treatment, fortunately, results in more malnourished children surviving into adolescence and adulthood(Bhutta et al., 2017). Stunting is a bad result of malnutrition during pregnancy and early childhood(UNICEF et al., 2021). The stunting condition is only identified when the baby is 2 years old, this is known by the indicator of body length/age or height/age according to WHO (World Health Organization) by looking at the z-score value below the standard deviation(Perumal et al., 2018). In general, by 2020, 149 million children aged <5 years are predicted to be malnourished, with marked geographic variations in different regions of the world(Kalu & Etim, 2018; Ssentongo et al., 2021). WHO reviews that stunting is a form of malnutrition that predominantly occurs among children under five and it is generally predicted that around 161 million children under five have been affected by stunting(Marcedes de onis, 2016). The stunting rate under the age of 5 years is the main health parameter in general. Goal 2 Target 2.2 of the goal on sustainable development, among other like-minded targets, has the goal of eliminating all forms of malnutrition by 2030, with stunting under the age of 5 predicted to be reduced to an internationally agreed target by 2025 and then it will be eliminated in the next 2030(Lozano et al., 2018).

Factors that influence the death of children under five are socioeconomic, biological, and demographic factors. Socio-economic factors can result in the death of eroticism in children, for example, extraction of milk teeth, cutting of the uvula, cutting of eyebrows at birth, and cutting of female genitalia which is closely related to socioeconomic and culture. Biological factors primarily refer to information on the fertility of the mother and the number of children that have been born focusing on the family level rather than the children. Demographic factors influence death both endogenous and exogenous, for example, birth problems that are difficult to control and prevent and exogenous deaths that can be anticipated through immunization, public health measures, and the presence of antibiotic treatment(Gebrekirostos et al., 2014). With the existence of technological innovation, it can provide a solution to eliminating subjectivity, increasing reproducibility, and also providing information with a higher level of description. There have been several advances in automated food intake tracking systems. For example, several devices have been proposed for a person to track and manage weight loss through recording intake using a mobile device(Meyers et al., 2015; Okamoto & Yanai, 2016; Pouladzadeh et al., 2016).

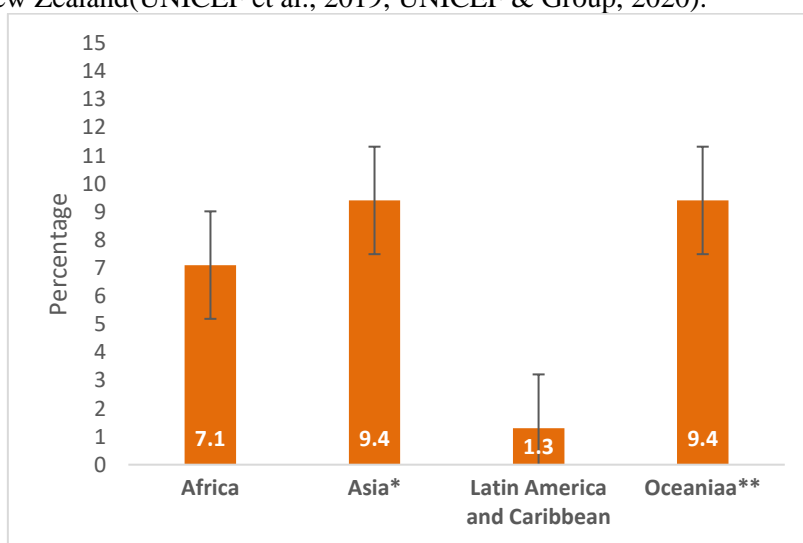
A very common symptom of stunting is a decrease in physical and cognitive development, which can have negative consequences in the long term(Quamme & Iversen, 2022). Stunting is also an obstacle for children to reach their physical and mental potential(Richter et al., 2017). In addition, in the early years, stunting has various long-term, irreversible effects on cognitive function, brain development, and various health problems, even though children are given environmental improvements and physical growth to catch up at an older age(Casale et al., 2020; Georgieff et al., 2018; Soliman et al., 2021). Even though there were 10 evidence-based nutrition interventions implemented within 90% coverage, only 20% were achieved in reducing stunting(Bhutta et al., 2013). Despite concerted efforts, the prevalence of malnutrition remains especially high in low- and middle-income countries, and efforts to reduce malnutrition have been slow(OMS, 2018). For example, families with low incomes may have difficulty obtaining food, which can lead to malnutrition in children. In some cases, linear growth may stop due to other diseases, so these concomitant events can result in profoundly negative developmental outcomes(Rolim et al., 2020).

