

PICTURE ARCHIVING AND COMMUNICATION SYSTEMS (PACS) AS A SOLUTION TO INEQUALITY IN THE NUMBER OF RADIOLOGICAL RESOURCES IN WEST JAVA

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Abstract

Inequality of health care facilities, especially radiology resources, is taking place in West Java Province. There are many class A hospitals in provincial capitals. Meanwhile, in areas far from the provincial capital and from DKI Jakarta Province, the quantity and quality of hospitals are still lacking. This also concerns with the quantity of radio diagnostic instruments and human resources. Twelve radiology specialists and an additional 192 radiographers are still needed in West Java Province. Picture archiving and communication systems (PACS) may be used as a solution so that health workers in hospitals located far from the city or district centers can consult, and expert conclusions can be obtained from radiology specialists at referral centers.

Keywords: PACS, radiodiagnostic, radiology specialist, radiographer, West Java

INTRODUCTION

Health and its various derivatives are still one of the unresolved problems in Indonesia, including in the province of West Java. The problem is not only in the form of various types of diseases, but also the problem of inequality in the number of health service facilities, infrastructure, human resources, and even supporting technology. Hospitals with state-of-the-art diagnostic and therapeutic equipment supported by consultant-level doctors can only be found in major cities. Meanwhile, in areas far from the city or district center, class D hospitals supported only by general practitioners and conventional radiology units, radiological expertise is difficult to obtain. Even in some remote areas, the access to public health centers (Puskesmas; Pusat Kesehatan Masyarakat) or village midwife (the only health care workers usually found in remote areas) is still far from optimal.

This inequality is characterized by the difficulty faced in obtaining health care services of health workers by the community living in areas far from the city or district. Funding from the government and the private sector is one form of support for health care

facilities. However, the fulfillment of human resources and the supporting technology cannot be considered sufficient to meet the needs of the community. In the era of National Health Insurance, the coverage of health insurance will be greater so that the demand for health services will increase.

One of the services needed by the community is medical imaging procedures. Medical imaging procedures are used as supporting examination procedures needed by doctors in the diagnosis process to determine the condition of the patient. The components needed in this procedure include diagnostic radiology equipment, radiographers as equipment operators, and radiology specialists. Thus, expert conclusions related to the results of the examination can be obtained more accurately.

Technological developments in terms of radio diagnostic equipment are directly proportional to their examination cost. Thus, a gap in medical imaging technology was found between hospitals in big cities and hospitals in regions. This inequality is further exacerbated by the disparity in the number of radiology resources that are unevenly

distributed in all regions. As a result, a buildup of patients was observed in the referral hospitals.

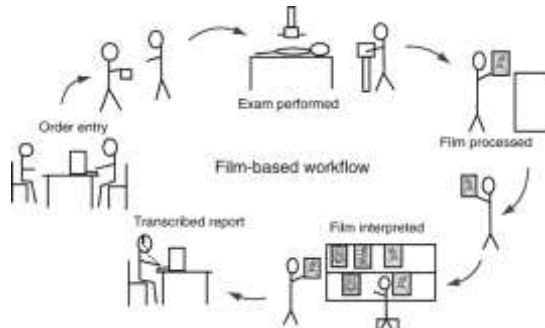


Figure 1 Conventional Radiology Examination Process (source: <http://radiologykey.com>)

METHOD

This study used literature review method. Data of hospital number in every classification and accreditation result also the numbers of radiological resources they need were reviewed. The standard of radiodiagnostic examinations, also the distribution of hospitals and radiological resources in West Java were collected from the literature. Then, the need of radiological resources and the differences from the ideal numbers were counted. So, the urgency and need of the PACS as a solution to the problem were discussed.

