

主論文の要旨

**Geographic distribution and utilisation of CT and
MRI services at public hospitals in Myanmar**

〔 ミャンマーの公立病院における CT と MRI 検査の分布と利用 〕

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【Background】

Geographic variation in healthcare challenges the basic principle of fair allocation of healthcare resources. With the healthcare budget increasing since 2012, Ministry of Health and Sports (MoHS), Myanmar, has allocated funds for advanced technologies such as CT, MRI, and PET CT, to public hospitals. As CT and MRI are costly, the allocation should be fair among states and regions, to utilise them effectively. However, no information was available on the fairness of the distribution and nationwide availability of CT and MRI in Myanmar. The utilisation rate of CT and MRI was also unknown. The government needed to be informed about equitable allocation and utilisation of CT and MRI for further procurement. Therefore, this study aimed to determine the geographic distribution of CT and MRI, as well as their utilisation patterns along with population coverage.

【Methods】

This nationwide, cross-sectional study was conducted to assess the distribution of CT and MRI equipment in public hospitals. The study included all public hospitals with functioning CT and MRI units: 40 hospitals for CT and 13 hospitals for MRI. The data were collected retrospectively using a prepared form from 2015 to 2017 at public hospitals and by accessing official reports of the Department of Medical Services and MoHS.

Data were captured from the government database. Descriptive analysis was conducted to assess population coverage of CT and MRI. Descriptive analysis was used for the absolute numbers and numbers per million population of CT and MRI. The annual growth rates (AGRs) of CT and MRI were also calculated from 2015 or 2016 to 2017. For assessing the equity status of CT and MRI distribution, Lorenz curve and Gini coefficient were used.

【Results】

1. Distribution of CT and MRI units

A total of 45 CT and 14 MRI units had been installed in public hospitals by the end of 2017. Most CT units were located in general hospitals, specialised orthopaedic and paediatric tertiary hospitals, and regional hospitals. Almost all of the MRI units were installed in tertiary hospitals, except one unit at the secondary Magway General Hospital. All states and regions had at least one CT unit (Figure 1). Yangon and Mandalay Regions had 28.9% and 15.6% of total CT units, respectively (Table 1).

Number of both CT and MRI units had been increasing during the period, while the number of MRI units grew faster than that of CT units. Numbers of CT and MRI units in Yangon and Mandalay Regions were larger than those in other states/regions (Table 2).

2. Equity status of distribution of CT and MRI units

Lorenz curve depicting the distribution of MRI was larger (Gini coefficient 0.69), as

MRI was not available in other states and regions except Yangon, Mandalay, Nay Pyi Taw, Magway, and Shan. Lorenz curve for the distribution of CT units was separated from the diagonal line (Gini coefficient 0.35) because CT units were available in all states and regions of Myanmar (Figures 2 and 3).

3. Population coverage of CT and MRI

Number of CT and MRI units per million population was 0.84 and 0.26, respectively. Population coverage of CT was the highest in Kayah State. Nay Pyi Taw had the highest population coverage for MRI (Table 3).

Average AGR were higher in Bago and Sagaing Regions for CT units. Average AGR was 31% in Yangon Region for MRI and Yangon Region grew the fastest. The number of CT per million population in Bago Region grew the fastest (Table 4).

4. Types and yearly installation status of CT and MRI units in public hospitals

Most of the CT units were 16-slice type, and 64-slice CT units were available only in the four major regions. Regarding MRI, 9 of the 14 MRI units were 1.5 Tesla and above. By the end of 2015, 31 CT and 7 MRI units had been installed, and 8 CT (seven 16-slice and one 64-slice machines) and 6 CT (four 16-slice and two 64-slice machines) units were installed in 2016 and 2017, respectively (Table 5).

5. Utilisation pattern of CT and MRI units

Examinations per 1,000 population were the highest in Nay Pyi Taw, followed by Yangon, for both CT and MRI examinations. Total number of CT examinations was extremely high in the Yangon Region compared with other regions (Table 3).

Regarding the patients who received CT examinations, more than a third (34.5% in 2015, 34.3% in 2016 and 35.1% in 2017) were aged between 46 and 65 years. However, younger patients (aged 36 to 55 years) received MRI examinations. Male patients utilised CT services more often than female patients. Utilisation of MRI services showed only a small difference by gender (Table 6).

CT examinations were mainly utilised for cranial/head examinations (60.0% in 2015, 60.7% in 2016 and 58.8% in 2017). The abdomen and thorax regions with or without other areas accounted for the second and third highest number of examinations (Table 7). Between 2015 and 2017, MRI was utilised mainly for spinal examinations (53.4% to 59.1%), with most examinations focused on the lumbar spine region (28.4% in 2015, 35.4% in 2016 and 30.9% in 2017) (Table 8).

A large gap was found between tertiary and secondary hospitals: 171,850 CT at tertiary hospitals and only 33,720 CT examinations at secondary hospitals. The number of MRI examinations at the secondary hospitals accounted for only 0.8% of the total (Table 9).

【Discussion】

CT services were accessible in all states and regions because installation of CT units in state/regional hospitals and national hospitals was prioritized. Most CT and MRI units were concentrated in the largest cities because these cities are located in central Myanmar, where the population density is the highest and transportation services are also relatively better than other areas. Population coverage of CT in states and regions with large populations should be improved since it was lower than in other states and regions. According to yearly installation types of CT and MRI, the procurement patterns of high-tech machines by the MoHS seemed to have shifted to meet the demands of advanced healthcare.

Utilisation was high in states and regions with a higher number of CT and MRI units. Yangon Region accounted for a large percentage of the total CT- almost a third (28.9%) and MRI (50.0%). One implication is that Yangon Region had a heavier workload than any other regions.

CT and MRI utilisation was higher for middle-aged people and nearly equal between male and female patients in the study. Regarding body regions subjected to CT examinations, more than half were carried out on the cranial/head region. This finding was consistent with the fact that injuries were found among the single leading causes of morbidity and mortality in Myanmar.

Limited capacity of secondary hospitals in terms of human resources and machine type leads to a large gap of utilisation between secondary and tertiary hospitals. Utilisation of tertiary hospitals was also very high because of patients' preferences as a consequence of weak referral policies and more advanced facilities in tertiary hospitals.

【Conclusion】

Throughout Myanmar, CT units were more equally distributed than MRI units. CT and MRI units were mostly concentrated in the Yangon and Mandalay Regions, where the population density is high. Geographic distribution and utilisation rate of CT and MRI units varied among states, regions, and patients' age group. However, the utilisation rates of CT and MRI increased annually in all states and regions during the study period. MoHS in Myanmar should consider the utilisation and population coverage of CT and MRI as an important factor when there will be procurement of CT and MRI machines in the future.