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A BEHAVIORAL CULTURAL SERVICE INTEGRATION MODEL (ADELIA) FOR EARLY LANGUAGE DEVELOPMENT DETECTION IN LOW-RESOURCE COASTAL SETTINGS: A MIXED-METHODS STUDY

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ABSTRACT
Early detection of language delay remains a major challenge in low-resource settings, where parental recognition of developmental milestones is often limited by socio-cultural and health system constraints. Limited awareness and delayed help-seeking behavior contribute to poor developmental outcomes among children, particularly in underserved populations. This study aimed to identify determinants of parental ability to recognize early language development and to develop an integrated empowerment model (ADELIA). A sequential explanatory mixed-methods design was conducted in a coastal area of Indonesia involving 304 parents. Quantitative data were analyzed using multivariable logistic regression, while qualitative data from in-depth interviews were analyzed thematically. A total of 67.4% of parents were unable to recognize age-appropriate language milestones. Significant determinants included education (OR=52.076; p=0.003), knowledge (OR=0.056; p=0.008), attitude (OR=81.587; p<0.001), culture (OR=0.031; p=0.008), and SDIDTK utilization (OR=32.766; p=0.004). Attitude emerged as the strongest predictor. Qualitative findings revealed normalization of speech delay, limited awareness, and structural barriers in service delivery. Parental ability is shaped by a complex interaction of behavioral, cultural, and system-level factors. The ADELIA model provides a multi-level and context-sensitive framework to bridge the gap between awareness and action in early detection.

KEYWORDS: Early childhood development; Language development; Speech delay detection; Parental ability; Health systems; SDIDTK; Coastal communities; Mixed-methods

INTRODUCTION

Early childhood development (ECD) is a critical foundation for lifelong health, cognitive capacity, and social well-being, with language development serving as a key indicator of overall development (Black et al., 2021; Walker et al., 2020). Delayed identification of language disorders is associated with long-term consequences, including poor academic performance and reduced social functioning (Jeong et al., 2021). Globally, children in low- and middle-income countries are at increased risk of developmental delays due to limited stimulation, poverty, and inadequate access to early detection services (Britto et al., 2021; McCoy et al., 2021). In such contexts, parental ability to recognize developmental milestones becomes a crucial determinant of early intervention (Lu et al., 2020). In Indonesia, the Stimulation, Detection, and Early Intervention of Child Development (SDIDTK) program has been implemented to support early detection at the primary healthcare level. However, its effectiveness remains constrained by low utilization, limited awareness, and competing service priorities in primary healthcare settings (Kemenkes RI, 2022; WHO, 2020). Coastal communities present additional challenges due to geographical barriers, irregular occupational patterns, and socio-cultural beliefs that may normalize developmental delays (Abubakar et al., 2018; UNICEF, 2023). These factors contribute to delayed health-seeking behavior and reduced engagement with preventive services (Ridde et al., 2020).

Previous studies have primarily focused on knowledge and access as determinants of parental behavior. However, limited research has examined the interaction between behavioral, cultural, and system-level factors using integrated approaches (Peters et al., 2018; Vaivada et al., 2020). Therefore, this study aims to identify determinants of parental ability and to develop the ADELIA model as an integrated framework to improve early language development detection in low-resource coastal settings. Despite growing evidence on early childhood development, most existing interventions focus primarily on knowledge dissemination and access to services. However, limited attention has been given to the interaction between behavioral readiness, cultural beliefs, and health system constraints in shaping parental ability. This gap is particularly evident in low-resource coastal settings, where sociocultural norms and structural barriers strongly influence health-seeking behavior. Therefore, this study not only examines determinants of parental ability but also proposes an integrated model that addresses these multi-level factors simultaneously. The ADELIA model is designed as a behavioral–cultural service

integration framework to bridge the gap between awareness and action in early detection of language development.

Despite increasing attention to early childhood development (ECD), gaps remain in translating knowledge into effective community-based practices, particularly in low-resource settings. Many interventions have focused primarily on improving parental knowledge through health education; however, evidence suggests that knowledge alone is insufficient to drive behavioral change. Parents often rely on cultural beliefs, social norms, and previous experiences in interpreting child development, which may lead to normalization of developmental delays and delayed help-seeking behavior.

