GOVERNANCE OF E-PPGBM AND SYSTEMIC CHALLENGES IN COMMUNITY NUTRITION SERVICES: A CRITICAL ANALYSIS OF CADRE CAPACITY, TECHNICAL BARRIERS, AND INSTITUTIONAL DYSFUNCTION

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ABSTRACT

Background: Stunting remains a serious problem in Indonesia, with high prevalence rates that impact the quality of human resources. The e-PPGBM system was developed as a response to strengthen community-based nutrition recording and reporting, but its effectiveness is highly dependent on the quality of governance and the role of Posyandu cadres.

Research objectives: To critically analyze the factors that influence the governance of the e-PPGBM system, especially in terms of cadre capacity, technical barriers, and institutional dysfunction in stunting locus areas. A qualitative case study approach was used involving four main informants who were the persons in charge of e-PPGBM as well as Nutrition Companion Personnel (TPG) in four Community Health Centers. Data were collected through in-depth interviews, analyzed using the Braun & Clarke thematic method with the help of NVivo 12 Plus, and validated through theory and policy triangulation.

Results: Identified four main themes, namely limited knowledge and basic skills of cadres, limited access to training, inconsistency in SOP implementation, and technical and institutional challenges. These factors synergistically affect the quality of e-PPGBM data management at the Posyandu level. The results of the study also showed that the problems were not solely in individual cadres, but were a reflection of systemic weaknesses in the program's supporting structure.

Conclusion: the success of e-PPGBM is not only determined by the technical capacity of cadres, but also by the function of institutional governance and adaptive and sustainable training systems. This finding emphasizes the need for a holistic approach in strengthening community-based nutrition information systems in Indonesia.

Keywords: Community-based surveillance, data quality and implementation fidelity

BACKGROUND

Stunting remains a serious problem in the Southeast Asia region. Based on the World Health Organization report (2018), Indonesia ranks third in terms of stunting prevalence in Southeast Asia after Timor Leste (50.5%) and India (38.4%). The Asian Development Bank report (2021) also places Indonesia as the country with the second highest stunting prevalence in the region. Historical data from the Basic Health Research (Riskesdas) shows that the stunting rate in Indonesia in 2007 was 36.8%, increasing to 37.2% in 2013, and decreasing to 30.8% in 2018. Meanwhile, the results of the Indonesian Nutritional Status Survey (SSGI) showed a significant downward trend in the last two years, from 24.4% in 2021 to 21.6% in 2022 [1] . However, the prevalence of stunting in several provinces is still very high. In West Sulawesi Province, for example, the stunting rate was recorded at 37.14% based on Riskesdas (2018), far above the national average.

Stunting is an indicator of the failure of human resource development which has an impact on various sectors, namely impacting children's physical growth, cognitive development, economic productivity, and intergenerational welfare [3]–[7] . United Nations Children's Fund (UNICEF, 2024) and the World Health Organization (WHO, 2018)

emphasize that stunting reduction interventions must be supported by a strong, accurate, and community-based nutritional status monitoring system.

The Indonesian government responded to these challenges by strengthening Posyandu as the starting point for community nutrition services, as well as the starting point for e-PPGBM (Community-Based Electronic Nutrition Recording and Reporting) data management [10] . The purpose of this system is to integrate anthropometric measurement data from Posyandu cadres, so that it can be used in real-time in formulating national and regional nutrition interventions [11] . Thus, this shows that the problem of stunting in Indonesia cannot be separated from the structural complexity of the nutrition service system, especially related to monitoring and data recording mechanisms at the community level [12] . This condition emphasizes the importance of in-depth analysis of contextual and institutional factors that shape the quality of e-PPGBM data management at the cadre and community levels.

In the context of the nutrition surveillance system, data accuracy is not only a technical indicator, but also becomes the basic foundation of evidence-based interventions, resource allocation, and monitoring of national program achievements [13], [14] . The data used comes from a system that is not managed properly, so evidence-based decisions that are the core of the modern health policy approach cannot be implemented optimally [15], [16] . Therefore, the study of e-PPGBM governance is not only aimed at seeing the effectiveness of the system, but also for data management practices in the field to contribute to the accuracy and integrity of the data produced.

This condition emphasizes the need for analysis of contextual and institutional factors that shape the quality of e-PPGBM data management at the cadre and community levels . In the implementation practice, various obstacles were found that were not only technical in nature, but also inherent in the institutional structure and governance of implementation. At the cadre level, limited capacity in terms of technical knowledge, measurement skills, and digital literacy are still major issues that impact the accuracy and consistency of data reporting. In addition, excessive workload, lack of ongoing training, and the unavailability of a systematic feedback system create additional pressures that contribute to low fidelity to standard operating procedures (SOPs).

