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EVALUATING THE PERFORMANCE OF ELECTRONIC MEDICAL RECORDS IN MONITORING NUTRITIONAL STATUS AND STUNTING RISKS IN RURAL AREAS USING THE E-PPGBM APPLICATION

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Abstract

Stunting among children under five remains a critical global health concern, particularly in rural areas with limited access to comprehensive health services. The adoption of Electronic Medical Records (EMR), exemplified by the e-PPGBM application used at Public Health Centers (PHCs) in Indonesia, holds substantial promise for improving the monitoring of under-five nutritional status and early identification of stunting risks. Despite its potential, the effectiveness of EMR systems like e-PPGBM in rural PHCs has not been widely assessed. This study evaluates the performance of the e-PPGBM application using the ISO 25010:2011 software quality standard, focusing on six key characteristics: functionality, performance efficiency, usability, security, reliability, and maintainability. A multi-method approach involving black-box testing, scenario testing, stress testing, and usability questionnaires was applied, with responses gathered from 37 PHC personnel. Findings indicate that, while infrastructure and training limitations persist, the e-PPGBM application demonstrates overall effectiveness in tracking nutritional status and detecting stunting risk in Kuningan District, West Java, Indonesia. Notably, the application contributes to improved health service delivery. This study suggests the integration of predictive analytics for stunting risk, based on additional data from local health posts (posyandu), to enhance future usability and performance.

Keywords: e-PPGBM, Electronic medical record, ISO 25010, Stunting, Toddler.

1. Introduction

Stunting is a major public health issue affecting children under five, particularly in developing countries where it is exacerbated by socioeconomic challenges and limited healthcare access. Stunting, characterized by inadequate growth due to chronic malnutrition, frequent infections, and insufficient psychosocial stimulation, results in long-term impacts on cognitive development, educational performance, and overall well-being. Various factors contribute to stunting, including maternal nutrition, infection rates, and sanitation practices, such as access to clean water and proper hand-washing habits, which remain inadequate in many rural areas [1-5].

In Indonesia, significant progress has been made to reduce the prevalence of stunting, with rates decreasing from 27.6% in 2018 to 21.4% in 2023, according to the Indonesian Nutrition Status Study (SSGI) [6]. However, stunting rates in some regions, such as Kuningan Regency, remain high; in 2021, 5.37% of children under five in this area were reported to be stunted, which equates to approximately 3,665 out of 68,250 toddlers [7].

Effective data management and accurate monitoring of child health metrics at Public Health Centers (PHCs) are crucial to addressing stunting, especially in remote areas [8]. The Indonesian Ministry of Health has recognized the importance of Electronic Medical Records (EMR) in improving health data quality and accessibility. As part of its Strategic Plan, the ministry has promoted EMR adoption with a gradual implementation strategy across health facilities. By 2021, the proportion of hospitals using EMR rose from 12.87% in 2020 to 21.39%, demonstrating progress but also indicating room for further expansion and optimization in primary care settings, particularly rural PHCs [9].

In Kuningan District, the EMR-based e-PPGBM application has been implemented across 37 PHCs to monitor and record child nutrition data, achieving full implementation across the district. This system plays a central role in optimizing child health monitoring and stunting prevention [10-12]. The performance of the e-PPGBM application must be continuously evaluated to ensure its efficacy and usability, especially in the context of limited resources and technical infrastructure. Although promising, the application still faces performance and feature limitations that could affect its efficacy in supporting the early identification of stunting risks [10-17].

This study seeks to evaluate the performance of the e-PPGBM application using the ISO 25010:2011 quality model, a standard for assessing software systems in terms of eight primary characteristics, such as functionality, performance efficiency, usability, security, reliability, and maintainability [18]. Given the critical role of EMRs in facilitating accurate health data collection and supporting health interventions, it is essential to assess the functionality and user acceptance of e-PPGBM to ensure it meets the practical needs of PHC workers in rural areas.

This study applies quantitative methods to assess six core characteristics of e-PPGBM, using black-box testing, usability questionnaires, and scenario-based testing with healthcare professionals across the district. This analysis aims to provide evidence-based recommendations for enhancing e-PPGBM, contributing to its role in supporting sustainable and responsive healthcare solutions for child health and stunting prevention in rural Indonesia [19-23].

