

# EFFECTIVENESS OF MATERIAL USING CT SCAN AND MRI AFTER USE OF PICTURE ARCHIVING AND COMMUNICATING SYSTEM AND RADIOLOGY INFORMATION SYSTEM AT RADIOLOGICAL INSTALLATION OF BUKITTINGGI NATIONAL HOSPITAL, WEST SUMATRA

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## ABSTRACT

**Background:** Efficiency while paying attention to service quality is the top priority of the hospital. The efficiency in radiology installations has also not gone unnoticed. The implementation of Picture Archiving and Commucating System (PACS) and Radiology Information System (RIS) is one of the efforts to control costs in radiology installations, especially in consumables' efficiency (BHP). Bukittinggi National Stroke Hospital (RSSN), as one of the vertical hospitals located in the City of Bukittinggi, West Sumatra, has become a precursor to PACS implementation RIS in this province. This study aimed to determine the effect of material using ct scan and mri after using picture archiving and communicating system and radiology information system at radiological installation of Bukittinggi national hospital, West Sumatra.

**Subjects and Method:** This was a descriptive study conducted at Radiological Installation of Bukittinggi National Hospital, West Sumatra from July 2020. The data were collected by observation and monthly report data.

**Results:** The results of the analysis of PACS and RIS's use had a significant impact on the cost efficiency of BHP CT scans and MRIs in the RSSN radiology installation reaching 97.9%.

**Conclusion:** Transfer of CT scan and MRI results from film to DVD-R for internal RSSN patients with considerable efficiency.

**Keyword:** PACS, RIS, cost control, BHP

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## BACKGROUND

Picture Archiving and Communicating Systems (PACS) is a computerized technology system that contributes to creating, distributing, and storing digital imaging (Kolowitz, 2012). As an automated system in radiology installations and radiological image-based medical clinical practice, PACS is an integrated part of the hospital information system (Setyawan and Supriatna, 2016). PACS in hospitals has grown in recent years due to the

development of radiology technology and an increase in the quality of efficient and integrated health services (Hakam, 2008). If used and possible, PACS can improve patient care quality and contribute to cost control (Wooldridge, 2008).

PACS is designed to store and display images imaging from various modalities such as conventional X-Ray, Computed Tomography (CT) and Magnetic Resonance Image (MRI) (Wooldridge, 2008). PACS components usually consist of modalities

digital imaging, diagnostic offices, software storage and hospital information systems (SIRS) (Obertson and Averaid, 2008). Radiology installations since 1960 have pioneered the use of hospital electronic systems as part of a clinical diagnostic workflow to assist the reporting system (Parwitasari, 2016; Setyawan and Supriatna, 2016). The development of an electronic radiology installation system has continued to develop along with the development of digital radiology and PACS in the 1970s and its implementation in the 1980s (Alhajeri and Clarke, 2016).

Radiology Information System (RIS) or Radiology Information System is a radiology patient data management system which includes patient personal data (demographic, financial, spiritual) and patient diagnostic data (examination schedule, type of examination, examination results) (Setyawan and Supriatna, 2016). PACS and RIS's relationship is the most important, interrelated and inseparable relationship in the radiology diagnostic imaging service. PACS and RIS cannot functionally stand alone without support from the Hospital Information System (SIRS) (L, Adi and Suryawati, 2019).

Efficiency in health services is related to the quality of health services. The principle of cost control and efficiency is to reduce unnecessary health care costs in hospitals. This cost control can be done by carrying out innovations in health services, including the use of PACS and RIS in radiology installations (Parwitasari, 2016).

Bukittinggi National Stroke Hospital, which was established in 2008, for the first time using PACS as an integrated system in services since October 2019. Stroke Hospital can also be said to be a pioneer in implementing this system in West Sumatra Province. This is due to the demand to

improve the quality of community services, especially the quality of medical support services, namely radiology installations, which are listed in the Minister of Health Regulation No. 1014 of 2008.

Regarding the commencement of PACS and RIS's use in the radiology installation of RSSN, based on the radiology installation recommendation, the President Director issued a policy regarding the results of radiological examination. In all related facilities, namely IGD, inpatient, outpatient, operating room, ICU, HCU using the RIS concept, the radiological examination results can be seen directly in the room using the existing computer. Besides, the results of internal MRI and CT scans that the patient will carry are replaced from film to DVD-R, impacting cost control. To see the extent of cost control, researchers wrote this article to determine how much cost control is due to PACS and RIS's use in RSSN radiology installations.

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## **SUBJECTS AND METHOD**

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### **1. Study Design**

This descriptive study was conducted at Radiological Installation of Bukittinggi National Hospital, West Sumatra from July 2020.

### **2. Population and sample**

This study's population was related to BHP's funds in the use of radiological modalities in internal patients at Bukittinggi National Stroke Hospital. With The number of samples used was 665 examinations.

### **3. Data Instruments**

Data were taken from monthly reports regarding BHP for CT scans and MRI by direct observation.

## RESULTS

With the policy of switching from film to DVD-R for MRI and CT scan, a comparison of costs was made. For the price of 14 x 17 colonic film, it costs Rp. 70,895 and a large envelope of Rp. 8,800, -. While the price for 1 DVD-R is Rp. 1500, - and the CD envelope

price is Rp. 1000, -. Based on the Standard Operating Procedure (SPO) in the RSSN radiology installation for 1 head MRI examination, 6 films are required, 4 films of MRI of the spine and shoulders, 1 head CT scan, 3 films of abdominal and thoracic CT scans.

