

ANALYSIS OF STORAGE MEDIA CAPACITY REQUIREMENTS FOR ELECTRONIC MEDICAL RECORDS FOR THE NEXT 5 YEARS

Nurhayati Hartono¹, Niska Salsiani Sinta^{2*}, Selvi Mayang Sari³

¹²³Politeknik Baubau, Kota Baubau, Indonesia

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CORRESPONDING AUTHOR

Nama : Niska Salsiani Sinta

Address: Jl. Dr Wahidin, Kel Lamangga, Kec Murhum, Kota Baubau

Email : niskasalsiani@gmail.com

A B S T R A C T

Electronic Medical Records (EMR) are an important component in providing health services because they generate digital data in continuously increasing amounts. The growth in data volume requires storage media capacity planning to ensure data availability remains guaranteed and health services can run continuously. This study aims to analyze the storage media capacity requirements for EMR over the next five years at BLUD RSUD Kabupaten Buton. The study uses a quantitative descriptive method with observation and documentation approaches. The analyzed data include the number of patient visits and the EMR storage volume for 2023-2026. Projections of storage capacity requirements are carried out using the Least Square method. The research results show that the number of patient visits in 2023 was 16.863 visits, in 2024 was 18.882 visits, in 2025 was 25.720 visits, while in 2026 was 4.927 visits up to March. The EMR data volume in 2023 was 21,4 GB, in 2024 was 23,7 GB, in 2025 was 25,9 GB, and in 2026 was 23,0 GB up to March, with a total usage of 94,0 GB. The projection results indicate storage requirements of 25,25 GB in 2027, 25,95 GB in 2028, 26,65 GB in 2029, 27,35 GB in 2030, and 28,05 GB in 2031. Thus, the accumulated projected storage requirement through 2031 reaches 227,25 GB. Hospitals need to periodically monitor capacity, provide backup systems, and gradually develop storage capacity according to data growth..

INTRODUCTION

The implementation of electronic medical records (EMR) in Indonesia has been regulated in the Ministerial Regulation of the Republic of Indonesia Ministry of Health Number 24 of 2022 concerning Medical Records, which mandates all healthcare service facilities to implement electronic medical records. Electronic Medical Records are a digital system for managing patients' health information, including the processes of recording, storage, processing, and presenting patient data in an integrated manner. The implementation of EMR aims to improve the quality of healthcare services, ensure the security and confidentiality of data, and support efficiency in managing medical information (Permenkes No. 24, 2022).

The growth in the volume of EMR data becomes one of the aspects that needs to be considered in the management of health information systems. The data produced is not only identity data and the patient service history, but can also include the results of laboratory examinations, radiology, scanned result documents, and various other digital information. These types of data have different sizes, so the more services provided, the greater the need for storage media. Therefore, the availability of storage capacity needs to be planned systematically so that limitations of storage do not occur, which could disrupt the continuity of the EMR system.

In addition to capacity, the management of storage media is also related to security, integrity, and the availability of patient data. A storage system that is not properly managed can increase the risk of disruption to data access and healthcare services. Thus, hospitals not only need adequate storage capacity, but also require capacity planning based on historical data growth patterns so that the storage needs in the coming period can be estimated.

Previous research shows that forecasting can be used as one of the approaches in storage capacity planning. Adinda Krida Wicaksono, Teguh Prasetyo, (2023) conducted research on forecasting database server storage utilization using the Holt-Winters and ARIMA methods in an e-government system. The study used historical time series data of storage utilization and showed that the Holt-Winters method produces a smaller RMSE value than ARIMA, making it more accurate for predicting storage capacity needs. The results of the research indicate that forecasting methods can be used as a basis for planning server storage capacity in the future period.

Next, Niska Salsiani Sinta, Felinda. (2025) carried out research on evaluation of the implementation of Electronic Medical Records in outpatient services at BLUD Kota Baubau using the Technology Acceptance Model (TAM). The study showed that the use of EMR can speed up and improve the efficiency of staff work while also providing ease in the service process. These results indicate that the use of EMR in healthcare services is increasingly growing and has become an important part of the process of managing patient information. As the use of EMR becomes more widespread, the need for supporting infrastructure, including adequate storage media, also needs to be considered so that increased system usage does not create obstacles in data management in the future.