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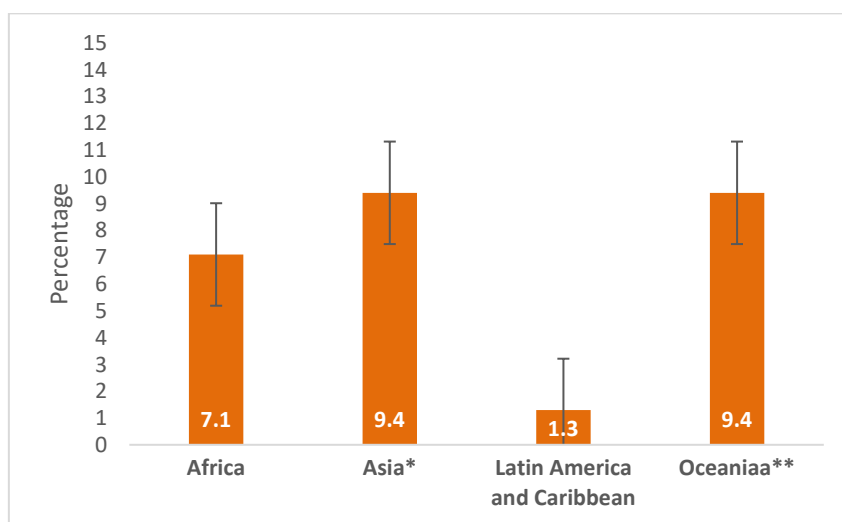


Apart from that, there are many obstacles in the diagnosis of stunting, including a long period and a lot of money and there are still many challenges that need to be done when we carry out observations at both the central and regional levels. In some cases, the planned program runs quite well, but there are several obstacles and in some cases, monitoring is often neglected, due to the large amount of data and not being properly organized(Indrayana et al., 2022).

Too many women, children, and young people around the world still have little or no access to essential and good quality health and education services, clean air and water, adequate sanitation, and good nutrition. They face violence and discrimination, are unable to fully participate in society, and face other obstacles to realizing their human rights(Requejo et al., 2015). As a result, as the Millennium Development Goal (MDG) era draws to a close, annual mortality rates remain very high: 289,000 maternal deaths, 2.6 million stillbirths, 5.9 million deaths in children under five years of age—including 2.7 million newborn deaths—and the 1.3 million adolescent deaths(Dick & Ferguson, 2015; WHO, 2014). Below is the percentage of the millions of young lives that are at risk worldwide due to wasting. Among them are Africa, Asia excluding Japan, Latin America and the Caribbean, and Oceania excluding Australia and New Zealand(UNICEF et al., 2019; UNICEF & Group, 2020).