Meanwhile, at the institutional level, the absence of clear standards in the recruitment process of cadres, weak technical supervision from the Health Center, and the absence of post-training coaching mechanisms illustrate systemic governance dysfunction. This condition shows that community-based nutritional data management is not supported by technology and procedures alone, but is highly dependent on the quality of relationships between actors, clarity of institutional mandates, and the existence of coordination and accountability mechanisms that function sustainably. Therefore, understanding e-PPGBM governance cannot be done partially, but must be seen as a socio-technical system that involves technical dimensions, human resources, and institutional context simultaneously.

Although e-PPGBM has been implemented nationally as a community-based nutrition surveillance system, most existing studies still focus on the technical aspects of cadres, such as limitations in anthropometric measurements and the use of digital applications. Studies that comprehensively examine how institutional factors, decision-making, and institutional support structures affect the quality of data management at the community level are still very limited. In addition, there are still few studies that use a qualitative approach to deeply understand the experiences of cadres in carrying out their duties in the context of complex structural and institutional pressures. Therefore, this study aims to fill this gap by raising the perspective of governance in the implementation of e-PPGBM in stunting locus areas, by highlighting how cadre capacity, technical obstacles, and institutional dysfunction interact and shape the quality of data management at the grassroots level.

MATERIALS AND METHODS

This study uses a qualitative design with a case study approach to explore the dynamics of community-based nutrition information system governance, known as e-PPGBM. The focus of the study is directed at how cadre capacity, technical barriers, and institutional dysfunction affect the quality of nutrition data management at the community level, especially in stunting locus areas.

The informants in this study were those responsible for implementing e-PPGBM in four Health Centers who also served as Nutrition Companion Personnel (TPG). They were selected purposively based on their direct involvement in the operationalization of the e-PPGBM system and technical assistance to Posyandu cadres in the working areas of Beru-Beru, Tampa Padang, Bambu and Binanga Health Centers.

Before the main data collection process was carried out, the researcher first conducted a trial of interview questions on two nutrition workers who were not included in the list of main informants, but had similar characteristics. This trial aimed to assess the clarity of language, relevance of context, and logical flow of questions. The results of the trial were used to refine the interview guidelines to be more contextual and in accordance with the role of informants in the field.

Data collection was conducted through in-depth interviews with four informants in August 2024 using Indonesian, and all conversations were recorded and transcribed verbatim. Data analysis was conducted using a thematic analysis approach following the six stages of Braun and Clarke [17], [18] . Coding and pattern discovery were carried out with the help of NVivo 12 Plus software. Triangulation was carried out by comparing data from various Puskesmas

locations and reviewing policy documents and technical guidelines for e-PPGBM from the Ministry of Health. This study has obtained approval from the ethics committee of the Faculty of Public Health, Hasanuddin University with Number: 1962/UN4.14.1/TP.01.02/2024, and all informants gave their informed consent to participate.

RESEARCH RESULTS

Characteristics of Informants
This study involved four informants who were nutrition surveillance personnel who acted as Nutrition Companion Personnel (TPG) at Posyandu. All informants participated in interviews aimed at exploring the need for cadre empowerment in improving the quality of electronic data management for community-based nutrition recording and reporting (e-PPGBM). The characteristics of the informants are presented as follows:

Table 1. Characteristics of research informants

Informant code	Age	Years of service	Education
Informant 1	31 years old	9 years	D3 Nutrition
Informant 2	34 years old	4 years	S1 Nutrition
Informant 3	32 years	6 years	D3 Nutrition
Informant 4	46 years old	15 years	D3 Nutrition

Based on Table 1, the characteristics of the informants in this study consisted of four informants with different variations in age, length of service, and level of education. Informant 1 was 31 years old with a length of service of 9 years and had a D3 Nutrition education background. Informant 2 was 34 years old with a length of service of 4 years and a Bachelor's degree in Nutrition. Informant 3 was 32 years old with a length of service of 6 years and had a last education of D3 Nutrition. Informant 4 was the oldest informant, which was 46 years old, and had the longest length of service, which was 15 years, with a D3 Nutrition education background. The variation in the characteristics of these informants is expected to provide diverse and in-depth information according to their respective work experiences and levels of education in the field of nutrition.

The results of thematic analysis to explore the needs of cadres in improving the quality of e-PPGBM data management.
The interview results were analyzed using NVivo 12 plus software to find themes and subthemes from informant answers according to the interview guidelines. The results of the thematic analysis were used to determine the right strategy in empowering cadres to optimize their potential in improving the quality of community-based nutritional data (e-PPGBM), adjusted to the findings of the themes and subthemes that had been analyzed.