2. Methods

The research used quantitative methods with the ISO/IEC 25010 framework to measure the quality of the RME system based on user experience and blackbox testing of the e-PPGBM system. Testing instruments to measure the quality of software products using blackbox testing. The research procedure is presented in Fig. 1.

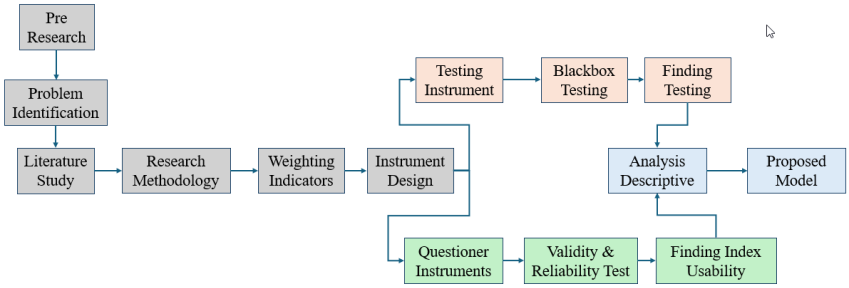


Fig. 1. Research procedure.

3. Results and Discussion

Table 1 summarizes the main functions of the features available in the e-PPGBM application. The home page provides users with access to the features available in the application. Next, tests were conducted on the features of the e-PPGBM application to evaluate its performance. summarizes the main functions of the features available in the e-PPGBM application.

Table 1. Features of the e-PPGBM application.

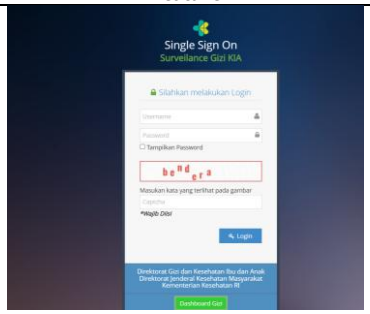
Feature	Function
	Login page of the e-PPGBM application
	- Menu to access information about toddlers such as stunting toddlers, non-stunting toddlers, underweight toddlers, deviant toddlers. - Sidebar, which is used to input toddler data and create data reports.

Table 1(continue). Features of the e-PPGBM application.

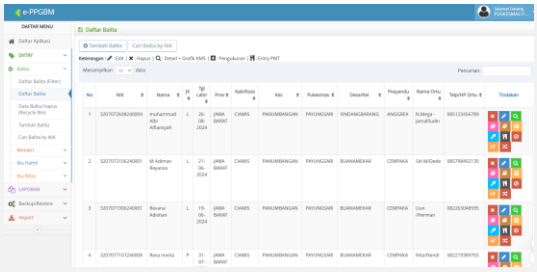
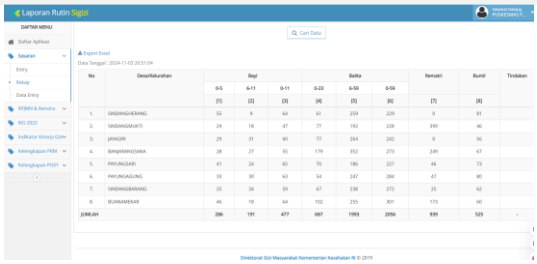
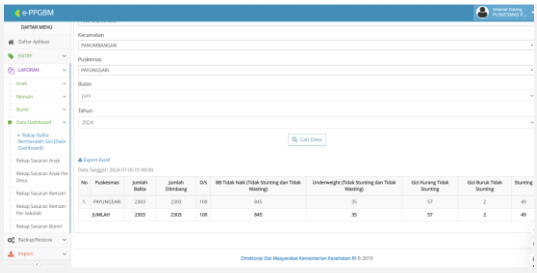
Feature	Function
	- Main Dashboard - Users can access other menus as needed.
	- Displays a list of toddler development information. - Data update: add, delete, and update toddler development.
	- Recap data and routine reporting by Public Health Center or village.
	- Recap menu of problematic toddler data - Users can filter to group data by place, or time.

