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Information Technology-Based Interventions in Stunting Prevention: A Systematic Review

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ABSTRACT
Introduction: Prevention of stuting in childhood is difficult to achieve with interventions that focus only on improving nutrition. Information technology-based interventions are increasingly used to support behavioral change in stunting prevention. This study aims to conduct a systematic review to evaluate information technology-based interventions in relation to addressing nutritional problems in early childhood. **Method**: We conducted a systematic review using electronic databases (Science Direct, Sage Journals, Scopus, ProQuest) limited to the last 5 years from 2019 to 2024 with relevant keywords. The study included RCT, pilot and case-control methods that focused on children under 5 years of age and reported at least one outcome of a change in maternal behavior with stunted children. Of the studies taken, 8 studies met the inclusion criteria. **Results**: The interventions in this systematic review were multifaceted, including smartphones, internet/web and a combination of multiple interventions. In total 100% of the 8 studies showed positive results from the interventions shown in terms of clinical, behavioral change in a positive direction and increased knowledge. **Conclusion**: This evidence shows the potential for IT-based interventions (i.e. smartphones, internet/web, android apps, text messaging and whatsapp) to support positive behaviour change in preventing stutning. The variety of interventions in this systematic review requires further research on which interventions are best implemented.

Keyword: Information, Prevention, Stunting,Technology

INTRODUCTION
The global problem that is happening is malnutrition or known as stunting. This has a major impact on children's health and development, such as stunted growth, decreased intelligence, sluggish cognitive development, and decreased productivity as they grow up (1). Stunting is a long-lasting malnutrition condition that causes children to experience growth disorders characterized by shorter height than the standard age (2). Studies have shown that stunting success is related to appropriate and productive behavior, which in turn leads to a healthy lifestyle(3).

According to the Health Promotion Model theory, a person's characteristics and experiences influence their behavior. On the

other hand, Lawrence Green's theory mentions three components that affect health behavior, namely predisposing, supportive, and supportive factors. as well as motivational factors. Knowledge, beliefs, attitudes, values, and beliefs are all components that influence a person's behavior. Knowledge is an important component that influences a person's behavior or actions. Attitude, on the other hand, refers to the level of feeling a person has towards something, object, individual, institution, or activity. If a person has faith and believes that doing a behavior will produce positive results, they will have a positive attitude (4). Innovation and efficient ways are needed to improve health behaviors in stunting prevention.

Currently, the 4.0 era is marked by digitalization, the widespread use of social media and the need to have a smartphone (5,6). Technological developments provide convenience and access to various health information applications and help services. In today's phenomenon, the application of mobile computerization related to health will be increasing. Technology implementation can now be delivered anywhere in the world and is no longer limited by location (7). The purpose of this study is to conduct a systematic review of the effectiveness of information technology-based interventions in stunting prevention. The results of this systematic review are expected to be applicable to relevant health services. This systematic review is presented in the form of an article consisting of an abstract, introduction, methods, results, PICOT, discussion, implications for practice, conclusions and a bibliography.

MATERIALS AND METHODS

This systematic review is conducted and reported in accordance with the guidelines for optional reporting items for systematic review and Meta-Analysis (PRISMA).

Search Strategies

Systematic search using the PICOT framework utilizes electronic databases through keywords. The first step is to search for an electronic database based on keywords determined according to the topics contained in the PICOT framework (Science Direct, Sage Journals, Scopus, ProQuest) to identify relevant studies published from 2019-2024. The search strategy includes a combination of keywords related to IT (such as information technology, m-health, e-health, monitoring) and also stunting (such as stunting, wasting, underwight, toddlers under 5 years old).

Eligibility Criteria

The selection criteria in this study are determined based on population, intervention, results and research design. The inclusion criteria include: 1) IT-based intervention in stunting, 2) information technology with mobile health (smartphone, PDA), email, internet/web, computer, telematics/electronic transmission devices, 3) research design including RCT, pilot studies and pseudo-experiments and 4) conducted in English. The exclusion criteria are: 1) studies whose users are healthcare providers, 2) studies that offer only the feasibility or validity of IT-based interventions, 3) pediatric patients.

Selection of Articles

This systematic review uses the PRISMA method whose systematic review is followed by selection including removing duplicates. Then, three reviewers chose the title, abstract and keywords, then deleted irrelevant research according to the selection criteria. The three reviewers independently screened the title and abstract, including the reasons for choosing the research and the selection of inclusion and exclusion criteria through electronic search. The full text of all articles is retrieved and assessed. Disagreements regarding the relevance of articles are resolved through discussion. After the article is completed, the note sheet is prepared for systematic data extraction. The data is extracted by the first reviewer and then the other reviewers check and verify its accuracy and identify any information that may be missing.