To increase the validity and credibility of the research results, theory/policy triangulation is carried out by comparing and combining various relevant theoretical or policy perspectives. In this context, theory triangulation involves the use of more than one theory or policy framework to analyze data, so that phenomena can be viewed from different perspectives and avoid interpretive bias. In addition, policy triangulation is used as a guide to assess the suitability of research results with existing standards or regulations. So that the results of this study can provide depth of analysis, helping to ensure that research findings are not only valid in one particular theoretical or policy context but are also relevant in a broader context.

The results of the thematic analysis using the Nvivo application, in Figure 1, show that there are four main themes. The first theme is the limited knowledge and basic skills of cadres, where there are still cadres who do not optimally understand their duties and functions in Posyandu activities. The second theme is limited access and frequency of cadre training, which shows that the training provided to cadres is still limited both in terms of quantity and accessibility. The third theme relates to the inconsistency of the implementation of standard operating procedures (SOP), where there are differences between the established guidelines and implementation practices in the field. The fourth theme includes technical and practical challenges in carrying out cadre duties, such as limited facilities and infrastructure, as well as obstacles in the use of e-PPGBM technology. These four themes illustrate the problems and needs that need to be considered in efforts to strengthen the role of Posyandu cadres, especially in supporting the implementation of the e-PPGBM program. The results of the analysis are summarized in the following figure:
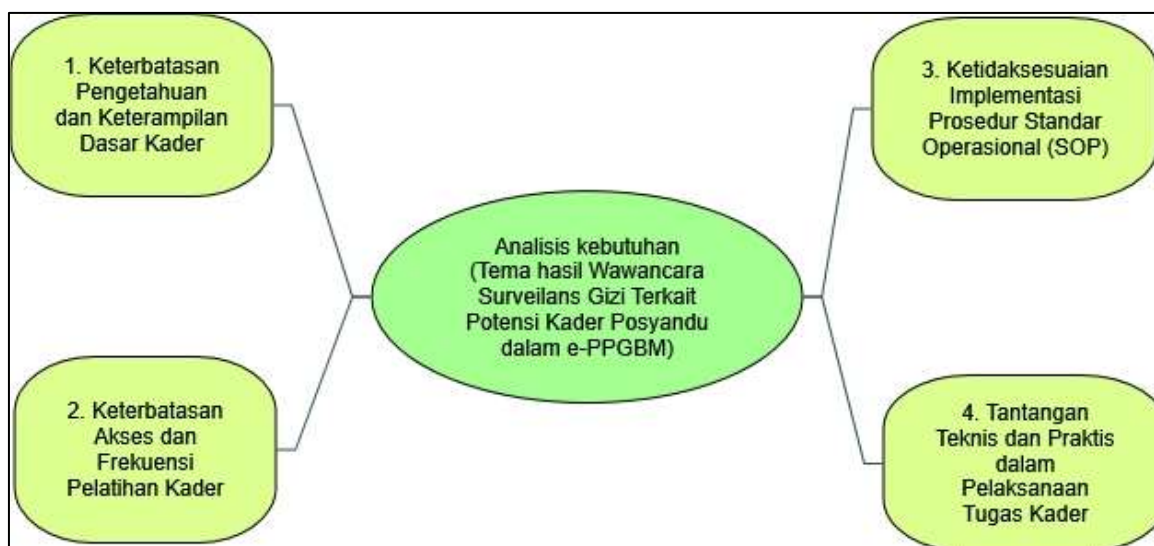
Figure 1. Mind map of thematic analysis results using Nvivo