Table 1 presents the results of testing the e-PPGBM application and Fig. 2 presents the quality measurement results of e-PPGBM applications using ISO. From the test results, Functional Suitability Characteristics obtained a total score of 0.37, followed by Performance Efficiency with a total score of 0.206, Usability which received a score of 0.128, Security with a score of 0.082, Reliability of 0.052, and Maintainability which obtained a score of 0.05. The total test value of the e-PPGBM application obtained a score of 4.513, which is categorized as good. The test results show that most characteristics and sub-characteristics obtained good results, reaffirming the overall good quality of the e-PPGBM application. However, several sub-characteristics, namely Usability, Performance, and Security, get imperfect

scores. Therefore, the results of this test can be used to assess the quality of the e-PPGBM application. The weight calculation results can be seen in Table 2.

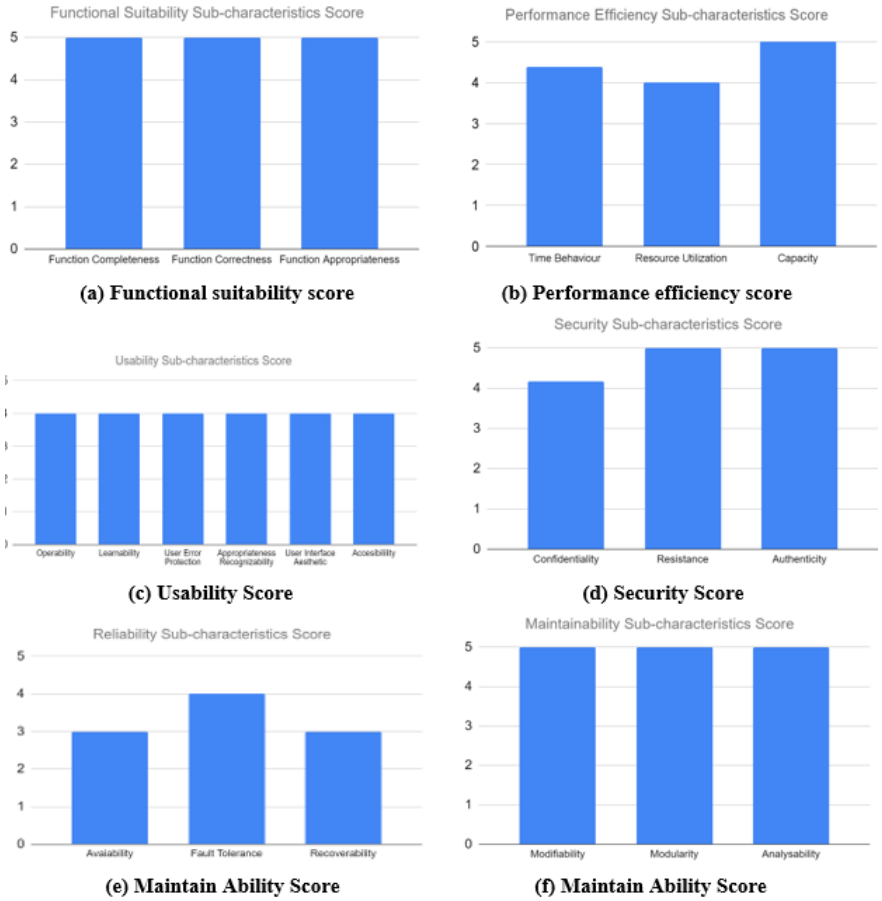


Fig. 2. Quality measurement results of e-PPGBM applications using ISO.

Table 2. Weight calculation results.

Characteristics	Weight	Sub-characteristics	Weight Sub-Characteristics	Result of Sub-Characteristics	Weight Results
Functional Suitability	37.0%	Function Completeness	16.0%	0.16	0.37
		Function Correctness	11.0%	0.110	
		Function Appropriateness	10.0%	0.100	
Performance Efficiency	25.0%	Time Behavior	12.0%	0.105	0.221
		Resource Utilization	7.0%	0.056	
		Capacity	6.0%	0.060	
Usability	16.0%	Operability	3.0%	0.024	0.128
		Learnability	2.0%	0.016	
		User Error Protection	3.5%	0.028	
		Appropriateness Recognizability	2.0%	0.016	
		User Interface Aesthetic	2.0%	0.016	
		Accessibility	3.5%	0.028	

Table 2(continue). Weight calculation results.