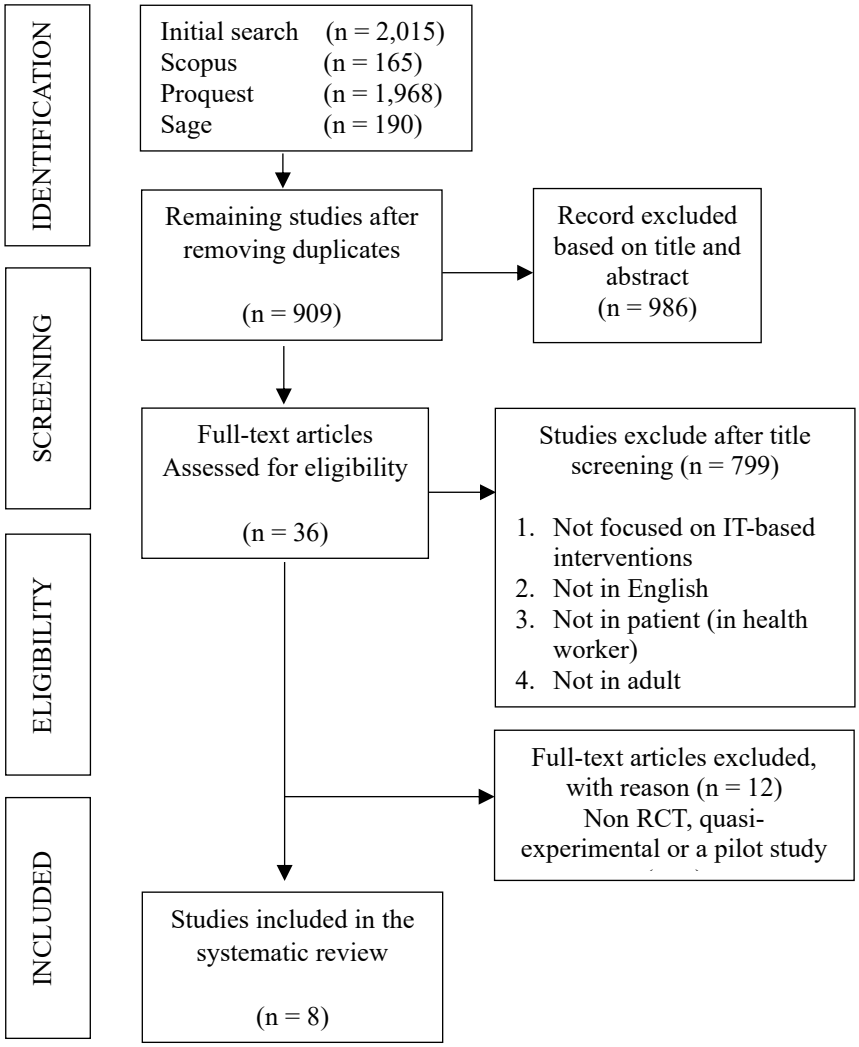

Figure 1. Searching for the Articles Following The PRISMA Flow

RESULT

This study reviews 8 selected articles from various countries. Overall, 8 studies (100%) showed that the use of technology-based interventions was effective in supporting health services in stunting. This review contains all the research on activities in achieving stunting prevention goals. The number of samples varied between 16-2,501 respondents. which is intended to get a broad picture of the scope of IT-based interventions.

Some of the information technology-based interventions used in this study include smartphones, internet/web, android applications, text messages and WhatsApp. Overall, research shows that the use of information technology-based interventions is effective in increasing behavior change in preventing stunting. Studies using smart phone interventions showed good results related to pregnancy data outcomes (8). In addition, the interventions used by websites that have been proven to give positive results (9).

Another intervention with an android application combined with a booklet (Bocesting) about eating recommendations for healthy and sick children has been proven to increase knowledge about proper nutrition to prevent stunting disease provided in both hard copy and soft copy). They show success in knowledge indicators towards stunting prevention (10). In the study that used the M-health intervention in the form of a

smartphone application that contained several contents about children's healthy diet, underweight in childhood, children's lost appetite, and child growth and development assessments. The test results were based on the improvement of maternal growth indicators, knowledge, attitudes, and practices in the group and the differences between the two (7).