**Figure 1.** Percentage of wasted children under 5, by United Nations region, 2018

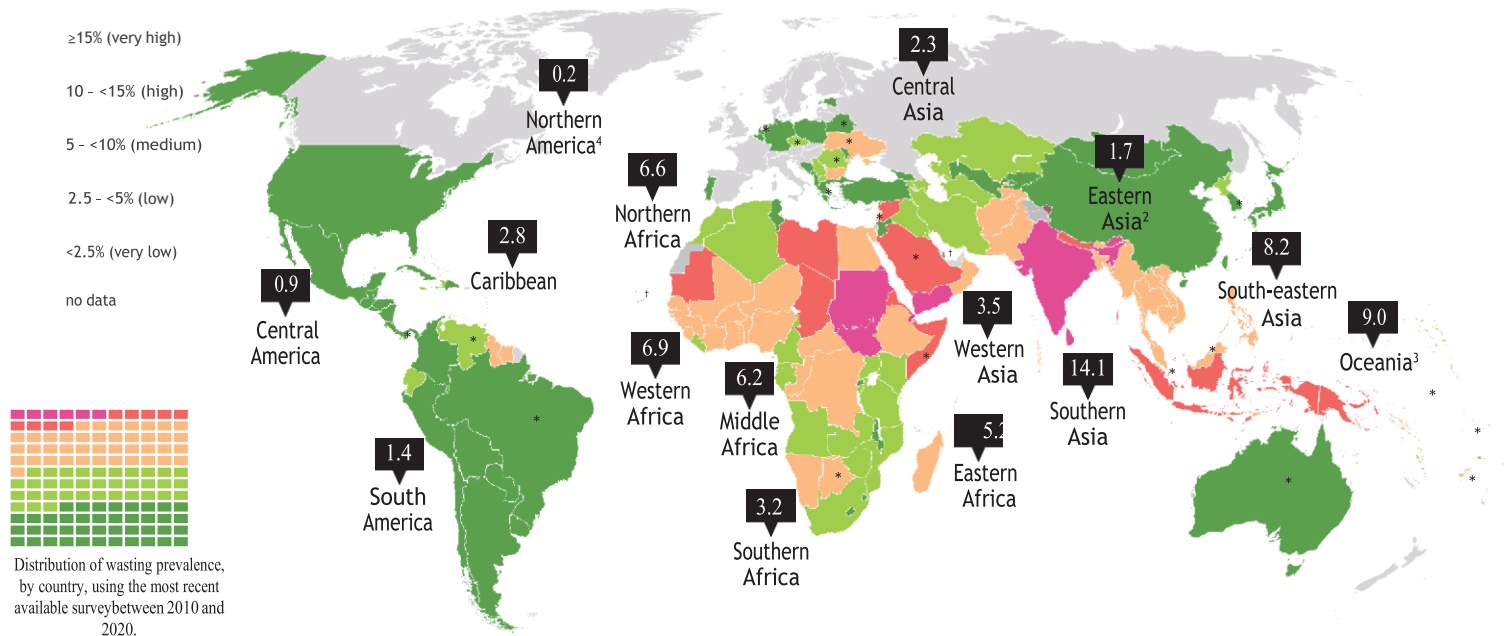


**Figure 2.** Percentage of wasted children under 5, by United Nations region, 2019

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In Asia and Oceania, wasting is putting nearly one in ten children under 5 at increased risk of death for the Asia and Oceania region, wasting approximately 1 in 10 children under the age of 5 years with an increased risk of death.



**Figure 3.** Percentage of children under 5 affected by wasting, by country and United Nations sub-region, 2020(Headey et al., 2020)

Country data are the most recent survey estimates available between 2010 and 2020; With the exception that older data is shown (2000–2009) where it is denoted by an asterisk (\*) and only data before 2000 is available, a footnote † is used, indicating no recent data. This sub-regional estimate does not take into account the impact of COVID-19 as a collection of household survey data on child height and weight has been limited from 2020 due to physical distancing measures with only four national surveys with some fieldwork in 2020 included in JME databases; thus, the JME forecast is based almost entirely on data collected before 2020. East Asia excluding Japan. Oceania does not include Australia and New Zealand. The North American sub-regional estimate is based on data from the United States only. There are no available estimates for the European or Australian and New Zealand sub-regions due to inadequate population coverage(UNICEF et al., 2021).

According to research that has been carried out regarding stunting development applications, many applications have been developed, both web-based and mobile-based. Researchers found that mobile-based stunting applications are easier to use because they can be accessed through the application market and are easy to use. Researchers also found various methods used to develop stunting applications. Therefore, researchers are interested in grouping the methods most widely used in developing Android-based stunting applications. It is hoped that this will help other researchers in developing stunting applications in the future.