More specific research regarding EMR storage media was conducted by Wulandari et al. (2024) at RSUP Nasional Dr. Cipto Mangunkusumo. The study used the Least Square method to predict the storage media capacity needs based on data from scanned medical records. The research results show that the total scanned data during the period September 2022 to March 2023 reached 261.424 MB, while the storage needs predicted for the next 25 years reach approximately 9 TB. The prediction accuracy level using Mean Absolute Percentage Error (MAPE) is 6,34% and falls into the very good category. The study indicates that the Least Square method can be used to help hospitals plan EMR storage capacity needs based on historical data growth patterns.

In addition, Nindia Septa Tiana, Lily Widjaja, Daniel Happy Putra. (2026) in research on RME data infrastructure management explains that the growth of electronic medical record data in healthcare service facilities tends to increase as digital-based healthcare services develop. The use of digital radiology results, CT-Scan and MRI imaging, and scanned result documents become factors that can increase the need for electronic storage media in hospitals. This shows that planning storage infrastructure needs to be implemented by considering the characteristics and growth of data generated by each service unit.

From several previous studies, it can be known that data growth digital requires storage capacity planning that is carried out in a measured way. The study by Adinda Krida Wicaksono, Teguh Prasetyo, (2023) shows the use of forecasting methods to predict storage server needs, while Wulandari et al. (2024) specifically show that the Least Squares method can be used to project media needs. RME storage. Meanwhile, the study by Nindia Septa Tiana, Lily Widjaja, Daniel Happy Putra. (2026) emphasizes that the development of digital data types, especially radiology data and scan results, also affects storage capacity needs. Therefore, research on projecting RME storage capacity is important for every health service facility because the characteristics of data volume and data types produced can differ.

BLUD RSUD Kabupaten Buton has implemented Electronic Medical Records since 2023. and its use has covered all service units, although its implementation is still hybrid with manual medical records. The system used is SIM GOS with storage media in the form of seven local servers each with a capacity of 2 TB. Based on initial observations, data backup is still done manually and not automatically scheduled. In addition, the radiology unit becomes one of the largest data contributors because it generates files of relatively large size. Although the storage capacity available at this time is still sufficient, the hospital does not yet have long-term storage capacity planning.

This condition indicates a need to analyze growth of RME data volume and estimate storage capacity needs in the coming years. Planning based only on current available capacity is not enough to ensure infrastructure readiness to face data growth sustainably. Therefore, a method that can be used to project storage needs based on historical data is required.

One method that can be used is the Least Squares method. This method is an time-series approach used to determine the pattern of tendency or trend based on historical data and produce a trend line equation that can be used to predict values in future periods. In the context of this study, the Least Squares method is used to analyze the growth of RME data volume and project storage media capacity needs for the next five years.

Based on the above, this study was conducted to analyze capacity needs storage media for Electronic Medical Records for the next five years at BLUD RSUD Kabupaten Buton. This study analyzes patient visit numbers and RME data volume growth based on historical data from 2023-2026, then projects storage capacity needs for 2027-2031 using the Least Squares method. The results are expected to inform the hospital in planning and development. RME storage infrastructure in a sustainable manner.

METHODOLOGY

This study uses a descriptive quantitative method with a time-series approach. The study is conducted to describe the growth in patient visits and Electronic Medical Record (EMR) data volume, then project the storage media capacity needs for EMR for the next five years. The historical data used in this study are from 2023-2026.

The research was conducted at BLUD RSUD Kabupaten Buton. The research object is the use of Electronic Medical Record data storage media and the growth of RME data volume stored on hospital servers.

The population in this study is all Electronic Medical Records stored on storage media at BLUD RSUD Kabupaten Buton.

The sample comprises RME storage volume data and the number of patient visits from 2023-2026 that are available and obtainable during the study.

Data analysis is performed quantitatively by examining the growth of RME data volume based on historical data from 2023-2026. Subsequently, the projection of storage media capacity needs is conducted. storage for the years 2027-2031 using the Least Square method. The Least Square method is used to determine the tendency or trend from historical data so that it can be used to estimate values in future periods.