Furthermore, the complexity of early detection is influenced by the interaction between individual, cultural, and health system factors. In coastal and geographically dispersed areas, access barriers, limited health workforce capacity, and competing service priorities further reduce the effectiveness of existing programs. These challenges highlight the need for integrated approaches that address not only knowledge gaps but also behavioral readiness, cultural context, and system-level constraints.

The ADELIA model was developed to address these gaps by integrating behavioral, cultural, and service components into a comprehensive framework. This model emphasizes participatory learning, contextual adaptation, and service integration to enhance parental capacity in recognizing early language development. By positioning parents as active agents in child development monitoring, the model aims to bridge the gap between awareness and action in early detection.

METHOD

Study Design: This study employed a sequential explanatory mixed-methods design, integrating quantitative and qualitative approaches to provide a comprehensive understanding of determinants influencing parental ability. The quantitative phase identified statistical relationships among variables, while the qualitative phase explored contextual factors underlying these findings.

Study Setting The study was conducted in a coastal area of Batam, Indonesia, characterized by dispersed populations and limited access to healthcare services. These contextual conditions were considered important in interpreting parental behavior and service utilization.

Sampling and Participants A total of 304 parents of children under five years were recruited using purposive sampling. Inclusion criteria included parents of children aged 0–59 months who were actively involved in childcare. Exclusion criteria included parents whose children had severe developmental disorders requiring specialized care.

Variables and Measurement The dependent variable was parental ability to recognize language development. Independent variables included education level, knowledge, attitude, cultural beliefs, and SDIDTK utilization. Knowledge and attitude were measured using validated questionnaires, while cultural beliefs were assessed using structured perception scales.

Data Analysis Quantitative data were analyzed using chi-square tests for bivariate analysis and logistic regression for multivariable analysis. Variables with p-values <0.25 were included in the regression model. Adjusted odds ratios (AOR) with 95% confidence intervals were calculated. Qualitative data were analyzed thematically through coding, categorization, and triangulation.

Ethical Considerations Ethical approval was obtained from the Faculty of Medicine, Universitas Andalas (No. 452/UN/16.2/KEP-FK/2025). Written informed consent was obtained from all participants.

RESULTS

Descriptive analysis showed that the majority of respondents were aged between 25–35 years and had a secondary level of education. Most participants were housewives, indicating that mothers were the primary caregivers responsible for monitoring child development. Further analysis revealed that parents with higher education levels demonstrated significantly better ability to recognize developmental milestones compared to those with lower education. Similarly, parents with positive attitudes were more likely to actively monitor and respond to developmental concerns. In terms of service utilization, parents who regularly attended SDIDTK services were more likely to identify early signs of language delay. However, qualitative findings indicated that many parents misunderstood SDIDTK as a service limited to physical growth monitoring rather than developmental screening.

The quantitative findings showed that 67.4% of parents were unable to recognize age-appropriate language development milestones, indicating a substantial gap in early detection capacity. Significant determinants included education (OR=52.076; p=0.003), knowledge (OR= 0.056; p=0.008), attitude (OR=81.587; p<0.001), culture (OR=0.031; p=0.008), and SDIDTK utilization (OR=32.766; p=0.004). Attitude emerged as the strongest predictor of parental ability (Jeong et al., 2021; Walker et al., 2020). Qualitative findings revealed several key themes. First, parents demonstrated limited understanding of developmental milestones and often equated language development with the ability to speak simple words. Second, speech delay was frequently normalized as a natural variation, reducing the urgency for intervention (Abubakar et al., 2018). Third, SDIDTK was commonly perceived as a physical monitoring service rather than a developmental screening program, leading to low utilization. Fourth, socio-cultural factors, including occupational demands and caregiving practices, limited parent–child interaction and service engagement (UNICEF, 2023). Fifth, service delivery constraints were identified, including high workload, limited time, and prioritization of routine services such as immunization over

developmental screening (Kruk et al., 2020; Leslie et al., 2021). Integration of findings indicates that parental attitudes are shaped by cultural beliefs and service visibility, which ultimately influence engagement in early detection.