## LITERATURE REVIEW

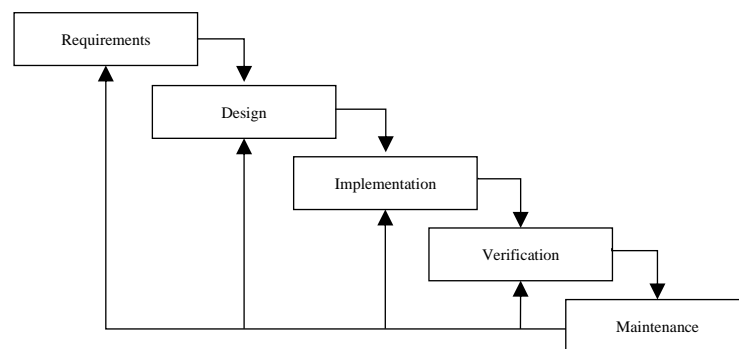
### Waterfall Method

The waterfall method is usually called the classic life cycle, actually the name of this model is "Linear Sequential Model" describes a systematic and sequential approach to software development, starting from the user requirements specification stage, planning, modeling, construction, deployment, and

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support for complete software that has been completed. generated. We can see the stages of the waterfall method in the following picture.

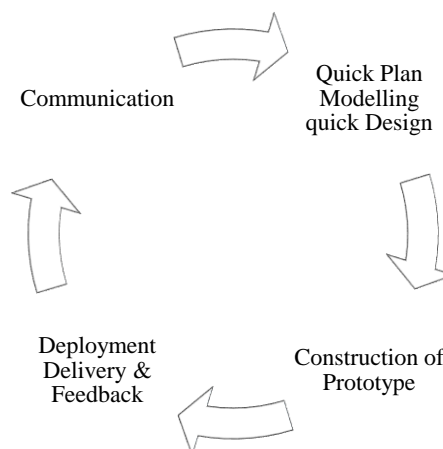


**Figure 4. Waterfall Method**

- Requirements  
At this stage, system developers need communication to understand the software that users want and the limitations of that software.
- Design  
The developer then creates a system design to help decide on hardware and system requirements and helps define the overall system architecture.
- Implementation  
The system is first developed in small programs usually called units, which are integrated at a later stage. Each unit is developed and then tested for functionality which is then called unit testing
- Verification  
Then the system is verified and tested to see whether the system meets the requirements, testing is categorized into unit testing, system testing to see system performance when all modules are integrated, and acceptance testing.
- Maintenance  
This is the final stage in the waterfall method. The software is then run and maintained.

**Prototyping Method**

The prototype method is a software development method with interaction between system developers and users, this helps overcome differences between system developers and users. The following is a prototype development model.



**Figure 5. Prototype Method**

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- Communication  
Identifying existing problems and the information needed to build the system.
- Planning  
Determining resources, development specifications related to system requirements, and goals based on communication results so that they are in accordance with what is desired.
- Modeling  
The prototype created using the temporary system design will be evaluated by the user, then the application is created from the system design which is then translated into the CodeIgniter Framework programming language which is then integrated into the MySQL database.
- Construction  
Build a prototype and test the system. The installation process and provision of related user support need to be carried out so that the data system runs without problems.
- Submission  
To get user feedback, as a result of evaluation at the previous stage, and implementation related to the system created.

### Cross Sectional Method

Research using this method has several steps, as explained by Notoatmodjo. The following are the steps in the Cross Sectional method.

- Determine the research subject starting from the situation and samples that have been taken during research activities.
- Observation of variables that risk aspects and also impact aspects simultaneously, is based on the status of the variables in data collection.
- Comparative analysis or what is called a correlation measure on group results that were observed during research activities.

### METHOD

The review method has been developed taking into consideration the guidelines of B. Kitchenham (Kitchenham, Barbara Ann and Charters, 2007) for systematic literature review. The review method elaborates the research questions, data sources, inclusion and exclusion process, quality assessment, data extraction, and data synthesis.