RESULTS & DISCUSSION

A. Number of Patient Visits

Based on the results of documentation of service data at BLUD RSUD Kabupaten Buton, obtained data on the number of patient visits including outpatient care, Emergency Unit (UGD), and inpatient care during 2023-2026. The data for 2023-2025 are for a full year, while the data for 2026 only covers the period January-March 2026. Results of data collection are presented in the following table:

Tabel 1. Number of Patient Visits 2023-2026

Tahun	Periode	Rawat Jalan	UGD	Rawat Inap	Total Kunjungan
2023	Januari-Desember	10.246	3.548	3.069	16.863
2024	Januari-Desember	10.485	4.431	3.966	18.882
2025	Januari-Desember	16.731	4.658	4.331	25.720
2026	Januari-Maret	2.736	1.133	1.058	4.927
Total		40.198	13.770	12.424	66.392

Source: Secondary data BLUD RSUD Kabupaten Buton, processed 2026

Based on the table above, the number of patient visits at BLUD RSUD Kabupaten Buton experienced an increase from 2023 to 2025. Total visits increased from 16,863 visits in 2023 to 18,882 visits in 2024, then rose again to 25,720 visits in 2025. The increase indicates higher health service activity that could generate a larger volume of electronic medical record data.

In 2026, the number of visits recorded was 4,927 visits, consisting of of 2,736 outpatient visits, 1,133 emergency department visits, and 1,058 inpatient visits. However, these data only cover January-March, so they cannot be directly compared with annual visit totals of previous years. 2026 data remains used as part of historical data because it is the data available at the time of the study.

The study results show that the number of patient visits at BLUD RSUD Kabupaten Buton experienced an increase from 16,863 visits in 2023 to 18,882 visits in 2024 and 25,720 visits in 2025. The increase in service activity indicates that more services are provided, and more health information must be recorded and stored in the RME system.

Each patient service generates various types of data, including patient identity, examinations, diagnoses, procedures, therapies, laboratory results, radiology, and administrative documents. Thus, the increase in visits can be an important indicator in estimating the growth in data volume that the hospital must manage.

These findings align with the study by Wulandari et al. (2024) which describes conducting research on predicting RME storage capacity at RSUP Nasional Dr. Cipto Mangunkusumo. The study shows that an increase in visits and digitization of health services is related to increased RME data volume, necessitating storage capacity planning for the future.

These study results also align with the research by Novita et al. (2022) which stated that an increase in patient numbers affects the need for medical record storage space. In the context of BLUD RSUD Kabupaten Buton, the rise in patient visits becomes an important indicator in preparing storage capacity for the media for sustainable RME storage.

Research by Siti Kamila. (2023) on cloud computing as a storage solution health data emphasizes the importance of efficiency and security in health data management. The study is related to this research as both address health data storage, but Kamila's study emphasizes the conceptual cloud computing approach, while this study uses hospital empirical data to analyze storage capacity needs.

Penelitian Turgay & Özç. (2023) study on data-driven approaches in planning and management of hospital capacity also shows the importance of using data and predictive models as the basis for decision making regarding capacity of service resources. Although the study focuses on hospital capacity more broadly, the data-driven capacity planning concept is relevant. to be applied to the management of RME storage capacity.

However, the relationship between the number of visits and storage volume is not always linear. linear directly. This is evident in the study data, where the data volume for 2026 is 23.0 GB, lower than 2025's 25.9 GB, although the number of visits in 2026 available is still 4,927 visits. This condition is mainly influenced by the observation period differences, as 2026 data only covers January-March. Therefore, 2026 data cannot be used to conclude a permanent decline in RME data growth.

B. Storage Media Capacity Condition

Monitoring results of storage media on the BLUD RSUD Kabupaten server Buton shows the server has a capacity of 2.0 TB. At the time of the study, 94 GB had been used, while about 1.9 TB was still available.

Tabel 2. Server Storage Capacity Condition

Komponen	Kapasitas
Kapasitas total	2,0 TB
Kapasitas terpakai	94 GB
Kapasitas tersedia	1,9 TB
Persentase penggunaan	5%

Source: Monitoring of the BLUD RSUD Kabupaten Buton server, 2026.

Based on the table above, storage media usage during the study is still relatively low, about 5% of total capacity. With a capacity of 2.0 TB and usage around 94 GB, the server still has about 1.9 TB of storage space. This condition indicates that in terms of actual capacity, the storage media is still sufficient to store RME data during the study.

Nevertheless, the remaining available capacity cannot be used as the sole basis to state that storage will be sufficient in the long term. RME data growth will continue along with increasing service activity, so capacity planning based on historical data growth trends is needed.

Study results show that the RME data volume increased from 21.4 GB in the year 2023 to 23.7 GB in 2024 and 25.9 GB in 2025. This pattern indicates that the RME implementation yields a continuously accumulating digital data. Although there is a volume decline in 2026, this condition has not yet shown a trend change because data available only up to March 2026.