From the analysis results, 4 main themes were found consisting of 13 sub-themes as follows:
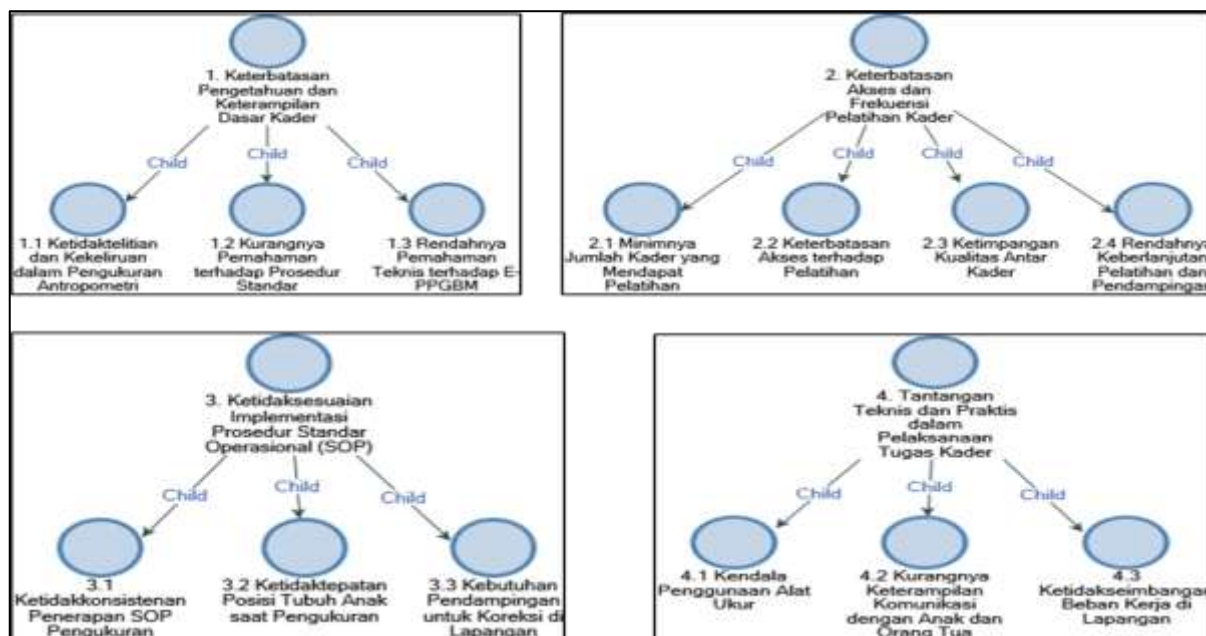

Figure 2. Project map of thematic analysis results using Nvivo

The description of the research findings includes themes, subthemes, supplemented with quotes from informants and complete theory/policy triangulation presented in the following table:

Table 2. Matrix of themes & subthemes composed of interview results

Theme	Subtheme	Quote from Informant's statement	Triangulation of Theory/Policy
1. Limited Basic Knowledge and Skills of Cadres	1.1. Inaccuracy and Errors in Anthropometric Measurements	"...when it comes to measuring the height or length of babies and toddlers, there are still some who are confused about the correct way" (Informant 1) "...in terms of anthropometric measurements, it is still often wrong.	Minister of Health Regulation No. 21/2020 and Ministry of Health Training Module (2020): the importance of anthropometric accuracy and skills.

Theme	Subtheme	Quote from Informant's statement	Triangulation of Theory/Policy
		Or sometimes not precise" (Informant 2) "When it comes to measuring babies and toddlers, many are still not careful" (Informant 3) "Most of them are still hesitant when asked to measure their weight or height. Sometimes they are not careful..." (Informant 4)	Minister of Health Regulation No. 75 of 2014: anthropometric measurements must be carried out according to standards for valid data.
	1.2. Lack of Understanding of Standard Procedures	"...but in the field there are still often things that are not appropriate" (Informant 1) "There are still many cadres who do not know how to measure correctly" (Informant 2) "...cadres do not understand the correct measurement techniques" (Informant 3) "...many cadres still do not implement the procedures correctly" (Informant 4)	The e-PPGBM Guidelines (2016) emphasize the importance of procedural consistency to ensure accurate nutritional data.
	1.3. Low Technical Understanding of E-PPGBM	"...when they do recording and reporting, the data is often inaccurate" (Informant 1) "...cannot fill in KMS correctly" (Informant 3) "...even though the data is important for us" (Informant 4)	Minister of Health Regulation No. 21/2020 and WHO Guidelines: the importance of technical understanding and data validity. The e-PPGBM system requires precise data input for appropriate nutritional interventions.
2. Limited Access and Frequency of Cadre Training	2.1. Low Number of Cadres Receiving Training	"...the main obstacle for cadres is the lack of training" (Informant 1) "...usually only one or two people have been trained." (Informant 2) "...usually only one person is sent to take part in the training" (Informant 3) "...the number of those who are truly trained is decreasing" (Informant 4)	Minister of Health Regulation No. 75/2014 and WHO Guidelines (2008): cadre training must be evenly distributed.
	2.2 Limited Access to Training	"Most of them have never participated in any training at all" (Informant 1) "...there were 2 cadres who had participated in the training, but one moved to another area, another stopped because he was busy taking care of his family" (Informant 4)	Ministry of Health (2020): cadre training should be carried out routinely and comprehensively.
	2.3 Quality Disparities Between Cadres	"...those who understand and are skilled are very limited" (Informant 2) "...even though ideally all cadres should be trained so that their knowledge is evenly distributed" (Informant 3)	Ministry of Health (2020): The principle of cadre empowerment requires an even distribution of skills.