Table 1. Determinants of Parental Ability to Recognize Language Development

Variable	OR	p-value	Interpretation
Education	52.076	0.003	Significant
Knowledge	0.056	0.008	Significant
Attitude	81.587	<0.001	Strongest
Culture	0.031	0.008	Significant
SDIDTK Utilization	32.766	0.004	Significant

These findings indicate that parental ability is not determined by a single factor but rather by a combination of individual, cultural, and system-level influences. Among these, attitude emerged as the strongest predictor, suggesting that internal readiness plays a more critical role than knowledge alone.

DISCUSSION

This study demonstrates that parental ability to recognize early language development is influenced by multi-level determinants rather than knowledge alone. The dominance of attitude as a predictor highlights the importance of behavioral readiness in shaping health behavior (Jeong et al., 2021). Furthermore, the normalization of speech delay identified in this study reflects deeply rooted socio-cultural perceptions. In many communities, late speech is often perceived as a natural variation rather than a developmental concern, reducing the urgency for early detection. This cultural lens significantly shapes parental interpretation of child development and delays help-seeking behavior.

From a systems perspective, the study also reveals a critical gap between service availability and effective utilization. Although SDIDTK services are formally implemented, their impact remains suboptimal due to limited visibility, competing priorities, and workload constraints among healthcare providers. This indicates that strengthening service delivery alone is insufficient without improving community engagement and perceived relevance of services.

The integration of behavioral, cultural, and system-level factors in this study provides a more comprehensive understanding of early detection challenges. Unlike previous studies that examined these determinants in isolation, this research demonstrates their interdependence, emphasizing the need for integrated intervention models. The ADELIA model contributes to the existing literature by offering a context-sensitive framework that aligns with global strategies on nurturing care and integrated early childhood development interventions.

This finding aligns with the Theory of Planned Behavior, which emphasizes that behavior is primarily influenced by attitudes and perceived control rather than knowledge alone. This challenges traditional health promotion approaches that prioritize information dissemination. The presence of a knowledge–practice gap suggests that information alone is insufficient to change behavior. Parents rely heavily on experiential knowledge and social narratives, which are shaped by cultural contexts (Abubakar et al., 2018; Super & Harkness, 2019). Cultural normalization of speech delay emerged as a key barrier, reducing perceived urgency for early detection. This finding supports the concept of cultural cognition, where health perceptions are socially constructed rather than individually determined (Ridde et al., 2020).

The study also highlights the distinction between access and utilization. While healthcare services are available, their impact is limited without active engagement. This finding is consistent with previous research showing that utilization is influenced by perceived relevance rather than availability (Peters et al., 2018). From a health systems perspective, service delivery constraints significantly affect implementation. Limited time, high workload, and competing priorities reduce the quality of developmental screening, reflecting systemic challenges in primary healthcare (Kruk et al., 2020; Haldane et al., 2021). The ADELIA model provides a conceptual advancement by integrating behavioral, cultural, and system-level factors into a unified framework. This approach addresses the gap between awareness and action and aligns with global ECD strategies emphasizing integrated interventions (Britto et al., 2021).

1. Behavioral Perspective Expansion

The dominance of attitude as the strongest predictor highlights the importance of behavioral readiness in shaping parental actions. This finding supports the Theory of Planned Behavior, which emphasizes that behavior is influenced more by intention and perceived control than by knowledge alone. Parents may possess adequate knowledge but still fail to act due to lack of confidence, perceived barriers, or social influences.

2. Cultural Context Expansion

The normalization of speech delay observed in this study reflects deeply embedded cultural beliefs. In many communities, late speech is perceived as a natural variation rather than a developmental concern. This perception reduces the urgency of seeking professional help and delays early intervention.

Cultural beliefs also influence parenting practices, including communication patterns and stimulation behaviors. In coastal communities, occupational demands often limit parent-child interaction, further contributing to delayed language development.

3. Health System Perspective

From a health systems perspective, the study reveals a gap between service availability and effective utilization. Although SDIDTK services are implemented, their utilization remains low due to limited awareness and perceived relevance.

Healthcare providers, particularly midwives, face challenges such as:

- High workload
- Limited time
- Competing priorities

These constraints reduce the effectiveness of developmental screening programs.

4. Integration

The integration of behavioral, cultural, and system-level factors represents a significant contribution of this study. Unlike previous research that examines these determinants separately, this study demonstrates their interdependence.