RME data growth can be influenced by various factors, such as the number of patient visits, service type, examination frequency, use of medical imaging, and scanned document results. Data from units generating large files can contribute more to storage needs than administrative data or plain text.

This aligns with the study by Nindia Septa Tiana, Lily Widjaja, Daniel Happy Putra. (2026) on managing electronic medical record data infrastructure. It is explained that the development of digital health service technology can causing large data growth, mainly from the use of digital radiology, CTScan, MRI, and scanning results documents.

Research by Nindia Septa Tiana, Lily Widjaja, Daniel Happy Putra. (2026) also highlights the importance of considering the ongoing digitization of healthcare services when planning storage needs. The more service processes and information are documented electronically, the greater the need for storage media capable of accommodating data growth.

This reinforces the need for storage capacity planning to be conducted on an ongoing basis and not solely based on currently available capacity.

Findings of this study are also supported by Wulandari et al. (2024) research that shows that electronic medical record (EMR) scanning data is increasing and ultimately requires larger storage capacity. The study shows that storage needs should be calculated based on data growth accurately so that hospitals can prepare storage infrastructure properly.

Thus, although the use of BLUD RSUD Kabupaten Buton storage is currently only about 5%, this condition should be monitored periodically. The large capacity at present does not mean storage needs will stay low in the future, especially if RME usage expands and the types of stored digital data become more diverse.

C. Growth of Electronic Medical Record Data Volume

Measurements of EMR data volume show changes in data volume during the study period. EMR data volume for 2023-2026 is presented in the table below this:

Tabel 3. RME Data Volume Growth 2023-2026

Tahun	Volume Data Terpakai (GB)	Pertumbuhan Tahunan (GB)
2023	21,4	–
2024	23,7	2,3
2025	25,9	2,2
2026	23	-2,9
Total	94	Rata-rata 0,53

Source: EMR data BLUD RSUD Kabupaten Buton, processed 2026.

Based on the table above, the EMR data volume in 2023 was 21.4 GB, increasing to 23.7 GB in 2024, and rising again to 25.9 GB in 2025. Meanwhile, the 2026 data volume was recorded at 23.0 GB for January-March. The total data volume recorded during the observation period is 94.0 GB.

Data volume growth shows a fluctuating pattern. In 2024, there was an increase of 2.3 GB and in 2025 an increase of 2.2 GB. Meanwhile, in 2026 there was a decrease of 2.9 GB. This decrease should be interpreted carefully because 2026 data only cover the first three months, not the full January-December period.

Results of analysis using the Least Squares method show a trend of increasing EMR data volume from 25.25 GB in 2027 to 28.05 GB in 2031. The cumulative data volume is projected to reach 227.25 GB by the end of 2031. This result shows that the Least Squares method can be used to provide storage needs estimates based on historical data patterns available.

These findings are consistent with Wulandari et al. (2024) which also used the Least Squares method to predict RME storage needs. In that study, scanning data for EMR from September 2022-March 2023 reached 261,424 MB and were projected to require storage capacity of about ± 9 TB for a 25-year period. The prediction accuracy reported via MAPE was 6.34% and categorized as very good.

The similarity of the two studies lies in using historical data as a basis for estimating future storage needs. The differences lie in data characteristics, projection period, and the conditions of each hospital. The study by Wulandari et al. uses EMR scanning data as the forecasting basis, while research at BLUD RSUD Kabupaten Buton uses RME data volume available during 2023-2026.

In addition, the study by Adinda Krida Wicaksono, Teguh Prasetyo, (2023) uses a time series forecasting approach to predicting storage server database utilization by comparing Holt-Winters and ARIMA methods. The study results show that Holt-Winters yields a lower RMSE value compared to ARIMA, thus it is considered more accurate in predicting storage needs.

The difference in these methods shows that the choice of forecasting method can be adjusted to the characteristics of the available data. The study by Adinda Krida Wicaksono,

Teguh Prasetyo, (2023) uses monthly data and compares two forecasting methods, whereas this study uses annual data and the Least Squares method. In the BLUD RSUD Kabupaten Buton study, Least Squares is used to obtain a linear trend in data volume based on the available historical data.

