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Appropriate Technology-Based Dental and Oral Health Care Model for Orphanage Children

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ABSTRACT Orphanage residents are school-age children in a group vulnerable to tooth decay whose rights and needs are no different from other children of the same age, such as survival, growth and development, protection, and participation. Dental and oral health problems that arise in orphanage children can be something complicated and are closely related to the living conditions in the orphanage. Appropriate technology assistance (AT) is needed to overcome dental and oral health problems in orphanage children. This study aims to develop a feasible and effective dental and oral health care service model based on appropriate technology (AT) tailored for children in orphanages to improve their dental and oral health outcomes. The study utilized a research and development (R&D) approach with a pre-experimental pretest-posttest design. Respondents included 20 dental health cadres to assess changes in knowledge, attitudes, and actions, and 150 orphanage children to evaluate Oral Hygiene Index Simplified (OHI-S) and Decayed, Missing, Filled Teeth (DMF-T) scores. Statistical analyses were performed to assess intervention effectiveness. Expert validation of the service model scored an average of 67.60% ($p = 0.035$), indicating high feasibility. Post-intervention analysis showed significant improvements in knowledge ($p < 0.001$) and actions ($p = 0.004$) among cadres but not attitudes ($p = 0.005$). The intervention did not significantly impact children's OHI-S ($p = 0.62$) or DMF-T scores ($p = 0.20$). The AT-based model effectively improved cadres' knowledge and actions but had limited impact on children's dental health outcomes. Future studies should explore factors affecting implementation and long-term effectiveness.

INDEX TERMS Dental and Oral Health Care Service Based, Approriate Technology, Orphanage Community

I. INTRODUCTION

According to Law Number 23 of 2002 about child protection, children are a gift and a mandate from God Almighty who have the dignity and worth of a whole human being. Every child has the right to survival, growth, and development, as well as protection from discrimination and violence.[1]

The interaction between children, parents, and dentists is crucial in maintaining children's dental health.[2] Parents act as motivators, educators, and facilitators in maintaining children's dental health.[3] A motivator encourages children to actively maintain their oral health, while an educator teaches children about health to instill behaviors that promote optimal health.[4]

Dental and oral health problems remain a significant challenge for vulnerable populations, including orphaned children.[5] Orphanages house school-aged children who are particularly susceptible to tooth decay due to inadequate dental hygiene practices and limited access to healthcare services[6]. Vulnerable groups for dental disease include pregnant women, toddlers, preschool children, and elementary school children.[7] Orphans, who lack family support, often experience challenges beyond their immediate living conditions, including limited access to health care.[8] Despite

these challenges, their rights to survival, growth, development, protection, and participation are no different from those of other children their age.

[9]

According to the 2018 National Health Research (RISKESDAS) report in Yogyakarta Special Region Province, dental and oral health problems in the 5-9 year old age group were 67.3% and the prevalence of dental caries in children aged 5-9 years was 92.6% [10] Apart from Indonesia, it is also found in other countries, in Iran [11], India, reported prevalence of dental caries is 49,6% with 41% in primary and permanent teeth respectively[12], Egypt[5], in the the prevalence of dental caries among orphans aged between 4-12 years was reported in a study in Saudi arabia to be 96%.[13]

One contributing factor to the high prevalence of dental and oral health issues in children is the underutilization of yard space for planting family medicinal plants (FMP) that support dental and oral health.[14] Dental and oral health problems among orphanage children are often complex and closely tied to their living conditions.[15] In Indonesia, data on parenting patterns, oral care practices, plaque index, saliva pH, and caries prevalence in orphanages remain limited.[16]

Orphanage children often face additional challenges, including limited parental guidance, inadequate hygiene routines, and insufficient access to dental care.[17] These factors necessitate the development of targeted interventions that are cost-effective and sustainable.[18] Appropriate technology (AT), characterized by affordability and ease of use, offers a promising solution. This study addresses these gaps by developing and validating an AT-based dental and oral health care model specifically for orphanage children.