**Table 1. Film and DVD-R Cost Analysis**

No	Type of Examination	Amount (n=665)	Cost calculated without using PACS and RIS (IDR)		The cost incurred after using PACS and RIS (IDR)	
			Film	Large envelope	DVD-R	Envelope CD
1	MRI Head	23	9,783,510	202,400	34,500	23,000
2	MRI Spine	78	22,119,240	863,400	117,000	78,000
3	Shoulder MRI	1	238,580	35,200	1,500	1,000
4	CT SCAN Head	524	37,148,980	4,611,200	786,000	524,000
5	CT Abdomen	13	2,764,905	43,200	24,500	13,000
6	CT scan Chest	26	5,529,810	686,400	39,000	26,000
<b>Amount</b>		665	77,585,025	2,130,600	1,002,500	665,000
<b>Total</b>			79,715,625		1,667,500	

## DISCUSSION

Based on the data above, the highest number of examinations in July were head CT scans totalling 524 examinations. The spine's MRI has 78 studies, 26 chest CT scans, 23 head MRI examinations, 13 abdominal CT scans, and at least 1 shoulder MRI examination.

From the table above, it can be concluded that by replacing CT scan and MRI results from film to DVD-R in internal patients, there is a significant reduction in costs. If you still use film, the costs incurred for film and envelope only reach Rp. 79,715,625. It can be seen that the difference in costs is in stark contrast to if the results are transferred to DVD-R, which is Rp. 1,667,500. In patients with internal efficiency, DVD-R on CT scans and MRI examinations reached 97.9% in July 2020.

Bukittinggi National Stroke Hospital is one of the type B hospitals in Bukittinggi, West Sumatra, which has complete diagnostic tool facilities with advanced technology. Sophisticated and radiological installation patient visits which have increased every year. In the last two years, the number of radiological examinations was in years 2018 a total of 8,882. In the year 2019, as many as 10,858 with an average number of inquiries increasing by 18.19%. The highest number of examinations was CT examinations totalling 6,769 examinations, especially CT Brain counting 6,031 reviews and this was related to the specificity of hospitals with stroke-related brain disease (Bukittinggi National Stroke Hospital, 2019).

The number of CT scans that are increasing every year. The efficiency of transferring the examination results from film to DVD-R has a very significant impact. The cost of both cinema and DVD-R is periodic, that is, it recurs every year, while most of the PACS prices are capital which is incurred at the time of purchase. For maintenance, RSSN also does not incur additional costs because the internal SIRS team can do it.

As previously mentioned, implementing the information technology system in the Radiology Installation of the Bukittinggi National Stroke Hospital began at the end of 2019, precisely in October 2019, using PACS. The decision to use PACS in the Radiology Installation of the Bukittinggi National Stroke Hospital was due to the doctor's need for imaging readings in diagnosing the patient's condition and also the need for radiology specialists to be able to interpret imaging results from anywhere and at any time and is also associated with the need for quality improvement along with the efficiency of radiology installation services.

Various imaging modalities are available in the Radiology Installation and have been standardized by DICOM to be integrated into PACS easily (Setyawan and Supriatna, 2016). However, modalities cannot be combined with PACS, namely panoramic radiographs and dental radiographs.

In the last 2 years, the Radiology Installation of the Bukittinggi National Stroke Hospital has added several new modalities, namely 1.5T MRI which is expected to speed up the time of the examination which was previously carried out for almost 1.5 hours for 1 MRI examination now only 30 minutes can be done. Of course, the addition of these new

modalities impacts the increasing number of analyses performed by radiology installations in 2019.

These modalities are linked to a workstation in the radiology room and managed by PACS except for panoramic and dental radiographs. PACS functions to control the modalities' input results and then store them on a CD or DVD-R. The printed input results result from conventional radiographic examinations using a small film measuring 10 x 12. For the results of MRI examinations, both internal RSSN patients and partial referrals are given on DVD-R. For the RSSN internal CT scan results in the form of DVD-R, while for partial referral, the results of 1 film for head CT scan and DVD-R and 2 movies for CT scan other than the head with DVD-R are given. Radiology results in the form of DICOM results are then integrated into all hospital units and accessed in each service room that needs them, such as outpatient installations, inpatient installations, central surgical installations, ICU, HCU.

However, PACS and RIS in RSSN Bukittinggi have not been fully integrated into the Hospital Information System (SIRS) of the Bukittinggi National Stroke Hospital. This is also due to the incompleteness of the hospital's new integrated SIRS system of 82.30% (Bukittinggi National Stroke Hospital., 2019). The obstruction of SIRS integration which is still far from the target of 95% is also a particular problem in RSSN Bukittinggi. It requires further attention from all hospital staff and directors. Meanwhile, the external constraints of the RSSN, for partial referral patients, are constrained by radiology facilities at the referral hospital, so that with these considerations the results of the examination in the form of a film are still limited.

From the results and analysis of this study, it can be concluded that the method of computerized radiological technology using PACS and RIS in carrying out archiving and communication in the field of radiology makes it possible to produce efficient results of the examination. From this study, the transfer of CT scan and MRI results from film to DVD-R for internal patients with RSSN resulted in significant efficiency, namely 97.9%. If it is aligned with the growth in radiological examinations in 2018 and 2019, which amounted to 18.19%, it will be very profitable. However, the incomplete integration of PACS, RIS, and SIRS still requires further attention from the Bukittinggi National Stroke Hospital management in the future. Likewise, with patients with partial referrals who are constrained by radiology facilities at the referral hospital, so that the examination results are still given in the form of films and DVD-R.

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