### Research Questions

Research questions play an important role in making decisions on search, data extraction, and analysis strategies. The following are research questions that have been identified in the form:

*RQ1: What methods are used in Android-based stunting prevention applications?*

*RQ2: What methods are mostly used by researchers for Android-based stunting prevention applications?*

### Data Sources and Search Procedure

Source of data obtained from search databases such as SpringerLink, ScienceDirect, and IEEE Xplore. The search focused on terms from research questions and terms commonly used related to application-focused stunting information systems.

### Inclusion and Exclusion Process

Inclusion criteria are general characteristics of research subjects in the target population and the affordable population. Researchers need to be careful so that the selected criteria are following the research problem.

Exclusion criteria are criteria that can make the object unusable in research

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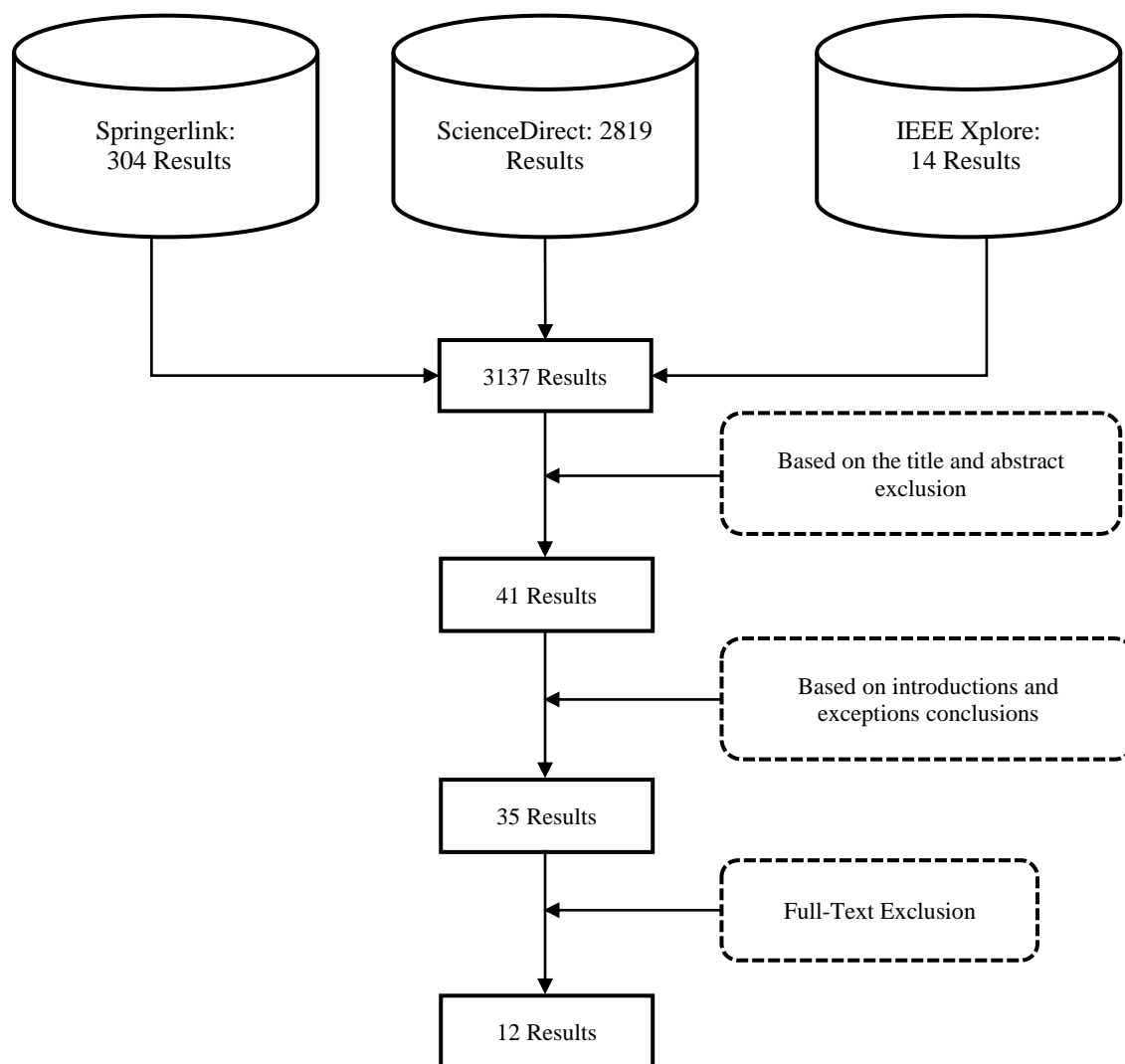