Characteristics	Weight	Sub-characteristics	Weight Sub-Characteristics	Result of Sub-Characteristics	Weight Results
		Confidentiality	5.0%	0.042	
Security	9.0%	Resistance	2.0%	0.020	0.082
		Authenticity	2.0%	0.020	
		Availability	4.0%	0.024	
Reliability	8.0%	Fault Tolerance	2.0%	0.016	0.052
		Recoverability	2.0%	0.012	
		Modifiability	2.0%	0.020	
Maintainability	5.0%	Modularity	2.0%	0.020	0.050
		Analyzability	1.0%	0.010	
Total	100%		100.0%	0.903	0.903
TOTAL					**4.513**

4. Conclusions

The assessment model applied has been a success in evaluating the e-PPGBM application. The application was assessed based on six main characteristics: Functional Suitability, Performance Efficiency, Usability, Reliability, Security, and Maintainability, which includes 26 sub-characteristics. The weighting shows that Functional Suitability has the highest weight, followed by the other characteristics. The results show that Functional Suitability and Reliability scored very well, while Usability and Performance Efficiency showed positive results, but there is still potential for improvement.

References

1. Laksono, A.D.; Wulandari, R.D.; Amaliah, N.; and Wisnuwardani, R.W. (2022). Stunting among children under two years in Indonesia: Does maternal education matter? *PLoS One*, 17(7), e0271509.
2. Khusuma, A.I.H.; Yudhastuti, R.; and Nata, J.H. (2023). Penyuluhan stunting dan kegiatan posyandu sebagai upaya peningkatan kewaspadaan ibu terhadap bahaya gizi buruk. *JMM* (*Jurnal Masyarakat Mandiri*), 7(3), 2849-2856.
3. Parinduri, N.C. (2022). Cegah stunting dan gizi buruk pada balita dengan edukasi gizi bagi tumbuh kembang anak di Puskesmas Batahan Kabupaten Mandailing Natal Tahun 2022. *Jurnal Kesehatan Ilmiah Indonesia*, 7(1), 216-221.
4. Scheffler, C.; Hermanussen, M.; Bogin, B.; Liana, D.S.; Taolin, F.; Cempaka, P.M.V.P.; and Pulungan, A. (2020). Stunting is not a synonym of malnutrition. *European Journal of Clinical Nutrition*, 74(3), 377-386.
5. Fadjriah, R.N.; Rusdianto, R.; Herman, H.; and Vidyanto, V. (2021). Factors associated with the stunting in toddlers in the work area of Tikson Raya public health center. *Open Access Macedonian Journal of Medical Sciences*, 9, 1207-1212.
6. Sinaga, H.T.; and Simbolon, I.T.J. (2023). Using anthropometric indices to assess change in the nutritional status of a population: A case study from Samosir District, Indonesia. *Jurnal Penelitian Pendidikan IPA*, 9(SpecialIssue), 171-177.
7. Hermansyah, A. (2023). Tentang stunting dan pola konsumsi: Sebuah catatan dari Kabupaten Kuningan. Retrieved July 15, 2024, from https://kumparan.com/asep-hermansyah-1615698905303716899/tentang-stunting-dan-pola-konsumsi-sebuah-catatan-dari-kabupaten-kuningan-1zmUZRzWkq7.