Theme	Subtheme	Quote from Informant's statement	Triangulation of Theory/Policy
		"...there are only new cadres who have not been trained" (Informant 4)	
	2.4 Low Sustainability of Training and Mentoring	"...the training itself is rare. In fact, the cadres are the spearhead of Posyandu" (Informant 1) "...cadres still do not understand the main tasks such as measuring weight, height and head circumference" (Informant 3) "...cadres who have been trained, they immediately move or quit" (Informant 4)	Capacity Building Theory and the Ministry of Health 2022: continuous training is essential.
3. Non-conformity of Standard Operating Procedure (SOP) Implementation	3.1 Inconsistency in Implementation of Measurement SOPs	"...cadres who are still inconsistent in implementing the steps" (Informant 1) "The standard measurement procedure at the integrated health post should have started in the right way from the beginning" (Informant 2) "...in the field, many standard measurement procedures are still not in accordance" (Informant 3) "...there was an error in the implementation of standard procedures" (Informant 4)	Practical Guide to Posyandu Services (Ministry of Health 2022): SOPs must be applied consistently.
	3.2 Inaccuracy of Child's Body Position during Measurement	"In fact, the child's position should be upright, legs straight, and head not lowered..." (Informant 1) "...in measuring height, there are several points on the body that must touch the measuring instrument, such as the heels, buttocks, back, and head" (Informant 2) "...in measuring body weight, height and head circumference, there are still some who are not careful in ensuring the correct position" (Informant 3) "...someone was in the wrong position when measuring weight or height, so the results were not up to standard" (Informant 4)	Ministry of Health Training Module (2020) and WHO Anthropometric Guidelines (2010): body position must be in accordance with standards.
	3.3 Need for Assistance for Corrections in the Field	"So, they need further guidance so they can be more proficient." (Informant 1) "Many cadres still need further guidance on correct measurement techniques" (Informant 3)	Ministry of Health Nutrition Development Policy (2022): field assistance is needed.
4. Technical and Practical Challenges in Executing Tasks	4.1 Obstacles to Using Measuring Instruments	"...there was something wrong in determining the child's position or using the measuring instrument" (Informant 1) "...the child's position is not straight or the device is unstable" (Informant 2)	Posyandu technical guidelines (2022): use of measuring instruments must comply with SOP.

Theme	Subtheme	Quote from Informant's statement	Triangulation of Theory/Policy
		"...when measuring height, there was a part of the child's body that touched the measuring instrument that it should not have touched" (Informant 3) "...I think it is very important for cadres to understand how to use measuring tools" (Informant 4)	
	4.2 Lack of Communication Skills with Children and Parents	"...cadres must also be able to communicate with children" (Informant 1) "...communication with parents and children who visit the integrated health post." (Informant 4)	Ministry of Health (2022): interpersonal communication skills are important in integrated health post services. WHO (2021): the importance of effective communication in primary care.
	4.3 Field Workload Imbalance	"This makes the workload unbalanced" (Informant 2) "...cadres have to handle many things alone" (Informant 3) "In fact, the cadre's job is not easy." (Informant 4)	Ministry of Health (2022): Posyandu management emphasizes fair and efficient division of tasks. WHO CHW Framework (2021): workload should be proportional.

Based on table 2 of the interview results with four nutrition surveillance personnel, four main themes with thirteen interrelated subthemes were found. Each theme describes the dimensions of the problems faced by Posyandu cadres in carrying out the task of recording and reporting nutrition data through the e-PPGBM system with the following points:

1. Limited Basic Knowledge and Skills of Cadres. This theme shows that Posyandu cadres still face challenges in understanding and applying basic anthropometric measurement skills as well as understanding standard procedures and technical aspects of e-PPGBM data quality. The sub-themes that emerged include: Inaccuracy and errors in anthropometric measurements; Lack of understanding of standard procedures; Low technical understanding of the e-PPGBM application. All informants stated that cadres are often not careful, do not understand standard procedures, and have difficulty filling in data. This is reinforced by Permenkes No. 21 of 2020 and WHO guidelines which emphasize the importance of accuracy and skills in measurement and the validity of data input.

2. Limited Access and Frequency of Cadre Training. Another dominant problem is the limited number and sustainability of cadre training. The sub-themes that emerged were: The minimal number of cadres who received training; Limited access to training; Inequality of quality among cadres; Low sustainability of training and mentoring. Quotes from the four informants showed that training was often only attended by one or two cadres, while others did not have the same opportunity. This led to an imbalance in ability. Some cadres who had been trained were no longer active. Minister of Health Regulation No. 75 of 2014 and WHO guidelines emphasize the importance of equitable and sustainable training as part of cadre empowerment.