- a. Inclusion Criteria: the available paper format must be in full text. Published from 2018 to 2022, and should be based on size estimates.
- b. Exclusion Criteria: paper whose criteria do not meet the requirements based on the inclusion above.

The results of this phase are 41 papers

### Quality Assessment

Articles are taken from quality databases related to journals and conferences by using the keyword “Stunting Application” from 2018 to 2022.



**Figure 6.** PRISMA Flow Diagram

### Data Extraction

The procedure for data extraction has been developed by the author by considering the purpose of the data that the researcher will review. Data extraction is carried out in the form of:

- a. Year of Publication
- b. Empirical Data with Valid and Reliable Provisions
- c. Method Used

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## Data Synthesis

The process of data synthesis means that the data is compiled and then the answers are concluded according to the research questions. In this case, data synthesis was carried out by reviewing the literature.

## RESULT

The results of the review are then presented in the form of answers to research questions.

### *What methods are used in Android-based stunting prevention applications? [RQ.1]*

Android-based development methods

Table 1 lists the various Android-based development methods. The statistical results of the approaches show that the prototyping method is most employed. Each approach has its pre-requisite conditions and characteristics according to which they are used. Table 3 lists various Android-based development methods. The statistical results of the approach show that the prototyping method is the most widely used.

**Table 1.** Android-Based Development Methods

Method	Statistics Of Usage	CITED LITERATURE
Waterfall	16.67%	(Syahputri et al., n.d.)(Permana et al., 2021)
Prototyping	25%	(Al Rahmad et al., 2022)(Ana et al., n.d.)(Hidayah et al., 2021)
System Development Life Cycle	8.33%	(Selviyanti et al., 2022)
Unified Modelling Language (UML)	8.33%	(Eyitayo et al., 2018)
A-Cross Sectional	16.67%	[45][46]
Experimental Study	8.33%	(Mulidah et al., 2022)
Fast (Framework For The Application Of System Techniques)	8.33%	(Susanti et al., 2019)
Approximate String-Matching	8.33%	(Syarafina & Palandi, 2021)

Android-based software development

Table 2 lists statistical details on Android-based software development. The following is a variety of software development used including Java Development Kit (JDK), Android Software Development Kit (SDK), Android Studio, Hypertext Preprocessor (PHP), My Structured Query Language (MySQL), and Statistical Program for Social Science (SPSS). Software that is very often encountered is the Java Development Kit (JDK), Android Studio, Hypertext Preprocessor (PHP), and My Structured Query Language (MySQL).

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**Table 2.** Software Development  
**SOFTWARE DEVELOPMENT STATISTICS OF USAGE CITED LITERATURE**

Java Development Kit (JDK)	22.22%	(Syahputri et al., n.d.)(Permana et al., 2021)(Al Rahmad et al., 2022)(Eyitayo et al., 2018)
Android Software Development Kit (SDK)	11.11%	(Permana et al., 2021)(Al Rahmad et al., 2022)
Android Studio	16.67%	(Al Rahmad et al., 2022)(Ana et al., n.d.)(Eyitayo et al., 2018)
Hypertext Preprocessor (PHP)	16.67%	(Al Rahmad et al., 2022)(Eyitayo et al., 2018)(Susanti et al., 2019)
Microsoft Excel	5.55%	(Selviyanti et al., 2022)
My Structured Query Language (MySQL)	16.67%	(Al Rahmad et al., 2022)(Eyitayo et al., 2018)(Susanti et al., 2019)
Statistical Program For Social Science (SPSS)	11.11%	(Manggala et al., 2018)(Ponum et al., 2020)