The above problems must be overcome with appropriate technological assistance in dealing with dental and oral health problems in children in orphanages.[19] Appropriate technology is technology that meets the needs so that it can be used optimally where the application of this technology is not too expensive and does not require complicated maintenance [20]

The model that the researchers developed is different from previous research, namely implementing several strategies in the form of counseling about dental and oral health, prevention and treatment of dental and oral health problems with the use of Family Medicinal Plants (FMP), as well as limited curative treatment up to referral to the community health center. It is hoped that this model can support effective and more targeted treatment, especially for children in orphanages.[21]

II. METHODS

The study employed an R&D approach with a pre-experimental pretest-posttest design to evaluate the effectiveness of the AT-based model. Therefore A total of 20 dental health cadres and 150 children from two orphanages participated. All children that living in the orphanage were targeted (total sampling).

The research and development procedure include five main steps, including 1) Information collection, 2) Product or model design, 3)Expert validation and revision, 4)test product or model and 5)data collection stage of information processed descriptively and qualitatively.

Cadres' knowledge, attitudes, and actions were assessed using validated questionnaires pre- and post-intervention. OHI-S and DMF-T scores for children were recorded to evaluate dental health status. Ethical approval was obtained, and informed consent was secured from all participants. Statistical analyses, including Wilcoxon and linear regression tests, were conducted to evaluate the intervention's impact.

III. RESULTS AND DISCUSSION

This research was conducted in two orphanages with a total of 20 dental health cadres and 150 children from the orphanage as respondents. The group in this study will be given intervention using an appropriate technology-based dental and oral health care service model. Researchers collected information and measured the level of knowledge, attitudes and actions of dental health cadres and the level of dental health of anti-care children. Before the oral health service model was tested on orphans and health cadres, a feasibility test was carried out by experts.

1. Expert Validation Test

The feasibility test was carried out by three experts according to their fields. The results of the feasibility analysis of the appropriate technology-based dental and oral health care model module are as follows (TABLE 1):

TABLE 1
Expert Validation Results

No	Name	Position	Average	*p-Value**	Category
1.	Dwi Suyatmi, S.SiT., M.DSc	Community Dental Health Care Service Expert	0.676	0.035	High
2.	Eldarita, S.SiT., M.Kes				
3.	Silvia Prasetyowati, S.SiT., M.Kes				

*Interclass Correlation Coefficient

The results of the module feasibility assessment show that the average value of the three experts is 0.676, meaning that 67.60% of the average of the experts who assessed it is real with a p-value of 0.035 and the feasibility category is "High".

2. Descriptive Analysis

This research was conducted on 20 respondents from dental health cadres. A general description of respondents is presented in the following (TABLE 2):

TABLE 2
Data on Respondent Characteristics

Characteristics	Dental and Oral Cadres	
	N	%
Sex		
Male	7	35.00
Female	13	65.00
Education		
Senior High School	12	60.00
Bachelor degree	7	35.00
Master Degree	1	5.00
Ages		
20-29 years	10	50.00
30-39 years	2	10.00
40-50 years	5	25.00
> 51 years	3	15.00

Based on the characteristics results in the table above, it is known that the majority of respondents in the sample in this study were female, namely 13 people (65.00%). Furthermore, based on education, the majority had a high school education, namely 10 people (50.00%) and at least 1 person had a master's degree (5.00%). The majority of respondents in this study were aged 20-29 years, namely 12 people (60.00%).

3. Analysis of The Results of Knowledge, Attitudes and Actions of Dental Health Cadres Before and After Treatment

Data obtained from respondents directly by collecting data before the test and after treatment. Research data collection techniques using tests (pretest and posttest) using questionnaires filled out by research respondents .

TABLE 3
Results of Analysis of Knowledge of Dental Health Cadres Before and After Providing Intervention

Information	Statistic			
	Before	After	Delta (Δ)	*p-Value**
a. Mean±SD	5.80±5.89	15.15±1.59	**9.35**	**<0.001**
b. Min-Max	0.00-16.00	11.00-16.00		

Wilcoxon

TABLE 3 shows that the results of knowledge analysis with a p-Value of <0.001 means there are significant differences. The average results show that the value after giving the intervention is greater than before giving the intervention with an increase of 9.35.

This is in accordance with research which states that providing training to health cadres can increase knowledge[22]. Counseling through training that is carried out well and correctly will influence the level of knowledge of someone who initially doesn't know and becomes knowledgeable[23].