8. Harahap, S. (2023). Implementation of information technology in increasing the effectiveness of recording and reporting the nutritional status of stunted toddlers at community health centers. *International Journal of Computer Sciences and Mathematics Engineering*, 2(2), 131-140.
9. Kapitan, R.; Farich, A.; and Perdana, A.A. (2023). Analisis kesiapan penerapan rekam medis elektronik RSUD Bandar Negara Husada Provinsi Lampung Tahun 2023. *Jurnal Kebijakan Kesehatan Indonesia*, 12(4), 205.
10. Alfiansyah, G.; Fajeri, A.S.; Santi, M.W.; and Swari, S.J. (2020). Evaluasi kepuasan pengguna electronic health record (EHR) menggunakan metode EUCS di unit rekam medis Pusat RSUPN Dr. Cipto Mangunkusumo. *Jurnal Penelitian Kesehatan* "*SUARA FORIKES*", 11(3), 258-263.
11. Herwati, I.; Ayu, J.P.; and Mustafida, L. (2023). User satisfaction analysis of hospital management information system using the EUCS method at Mitra Delima Hospital. *Jurnal Manajemen Kesehatan Indonesia*, 11(3), 260-268.
12. Nurhayati, N.; Noor, H.L.; Qurrotaayun, Z.; and Fajarwati, R.N. (2023). Digitalisasi pencatatan data rekam medis balita dan upaya pencegahan stunting. *Surya Abdimas*, 7(1), 156-166.
13. Setyowati, M.; and Ardi, M.F. (2017). Pengelolaan data pelayanan kesehatan ibu dan anak bagian gizi balita di puskesmas berbasis android mobile untuk mendukung pencapaian sustainable development goals (SDG's). Retrieved July 18, 2024, from https://publikasiilmiah.ums.ac.id/bitstream/handle/11617/8968/kesmas_2017_5.pdf?sequence=1&isAllowed=y.
14. Asmawati, A.; Marianah, M.; Ihromi, S.; Sari, D.A.; and Nurhayati, N. (2022). Edukasi pemanfaatan daun kelor sebagai alternatif pencegahan gizi buruk dan stunting pada ibu-ibu rumah tangga di Desa Selat Kabupaten Lombok Barat. *JMM* (*Jurnal Masyarakat Mandiri*), 6(2), 1402-1410.
15. Christy, J.; Sari, N.; and Khairani, K. (2023). Penyuluhan tentang pencegahan stunting dan gizi buruk di Desa Tombang Bustak, Kabupaten Mandailing Natal. *Zadama: Jurnal Pengabdian Masyarakat*, 2(1), 8-12.
16. Saputra, M.G.; Munaa, N.; Anggraini, Y.; Ummah, F.; Rahmawati, N.V.; Kusdiyana, A.; and Nuryati, N. (2023). Evaluasi implementasi sistem informasi manajemen rumah sakit dengan metode HOT-Fit di RSU Muhammadiyah Babat. *J-REMI: Jurnal Rekam Medik dan Informasi Kesehatan*, 4(4), 248-256.
17. Wibowo, S.S.; and Chuvita, L. (2023). Perancangan rekam kesehatan personal (RKP) untuk deteksi dini cegah stunting pada balita di posyandu. *Jurnal Endurance*, 8(1), 1-8.
18. Tangkudung, I.; Dako, R.D.R.; and Dako, A.Y. (2019). Evaluasi website menggunakan metode ISO/IEC 25010. *Seminar Nasional Teknologi*, 1(1), 87-107.
19. Elwan, M.L.O.; Rahman, R.; and Fitri Cahyani, E. (2022). Implementasi program penanggulangan pravelansi stunting anak balita pada Dinas Kesehatan Kabupaten Konawe. *Journal Publicuho*, 5(2), 289-303.
20. Soliman, A.; De Sanctis, V.; Alaaraj, N.; Ahmed, S.; Alyafei, F.; Hamed, N.; and Soliman, N. (2021). Early and long-term consequences of nutritional stunting: From childhood to adulthood. *Acta Bio Medica*: *Atenei Parmensis*, 92(1), e2021168.

21. Rahmadhita, K. (2020). Permasalahan stunting dan pencegahannya. *Jurnal Ilmiah Kesehatan Sandi Husada*, 9(1), 225-229.
22. Mustakim, M.R.D.; Irawan, R.; Irmawati, M.; and Setyoboedi, B. (2022). Impact of stunting on development of children between 1-3 years of age. *Ethiopian Journal of Health Sciences*, 32(3), 569-578.
23. Moja, L.; Kwag, K.H.; Lytras, T.; Bertizzolo, L.; Brandt, L.; Pecoraro, V.; and Bonovas, S. (2014). Effectiveness of computerized decision support systems linked to electronic health records: A systematic review and meta-analysis. *American Journal of Public Health*, 104(12), e12-e22.