RESULT AND DISCUSSION

Hospitals in West Java Province reportedly consist of 328 hospitals (as of June 2017), 258 of which were private hospitals. In this case, 9 hospitals have been classified into Class A Hospitals, 6 of which were in Bandung City, while 1 each in West Bandung Regency, Bogor City, and Bogor Regency. In addition to the 9 hospitals classified as Class A Hospitals, 54 Class B Hospitals, 160 Class C Hospitals, and 58 Class D Hospitals were owned by the Province of West Java. Meanwhile, 47 hospitals were still in the classification

process. Only 94 hospitals in West Java Province have been accredited. Fifty-eight hospitals were accredited as plenary hospitals (categorized as “rumah sakit paripurna” in Bahasa), 4 were accredited as main hospitals (“rumah sakit utama”), 5 were accredited as middle hospitals (“rumah sakit madya”), and 1 was accredited as basic hospital (“rumah sakit dasar”). Meanwhile, the other 234 hospitals have not been accredited or are still in the accreditation process.¹

In general, every hospital is equipped with medical imaging instruments, at least conventional X-ray instruments and ultrasound. Class A hospitals should ideally be equipped with at least 20 radiological instruments with 6 radiology specialists and 40 radiographers. Class B hospitals should ideally be equipped with at least 13 radiological instruments with 2 radiology specialists and 26 radiographers. Class C hospitals should ideally be equipped with at least 4 radiological instruments with a radiology specialist and 8 radiographers. Meanwhile, Class D Hospital should ideally be equipped with at least 2 radiological instruments with a radiology specialist and 4 radiographers.²

At the provincial level, the standard of supporting examinations for various diseases including radiodiagnostic examinations has been determined by the West Java Provincial Health Office. X-rays and ultrasound examinations at the second-level healthcare service facility are indispensable in the diagnosis of diseases. In special cases, such as the presence of a foreign body in the esophagus, an X-ray examination even needs to be undertaken in the first-level healthcare service facilities. Other radiodiagnostic examinations, such as computed tomography scanning (CT-scan), are also needed for certain cases in second-level healthcare service facilities, magnetic resonance imaging (MRI), or nuclear imaging in third-level healthcare service facilities. Nuclear medicine examination in the second-level

healthcare service facilities is required for goiter cases.³

Another problem faced is the evident disparity in the quantity and quality of hospitals. Nuclear medicine facilities are only available at the referral center public hospital, which is in the provincial capital. In addition, Bandung City was supported by 32 hospitals (6 Class A Hospitals, 8 Class B Hospitals, and 18 Class C Hospitals). Meanwhile, Majalengka Regency was only supported by 4 Class C hospitals, and Banjar City, which is directly adjacent to Central Java Province, was only supported by 3 hospitals (1 Class B Hospital, 1 Class D Hospital, and 1 Hospital that was not assigned to a class yet). Ciamis Regency, which is in the eastern West Java Province, was supported by 3 hospitals (1 Class C Hospital, and 2 Class D Hospitals). Pangandaran Regency was not even supported by an official hospital.⁴

Inequality can also be seen in the number of human resources, i.e., radiology specialists and radiographers, who play an important role in radiodiagnostic examinations. The number of radiology specialists in West Java Province was 131.⁵ While the number of radiographers was 963 people. Most of the radiographers were in Bandung City (185 people) and Bekasi City (125 people). Other areas that were also supported by many radiographers were Depok City (84 people), Karawang Regency (70 people), Cirebon Regency (65 people), Bekasi Regency (58 people), Bogor Regency (48 people), Cirebon City (43 people), and Bogor City (41 people). Meanwhile, the Cianjur District Hospital was supported by only two radiographers, and the Ciamis District Hospital was supported by only one radiographer. The Pangandaran District Hospital was not even supported by radiographers at all.⁶

Radiological resources in large quantities are needed by hospitals in West Java Province. Based on the results of the literature review above, it can be calculated

that the need for radiodiagnostic instruments in West Java Province is 1,732 units. However, the number of radiodiagnostic equipment in all hospitals in West Java has not been calculated thoroughly by the authors. Thus, the shortage or excess of the number of radiodiagnostic equipment cannot be calculated completely. Data related to the number of radiodiagnostic equipment, and whether the equipment can function or not in each hospital can be reviewed in the Hospital Information System provided by the Ministry of Health for each hospital.