D. Projection of RME Storage Capacity Needs for 2027-2031

The value 23.5 represents the average RME data volume during the observation period, while 0.35 is the trend coefficient indicating the tendency of data volume changes based on the time period. The projected storage needs for the next five years are shown in the table below:

Tabel 4. Projected Storage Capacity Requirements for EMR (2027-2031)

Tahun	X	Prediksi Volume Data Tahunan (GB)	Akumulasi Total Data Terpakai (GB)
2027	5	25,25	119,25
2028	7	25,95	145,2
2029	9	26,65	171,85
2030	11	27,35	199,2
2031	13	28,05	227,25

Source: Results of Least Squares analysis, 2026.

Based on the table above, the RME data volume is projected to 25.25 GB in year 2027, increasing to 25.95 GB in 2028, 26.65 GB in 2029, 27.35 GB in 2030, and reaching 28.05 GB in 2031. Thus, the accumulated projected data volume up to 2031 reaches 227.25 GB.

The result shows a tendency for increasing storage needs storage year over year. Although the current server capacity of 2.0 TB is still much larger than the projected accumulation of 227.25 GB, capacity planning is still necessary because hospital storage needs are not only influenced by main RME data, but may also include medical imaging data, scanning results, backups, applications, and other data management needs.

Based on the projection results, the accumulated RME data volume through 2031 is expected to reach 227.25 GB. Compared to the current server capacity of 2.0 TB, mathematically this capacity is still larger than the projected data needs. Thus, based on the RME data analyzed in this study, there is no indication of storage capacity shortage through 2031.

However, the result does not mean that the hospital does not need storage planning. Capacity planning needs to consider other data that may use storage space, such as radiology data, laboratory data, scanning result documents, backups, operating systems, applications, and needs for redundancy and data security.

Therefore, long-term storage capacity needs should not only be determined based on the accumulation of 227.25 GB, but also consider backup needs and growth of other digital data types. The hospital should monitor storage usage regularly so that capacity additions can be performed before storage space becomes limited.

The findings of a study by Sinha & Mondal. (2024) show that forecasting techniques can be used to help predict future medical record storage needs. Such forecasts can serve as the basis for storage capacity planning, enabling organizations not only to add storage when capacity is nearly full but also to plan ahead based on data growth trends.

Overall, the results of the study show that the current storage condition is adequate, but the need for long-term capacity planning remains. This planning is important to maintain the continuity of RME administration, anticipate increased data volumes, and ensure medical data remains available, secure, and accessible when needed.

CONCLUSION

Based on the results of a study analyzing the storage capacity needs for Electronic Medical Records (EMR) over the next five years at the Buton Regency General Hospital (BLUD RSUD), it can be concluded that:

The number of patient visits at the Buton Regency General Hospital (BLUD RSUD) increased during the 2023-2025 period, rising from 16,863 visits in 2023 to 18,882 visits in 2024 and 25,720 visits in 2025. In 2026, there were 4,927 visits recorded for the January-March period. This increase in

service activity indicates a potential increase in the amount of data generated and stored in the RME system.

At the time of the study, storage capacity was still sufficient. The server had a capacity of 2.0 TB, with approximately 94 GB (5%) in use and approximately 1.9 TB of remaining capacity. Although the current capacity is still adequate, the growth of RME data and increased service activity require ongoing monitoring and capacity planning.

RME data volume has shown fluctuating growth. Data volume was recorded at 21.4 GB in 2023, increasing to 23.7 GB in 2024 and 25.9 GB in 2025. In 2026, 23.0 GB was recorded for the January-March period, with a total data volume of 94.0 GB during the observation period. The decrease in 2026 should be understood in light of the fact that the available data does not yet cover a full year.

Forecasting results using the time series method with the least squares approach indicate that the RME data volume is projected to be 25.25 GB in 2027, 25.95 GB in 2028, 26.65 GB in 2029, 27.35 GB in 2030, and 28.05 GB in 2031. The projected cumulative data volume through 2031 is 227.25 GB. Based on these results, a storage capacity of 2.0 TB is mathematically sufficient to accommodate the projected RME data volume through 2031.

Long-term storage capacity planning remains necessary, even though projections indicate that available capacity is still sufficient. Planning must take into account the growth of RME data, radiology and laboratory data-which have relatively large file sizes-scanned documents, backup requirements, and the evolution of the hospital's information systems. Therefore, regular monitoring of storage capacity and the development of an automated, scheduled backup system are necessary to ensure the security, availability, and continuity of RME data.

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