3. Inconsistency in Implementation of Standard Operating Procedures (SOP). This theme highlights the weaknesses in the implementation of measurement SOPs in the field. The sub-themes presented are Inconsistency in the implementation of measurement SOPs; Inaccuracy of the child's body position during measurement; Need for assistance for correction in the field. Informants explained that cadres often do not follow the SOP steps correctly, including in terms of ensuring the child's body position during measurement. Assistance from nutrition officers is considered important so that cadres can improve their techniques. This is in line with the Ministry of Health's Nutrition Development policy.

4. Technical and Practical Challenges in Task Implementation. The last theme reflects the practical obstacles faced by cadres in the field. The sub-themes are Obstacles in the use of measuring instruments; Lack of communication skills with children and parents; Unbalanced workload in the field. Informants said that the use of tools is often not in accordance with SOP, and cadres lack good communication skills with children and parents. The cadre's workload is also considered heavy because they have to do various tasks independently. The WHO CHW Framework and posyandu management emphasize the importance of fair task distribution and improving cadre soft skills .

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DISCUSSION

Limited knowledge and basic skills of cadres

The results of this study indicate that the existence of knowledge alone does not necessarily guarantee changes in cadre behavior in carrying out their duties. Although some cadres have obtained information regarding anthropometric measurement procedures and e-PPGBM data recording, practices in the field still show inconsistencies and fundamental errors. This phenomenon reflects the existence of a knowledge–behavior gap , namely the gap between what is known and what is done [19], [20] . This finding is in line with research by Fabrigar et al., (2006) and Huang et al., (2024) , which states that knowledge will only affect behavior if supported by other psychological factors, such as self-efficacy and attitudes. In other words, declarative knowledge needs to be developed into procedural and applicable knowledge through a more contextual and iterative learning approach [23], [24] .

This finding also underlines the importance of distinguishing between declarative knowledge (knowing that) and procedural knowledge (knowing how). Many cadres were able to explain that height measurements must be accurate, but did not know how to ensure the child's body position according to WHO anthropometric standards. In Bloom's taxonomy revised by [25] , mastery of skilled behavior can only be formed from a combination of conceptual understanding and practical application. Therefore, efforts to improve cadre knowledge must include training strategies that not only convey information, but also build technical skills that can be practiced directly.

Knowledge in the context of Posyandu cadres cannot be understood in a reductionistic way as an accumulation of static information, but rather as an active, dynamic entity that is always interwoven into the social reality in which cadres interact [26], [27] . Cadre knowledge develops in a social space that is laden with values, norms, power relations, and community expectations [28] .

Cadre knowledge is not simply the result of top-down information transfer through technical training, but also a social construction formed through experiences, interactions, and the meanings they create together in carrying out daily tasks [29] . This view is in line with Q. Wang et al., (2021) and Peng et al., (2024) who emphasize that knowledge is the result of social and cultural mediation, not a neutral individual entity. In this context, cadre knowledge becomes a reflection and gives meaning to instruments such as e-PPGBM, negotiating procedures with field conditions, and responding to policy standards that are sometimes not contextual. Therefore, every effort to increase cadre capacity must view knowledge not as a passive variable that is sufficient to be filled through training, but as a living entity that must be built together with cadres through a dialogical, participatory, and contextual process [32], [33] . This approach is what distinguishes true empowerment from mere technocratic training.

Limited Access and Frequency of Training

Limited access and frequency of Posyandu cadre training is a significant challenge in efforts to improve the quality of public health services. Uneven and infrequent training can lead to disparities in knowledge and skills among cadres, which in turn impacts consistency and accuracy in collecting and reporting nutritional data [34], [35] . This study is in line with findings that suggest that unsustainable and non-standardized training can hinder the performance of community health workers in low- and middle-income countries [36] .

In addition, limitations in access to training can also affect cadre motivation and retention. Cadres who feel they do not receive adequate support and capacity development tend to experience decreased work enthusiasm, which can ultimately affect the quality of services they provide [37] . A study conducted by Kok et al., (2016) , showed that ongoing support and adequate training are key factors in maintaining the motivation and performance of community health workers.

Furthermore, limited access to Posyandu cadre training is not solely caused by technical constraints or low individual capacity, but is also greatly influenced by local structural and political dynamics [39] . Interview results show that one of the main obstacles is the issue of training funding. Budget allocation for cadre capacity building activities still depends on government priorities. If training is not considered an urgent need, or is not in line with the agenda of the authorities, then cadres do not get adequate access, even though they play a vital role in the community nutrition information system.