Based on the results of the literature review, it can be calculated that 427 posts for radiology specialists are needed by the hospitals in West Java Province. If a radiology specialist works in three hospitals, as permitted in the Minister of Health Regulation (also known as Permenkes in Bahasa) number 2052 year 2011⁷, the minimum requirement for radiology specialists in West Java is 143 people. With the availability of 131 people, 12 additional radiology specialists are needed by hospitals in West Java.

In addition to doctors, 3,464 radiographers are needed by the hospitals in West Java Province. In this case, one radiology instrument is operated by two radiographers. As stated in the Minister of Health Regulation (Permenkes) number 357 year 2006⁸, a radiographer can have a maximum of two radiographer working licenses, and one license is only valid for working in one hospital. Therefore, a radiographer can work in two hospitals as well as a doctor. In other words, a minimum of 1,732 radiographers are needed by the hospitals in West Java Province. In 2017, there were 963 radiographers registered in West Java, so an additional 769 radiographers are needed in West Java Province.

The required quantity and quality of radiological resources needs to be fulfilled so that the ideal condition can be achieved. Therefore, alternative solutions related to

accurate radiodiagnostic examination results are needed by the community.

The concept of electronic health (e-health) and telemedicine systems that have been developing progressively nowadays could be used as a solution. One of the implementations, the picture archiving and communication system (PACS), can be used in hospitals in West Java Province. By doing so, it is easier for health workers who work in areas far from the city or district center to communicate and have consultation with a radiology specialist. Thus, expert conclusions can be obtained more easily from radiology specialists.

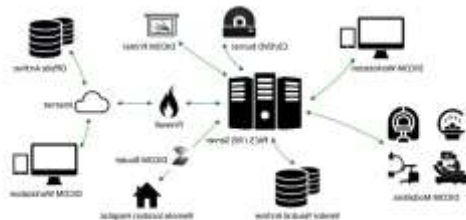


Figure 1 Picture Archiving and Communication System (PACS) (source: <http://raster.in>)

With the implementation of PACS, the images can be sent from the image acquisition location to several physically separated locations that can be done more easily.⁹ The components that are needed in this system include a set of computers connected to the server, data storage, monitors, printers, equipment radiology, local area network (LAN), and the internet so that it can be connected to a Radiology Integrated System (RIS) and a teleradiology system.²

The basic structure of PACS is:

1. Digital radiodiagnostic device or digitalized analog device
2. Image acquisition device
3. Image storage device
4. Transmission network (LAN or internet)
5. Display stations
6. Camera (if printed image is required)

7. Integration with the Radiology Information System and Hospital Information System.⁹

Besides being useful for remote consultation, this system is also environmentally friendly, more efficient, safer, and accelerates service duration. The weaknesses of this system are its large cost at the beginning of the installation for the purchase of equipment and user training, mandatory good telecommunications network, and the acceptance also discipline of a radiology specialist is required in every action as a consultant.

Remote consultation through messenger applications, such as WhatsApp, Facebook Messenger, Telegram, or LINE can be carried out. However, the chance of an inaccurate image acquisition process is greater. The camera used by the sender also may have limited resolution. In addition, the image that is sent via messenger apps will go through a compression process before it is sent because the messenger apps have memory limitations. So, the quality of the images received by radiology specialists may be much lower in quality than the original image. Ineffective results may take place when expert conclusions made by radiology specialists are inaccurate.

CONCLUSION

The use of PACS needs to be promoted further. Therefore, hospitals that are located far from major cities or district centers need to be supported with the appropriate radiological units and PACS-installed computers. In this case, other supporting elements, such as a good telecommunications network, are needed. In addition, it is necessary to conduct training for radiographers regarding the operation of the system. If all these things have been fulfilled, the inequality problem regarding the condition of radiology resources in West Java Province will be overcome.

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AUTHORS CONTRIBUTION

Conceptualization and Writing—original draft (Thareq Barasabha); Writing—review and editing (Yati Hardiyanti).

CONFLICT OF INTEREST

The authors declare no conflict of interest in the writing of this publication.

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