TABLE 4
Results of Analysis of Dental Health Cadres' Attitudes Before and After Providing Intervention

Information	Statistic			
	Before	After	Delta (Δ)	*p-Value**
a. Mean±SD b. Min-Max	17.45±13.53 0.00-33.00	28.50±3.50 24.00-40.00	**11.05**	**0.005**

Wilcoxon

TABLE 4 shows that the results of the knowledge analysis with a p-Value of 0.005 means there is no significant difference or which means that H1 is rejected. The average results show that the value after giving the intervention is greater than before giving the intervention with an increase of 11.05.

This is in line with research by Pamunarsih (2018) showing that respondents who have a poor attitude tend to feel disinterested and are not sure that they will get something as expected[24]. According to Researchers say that a person's attitude towards something or changes in their life may not improve or even experience negative changes due to various factors that influence it, such as resistance to change, where a person resists change and tends to be more comfortable in their zone.[25]

TABLE 5
Results of Analysis of Dental Health Cadre Actions Before and After Providing Intervention

Information	Statistic			
	Before	After	Delta (Δ)	*p-Value**
a. Mean±SD b. Min-Max	7.80±6.88 0.00-20.00	28.50±3.50 11.00-16.00	**20.70**	**0.004**

Wilcoxon

TABLE 5 shows that the results of the action analysis with a p-Value of 0.004 means there is a significant difference or which means H1 is accepted. The average results show that the value after giving the intervention is greater than before giving the intervention with an increase of 20.70.

Researchers assume that an increase in a person's actions is influenced by increased knowledge. Knowledge is an important domain that shapes a person's actions, while attitude is a person's reaction to certain stimuli, which is an emotional response to social stimuli.[26]

4. Results of Analysis of the Influence of Knowledge, Attitudes and Actions of Dental Health Cadres on OHIS and DMFT

The results of the regression test to determine the influence of knowledge, attitudes and actions on OHI-S and DMF-T are as follows:

TABLE 6
The Influence of Knowledge, Attitudes and Actions on OHIS

Variable	R	R *Square*	*p-Value**
Knowledge Attitudes Actions	0.320	0.491	0.62

***Linear Regression**

TABLE 6 show that partially or individually knowledge, attitudes and actions have no effect on OHIS. This is proven by the p-value which is greater than 0.05. The correlation value (R) is 0.320, which indicates that the strength of the relationship between the knowledge, attitudes and actions of cadres and OHIS is included in the weak correlation category. The R square value of 0.491 means that the knowledge, attitudes and actions variables contribute to the OHIS variable by 49.10 % and the remaining 50.90% is influenced by other factors

TABLE 7
The Influence of Knowledge, Attitudes, and Actions on DMF-T

Variable	R	R *Square*	*p-Value**
Knowledge Attitudes Actions	0.320	0.102	0.20

***Linear Regression**

TABLE 7 show that partially or individually knowledge, attitudes and actions have no effect on DMFT. This is proven by the p-value which is greater than 0.05. The correlation value (R) is 0.320, which indicates that the strength of the relationship between the variables of knowledge, attitudes and actions of cadres and DMFT is included in the weak correlation category. The R square value of 0.102 means that the knowledge, attitude and action variables contribute to the DMFT variable by 10.02% and the remaining 89.80% is influenced by other factors.

Researchers think this could happen because dental health cadres may feel burdened in their efforts due to a lack of encouragement and collaboration with other health workers. Cadre participation is voluntary so there is no guarantee that they will continue to carry out their functions as expected[27] It is hoped that prevention and health education can be carried out well, sustainably and structured so that the goals will be achieved and on target[28]

IV. CONCLUSION

The conclusion of this research is that the AT-based dental and oral health care service model is feasible and its implementation is less effective in improving dental and oral health in children in orphanages. This is proven by the following research results: 1. The AT-based dental and oral health care service model is effective on the knowledge and actions of dental and oral health cadres in orphanages (p-Value <0.05) but not attitudes (p-Value>0.05) ; and The AT-based dental and oral health care service model is not effective in improving dental and oral health in children in orphanages (p-Value >0.05).

The AT-based dental and oral health care model is feasible and effective in improving the knowledge and actions of dental health cadres but shows limited impact on children's dental health. Recommendations include:

1. Implementing long-term monitoring to evaluate sustained impacts.
2. Enhancing collaborations between orphanages and healthcare providers.
3. Expanding research to include larger and more diverse populations.

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