This condition shows that cadre training is not merely a matter of operational technicalities, but also a reflection of village governance and prioritization bias in budgeting. In many cases, decisions about who to train, when training is conducted, and how resources are allocated are decided more based on political relational considerations than on objective data-based needs. This gives rise to inequality in access to training among cadres and has a direct impact on inconsistencies in service quality [40] . The success of cadre-based programs is largely determined by the integrity of the cadre management system, not just by the individual competence of cadres [41] . Thus, increasing cadre capacity cannot be separated from systemic improvements in institutional aspects and local policies that support the sustainability of cadre formation.

In addition to financial constraints, this study also found that the sustainability of cadre formation was disrupted by family mobility factors. Several cadres who had undergone formal training were unable to continue their roles because they had to move following the family's move. This condition caused the loss of trained human resources in the community, created a functional vacuum, and re-emerged the need for retraining for replacement cadres. This

phenomenon reflects that cadre training, if not followed by an adaptive and structured cadre formation preservation strategy, will result in a waste of training investment [42] .

Family mobility as a cause of cadre transfer reflects that the sustainability of cadre formation is not only determined by organizational and policy factors, but is also influenced by the socio-demographic realities inherent in individual cadres [43], [44] . In rural or semi-urban communities, relocation due to economic reasons, spouse's work, or family assignments is a common phenomenon. Hussien et al., (2022) stated that the sustainability of community-based health workers is highly dependent on a retention strategy that considers the dimensions of cadres' personal lives. Training that is not accompanied by a good competency documentation system, or there is no mechanism for tracking and redeploying cadres across regions, then each transfer will create a functional vacuum and cancel the training investment that has been made [46] . Therefore, in the future, a digital-based cadre information system is needed that is integrated between regions as well as regulations for formal recognition of cadre training that applies across administrations, so that the competencies of cadres who move can still be utilized. Thus, retaining cadres does not only mean managing human resources, but also managing the expectations, mobility, and social relations inherent in the lives of cadres as part of their community.

SOP Implementation Mismatch

The research findings show deviations between guidelines and field practices in the implementation of standard operating procedures (SOPs), especially in anthropometric measurement activities and data entry into the e-PPGBM system. This inconsistency is evident in technical aspects such as incorrect body positioning of children when measuring height, to procedural aspects such as inconsistent manual recording and digital entry. This inaccuracy not only risks producing inaccurate data, but also has consequences for the quality of interventions designed based on the data.

Non-conformity in the implementation of SOPs reflects the low level of fidelity of implementation, namely the level of a procedure carried out according to the standards that have been designed [47] . In this context, SOPs act as a form of structured intervention, and fidelity refers to the compliance of cadres in carrying out procedures. Implementation fidelity consists of several important dimensions, including adherence, dose (intensity of implementation), quality of delivery, and participant responsiveness (response and involvement of implementers) as well as Program differentiation. [48] . Based on the findings of this study, deviations in the implementation of SOPs are not only caused by low adherence and quality of implementation, but also by inconsistent frequency of implementation of the procedure as a whole (dose) and minimal reflective involvement of cadres regarding the importance of the procedure (participant responsiveness).

The five dimensions of implementation fidelity can be further explained in the context of anthropometric measurement activities carried out by Posyandu cadres. The adherence dimension is reflected in the cadres' compliance in following each stage in the SOP, such as ensuring that the child stands upright with their feet together and their head pressed against the measuring instrument. In some cases, informants admitted that this procedure was often skipped due to time constraints or because the child was uncooperative. Thus, this indicates a deviation from the standard. The dose dimension shows how often the procedure is carried out in its entirety and completeness in each service session. Field observations show that the implementation of the SOP is often inconsistent, even between cadres in the same location. Meanwhile, the quality of delivery assesses not only whether the procedure is carried out, but also the quality of implementation, the measuring instrument is used correctly, the cadres pay attention to accuracy, and the measurement environment supports the accuracy of the results. The findings of this study show that the quality of implementation is greatly influenced by the cadres' self-confidence and the limitations of the technical training received.

Participant responsiveness refers to the active and reflective involvement of cadres in carrying out their duties. In several interviews, there were indications that cadres tended to carry out tasks mechanically without a deep understanding of the importance of data accuracy, indicating low affective involvement in procedures. The analysis of this fidelity dimension shows that deviations from SOPs do not stand alone, but are the result of complex interactions between technical, psychological, and structural factors that mutually weaken the quality of program implementation at the field level.

Program differentiation indicates an intervention that is clearly differentiated from other similar or pre-existing practices. In the context of e-PPGBM, the findings of this study indicate that many cadres do not fully understand the difference between SOP-based measurements and long-standing local customs. Such as improvised methods of measuring height at home or using non-standardized tools. The lack of clarity in the difference between technical standards and old practices risks creating uncontrolled hybrid implementation. Thus, the fidelity of the implementation of the procedure becomes biased from the early stages. In the absence of affirmation of program differentiation, cadres tend to rationalize violations of procedures as a form of contextual adaptation [49], [50] . This directly reduces the validity and reliability of e-PPGBM data management. Therefore, the integration of program differentiation in cadre training and supervision strategies is very important to ensure that SOPs are not only known, but also explicitly recognized as operational boundaries that distinguish quality standards from non-standard customs.