The number of research publications in the given years

Table 3 provides the number of published research papers on the estimated effort of an android-based development method over a predetermined period. The distribution of papers shows that there are consistent efforts made by researchers to increase the estimated effort using a variety of new methods.

**Table 3.** Division of Research Publications Over Years

<i>Electronic Sources/Databases</i>	<i>Index</i>	<i>2018</i>	<i>2019</i>	<i>2020</i>	<i>2021</i>	<i>2022</i>	<i>TOTAL</i>
Journal Of Physics: Conference Series	Conf				1		1
Ieee Xplore	Q1	2	1				3
Atlantis Press	Q2					1	1
Bmc Pediatrics	Q2			1			1
Macedonian Journal Of Medical Sciences	Q3					1	1
Paediatrica Indonesiana	Q4	1					1
Malaysian Journal Of Medicine And Health Sciences	Q4					1	1
Jurnal Manajemen Kesehatan Indonesia	Sinta 2		1				1
Journal Of Computing And Information System	Sinta 3				1		1
<u>Matrix : Jurnal Manajemen Teknologi Dan Informatika</u>	Sinta 3				1		1
Total Of Results Publications		3	2	1	3	3	12

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**What methods are mostly used by researchers for Android-based stunting prevention applications? [RQ.2]**

Table 4 shows what methods are most often used in the development of Android-based stunting applications. In the first place, there is the most widely used prototyping method with a total of 3 and statistics of usage is 42.85%, and the waterfall method and cross sectional method with a total of 2 and statistics of usage of 28.57%.

**Table 4.** Final List of Android-Based Development Methods

Method	Total	Statistics Of Usage	CITED LITERATURE
Prototyping	3	42,85%	(Al Rahmad et al., 2022)(Ana et al., n.d.)(Hidayah et al., 2021)
Waterfall	2	28,57%	(Syahputri et al., n.d.)(Permana et al., 2021)
Cross-Sectional	2	28,57%	(Manggala et al., 2018)(Ponum et al., 2020)

**DISCUSSION**

It can be concluded that there are 3 methods that are often used in stunting applications. In first place is the prototyping method which is very often found in custom application design, which means that customers also have an active role in system development. The weakness of this method is that customers often do not realize that the software used as an example has not been completed in its entirety and usually do not think about maintaining the system over a long period of time. Furthermore, the waterfall method has a systematic and sequential approach (one by one), so it can minimize errors that occur. The weakness of this method is that it is difficult to make many revisions due to the work starting from the beginning in sequence, especially after entering the testing stage, it is quite difficult to go back and change something in the previous concept stage, and finally the cross-sectional method which is observational research, analyzing the data collected at the same time (one point in time). The weakness of cross-sectional is that it is difficult to know cause and effect because data collection is carried out simultaneously. It is hoped that the discussion regarding the methods that researchers often use in stunting applications can help other researchers to choose relevant methods related to stunting applications that will be developed in the future. Apart from that, it can help monitor the stunting rate in Indonesia so that it decreases every year.

**CONCLUSION**

The literature review concluded that a large number of studies have been conducted on methods to reduce stunting symptoms. The distribution of research over the years is quite significant. The learning approach to the android-based development method used is the prototyping method with 3 journals, the waterfall with 2 journals, and Cross-Sectional with 2 journals. Most of the studies use the prototyping method. Software that is widely used in the mobile-based stunting application development method includes the Java Development Kit (JDK), Android Studio, Hypertext Preprocessor (PHP), and My Structured Query language (MySQL). A further review reveals that there is still a lack of development of Android-based stunting applications from 2018 to 2022.

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