The ADELIA model provides a multi-level framework that:

- Enhances knowledge
- Shapes attitudes
- Addresses cultural beliefs
- Strengthens service utilization

5. Comparison with Previous Studies

This finding is consistent with previous studies indicating that parental behavior is influenced by multiple factors beyond knowledge. However, this study extends existing literature by demonstrating that attitude plays a more dominant role than previously reported.

These findings highlight the importance of integrated and context-sensitive interventions in addressing early childhood developmental challenges in low-resource settings.

The integration of behavioral, cultural, and health system factors identified in this study is summarized in the ADELIA model (Figure 1)

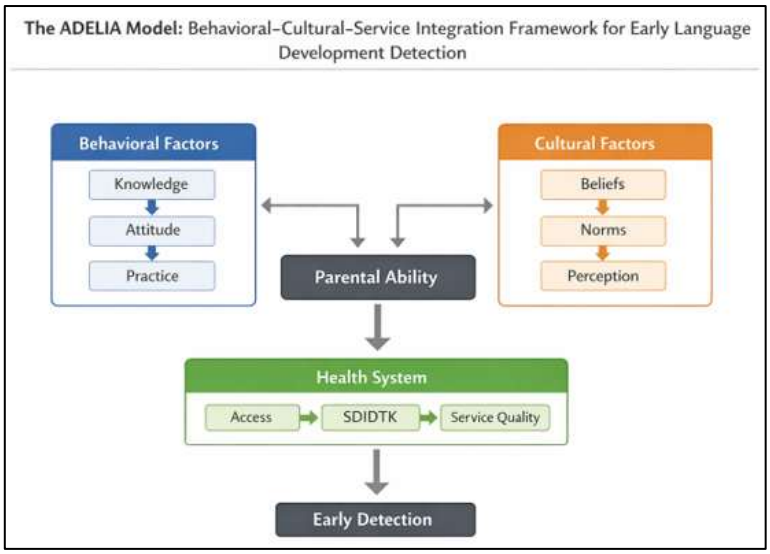

Figure 1. The ADELIA Model: Behavioral Cultural Service Integration Framework for Early Language Development Detection

IMPLICATIONS

This study has important implications for public health practice and policy. First, interventions aimed at improving early detection of child development should go beyond knowledge enhancement and incorporate behavioral change strategies that address parental attitudes and beliefs. Second, culturally sensitive approaches are essential in addressing misconceptions and normalization of developmental delays. Community-based education that integrates local values and practices may improve acceptance and effectiveness of interventions. Third, strengthening primary healthcare services should focus not only on availability but also on improving service delivery quality, visibility, and integration into routine care. Midwives and primary healthcare providers play a critical role as frontline educators and facilitators of parental empowerment. Finally, the ADELIA model offers a scalable framework that can be adapted to similar low-resource settings, particularly in geographically dispersed and underserved communities.

STRENGTHS AND LIMITATIONS

This study has several strengths. The use of a mixed-methods design allows for a comprehensive understanding of both quantitative determinants and contextual factors influencing parental ability. The integration of behavioral, cultural, and system-level perspectives provides a novel contribution to early childhood development research.

However, this study also has limitations. The cross-sectional nature of the quantitative phase limits causal interpretation. In addition, the study was conducted in a specific coastal setting, which may affect generalizability to other populations. Future research should evaluate the effectiveness of the ADELIA model through experimental designs and in diverse settings to strengthen its external validity.

CONCLUSION

The ADELIA model proposed in this study integrates behavioral, cultural, and health system components into a unified framework to improve early detection of language development in children. The findings demonstrate that parental ability is shaped by the interaction between knowledge, attitudes, cultural beliefs, and service accessibility.

Interventions that focus solely on knowledge improvement are insufficient to produce meaningful behavioral change. Instead, integrated and context-sensitive approaches are required to address the complexity of early detection in low-resource settings.

The ADELIA model provides a theoretically grounded and practical framework that bridges the gap between awareness and action. Future research should evaluate its effectiveness through experimental designs and explore its scalability across diverse settings. These findings provide strong evidence for the importance of integrated, multi-level strategies in improving early childhood developmental outcomes in underserved populations.

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