Technical and Practical Challenges in Executing Tasks

The findings of this study reveal that the technical and practical obstacles faced by Posyandu cadres are multidimensional and interrelated and create complex challenges in implementing e-PPGBM data management. At the technical level, the main problem lies in the mismatch between the measurement infrastructure and the operational context in the field. Three crucial aspects identified include: (1) the availability of anthropometric tools that do not meet WHO standards, such as uncalibrated scales; (2) no standard protocol for tool maintenance and calibration; and (3) tools that are not ergonomic for Posyandu conditions. A comparative study by Rahman et al., (2023) showed that measurement errors due to tool factors contributed up to 38% of the variation in nutritional status data in Southeast Asia. When compared to sub-Saharan Africa, the figure is much higher, at 25%. This is partly associated with disparities in monitoring systems [52] .

Furthermore, technical constraints are not only related to the quality of the tool, but also related to the context of tool use. Although the measuring tools used by cadres have been designed following general technical specifications, the effectiveness of their implementation in the field is still hampered by incompatibility with the physical and logistical conditions of the Posyandu. Observation results show that some height measuring tools are installed on permanent walls as instructed, but they are placed in rooms with minimal lighting, uneven floors, or narrow areas, making it difficult to operate the tool accurately.

The findings of field observations also show that the problem of the quality of e-PPGBM data management cannot be separated from the weak institutional structure that oversees Posyandu cadres. One of the most crucial aspects is the absence of standard standards in the cadre recruitment process. The impact is significant variation in the initial capacity, motivation, and technical readiness of cadres. The absence of regulations or guidelines governing the qualifications and selection process of cadres creates inconsistency in the quality of human resources at the community level [28] . The results of the study also showed that the low intensity of supervision during measurement activities reflects the lack of a quality control system that should be carried out by technical institutions such as Puskesmas or village governments. When cadres carry out measurements without periodic assistance, procedural errors tend to be repeated and uncorrected, which ultimately damages the integrity of the data in e-PPGBM data management.

Another factor that strengthens the cadre inequality is the weakness of systematic capacity building programs. Training is uneven and unsustainable and there is no post-training coaching mechanism that guarantees consistent application of competencies. Within the framework of institutional theory, this phenomenon shows that failure to achieve data standards is not only caused by individual cadre limitations, but is a manifestation of the dysfunction of the cadre governance system [53] . The cause is that the role of local institutions in terms of cadre selection, supervision, and coaching has not been optimally integrated into the e-PPGBM implementation architecture. Therefore, improving data management requires not only technical intervention, but also restructuring of institutional functions in supporting program implementation at the forefront of community-based health services. [54], [55] .

In addition to the limitations of measuring instruments and disproportionate workloads, field observations also show that the cadre role rotation system is not implemented in the implementation of the five Posyandu tables. Each cadre remains in one permanent position, without any role rotation that should encourage cross-functional capacity building, especially at the anthropometric measurement table which is a crucial point in the e-PPGBM system. Research conducted by Wulandari et al., (2022) stated that the absence of a rotation process by cadres was due to the lack of cadre knowledge. The absence of a rotation mechanism not only creates role rigidity , but also increases the inequality of skills between cadres, increases dependence on certain individuals, and hinders the regeneration of collective capacity in the implementation of nutritional recording [57] . The five-table system is explicitly designed to be run in rotation by all cadres, to ensure equal workload and fair distribution of skills [58] .

CONCLUSION

This study shows that the quality of data management in e-PPGBM management is influenced by the interaction between individual cadre limitations and structural weaknesses in the support system. Four main themes related to knowledge capacity, access to training, SOP implementation, and technical barriers represent systemic challenges that hinder data accuracy and consistency at the community level. These findings highlight the importance of a more equitable training approach, strengthening supervision, and improving institutional governance. The success of e-PPGBM management cannot be separated from the integration between increasing cadre capacity and reforming the data management system that is adaptive and responsive to the local context.

Conflict of Interest: The author declares no conflict of interest.

Ethical Considerations: This study has received ethical approval from the Research Ethics Committee of the Faculty of Public Health, Hasanuddin University with the number: 1962/UN4.14.1/TP.01.02/2024. All informants provided written or verbal consent before participating and were guaranteed confidentiality during the research process.

Thank-you note:

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