Table 1. Article Search Result

Journal Identity	Result
M-SAKHI-Mobile Health Solutions to Help Community Providers Promote Maternal and Infant Nutrition and Health using a Community-based Cluster Randomized Controlled Trial in Rural India: Study Protocol (8)	Efficacy of M-SAKHI to reduce stunting in young children in rural India, and if effective, the cost-effectiveness of M-SAKHI
Web-Based Information System as an Education and Prevention Medium for Stunting at "Mangga" Integrated Health Post in Tumpangkrasak Village, Jati Kudus (9)	The collaboration between the service team and Posyandu "Mangga" provides real benefits to the community, especially to parents who have toddlers, with the main goal of preventing stunting. This program is a good example of how higher education can play an active role in improving the quality of life of local communities through community service
Utilization of the Android Application “Bocesting” in Enhancing Knowledge for Mothers of Children Under Five Years About Stunting Prevention (10)	The Android application of the stunting prevention booklet (bocesting) as an educational media to improve mothers' knowledge, it can be concluded that there is a significant difference in improving mothers' knowledge of stunting prevention
MyKid’sNutrition mobile application trial: a randomized controlled trial to promote mothers’ nutritional knowledge and nutritional status of preschool children with undernutrition—a study protocol (7)	MyKid Nutrition App offers diet solutions for nutritional problems such as underweight, loss of appetite, and malnutrition in children. Meanwhile, the app provides detailed instructions on how to interact with children. Trials
Booklet preventing stunting based Android application (Bocesting) as a tool to enhance maternal nutritional behaviour and nutritional status (3)	Educational media in the form of booklets and Android applications can influence maternal nutritional behavior and children's nutritional status in the context of stunting prevention education.
The effect of providing Koya Nate on the appetite of stunting toddlers (11)	The potential of Koya Nate as an effective intervention to increase the appetite of children with stunting, contributing to efforts to overcome nutritional disorders and prevent negative health impacts such as stunting.
Text messages to improve child diets: Formative research findings and protocol of a randomised controlled trial in Nepal (12)	An emerging body of evidence on the effectiveness of using text messaging for behaviour change, particularly for dietary outcomes in young children in South Asia. Recent studies suggest that mobile phone-based interventions alone may be insufficient but are valuable when added to other social and behavioural interventions; this trial will help provide evidence for or against this emerging theory.
Family-Based WhatsApp Intervention to Promote Healthy Eating Behaviors Among Amazonian School Children: Protocol for a Randomized Controlled Trial (13)	This innovative multimedia messaging intervention has significant potential to drive behavioral change among Amazonian children

Another study using koya nate stated that it had a significant impact on the appetite of toddlers. Because the impact of koya nate is not immediate but requires a long term (11).

In addition, in the research (12). SMS campaign interventions are designed with individual messages with different types of respondents so that these messages can overcome misunderstandings and other barriers to ideal behavior, not just educational. This SMS messaging intervention has an impact on motivating behavior change such as increasing egg consumption and other behavioral practices in stunting prevention.
Other research by (13), Proving that family-based WhatsApp interventions that focus on children shows that innovative multimedia messaging interventions have significant potential in driving behavioural change in stunting prevention among children.

DISCUSSION

A very important effort to prevent stunting cases is increasing by taking advantage of current information technology developments, which are easy to use and can be viewed at any time. In addition, efforts to support health system change programs, especially on the priority of inhibition through increasing knowledge and attitudes are integral to improving the health status and stunted children (10).

This review provides evidence of how mobile phones can be used as behavioural change communication interventions to improve public health communication skills, nutrition and health-seeking behaviours during pregnancy through labour until their babies are 18 months old. Techniques used in stunting prevention include the use of mobile phones, computer networks, and web-based tools. This is especially useful in developing countries because mobile phones have the potential to increase material coverage in hard-to-reach areas (9).

The study provides evidence regarding the effectiveness of smartphones as a suitable device for learning, allowing patients and families to access stunting education anytime and from anywhere. This result was achieved because the media was easy to understand and led to a significant improvement in maternal behavior and attitude in preventing stunting (3)

Prior study found that Stunting Diagnostic and Education app able to educate mothers to diagnose stunting and to teach about the prevention of stunting and improve mother awareness (14,15).

Parents awareness toward child health should be increased because parents' awareness matters for improving child physical and mental health status (16). It is important to optimize the use of internet and increase parents participation with the health professional guidance (17).

In some of the studies reviewed, IT-based interventions allow service providers to manage patient data remotely so that they can monitor and provide the direction patients need (7). There are several potential limitations associated with this systematic review; (1) the heterogeneity of the study design and (2) the review had diversity in the outcomes and interventions reviewed, so further research is needed on which interventions are best applied.

Based on the results of the study, the use of interventions with smartphones can support stunting prevention, especially in terms of knowledge, attitudes and values of indicators of child growth and development. Smartphone-based interventions have comprehensive potential to address the complexity of lifestyle-related behaviours with complete, unique and attractive characteristics.

CONCLUSION

IT-based interventions can be an alternative intervention to improve stunting health management. Technological advances have made IT-based interventions a promising alternative, but more research is needed on

evidence-based outcomes, especially in developing countries.

By knowing some IT-based interventions, it can be used as a consideration in choosing alternative interventions suggested by health care providers. This study shows that IT-based interventions can increase knowledge and positive behaviors in preventing stunting. Therefore, IT-based interventions can be used in further clinical practices, such as a combination of smartphones and healthcare devices.

Conflict of Interest
None

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