Editorial

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The Growing Problem of Radiologist Shortages: Perspectives From Singapore

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INTRODUCTION

Singapore is a small island nation and city-state with a population of 5.92 million [1] in a land area of only 734 km^2. Singapore is highly urbanized, and citizens have easy access to tertiary healthcare facilities, including advanced imaging modalities such as positron emission tomography (PET), magnetic resonance imaging (MRI), and computed tomography (CT).

Growth in Imaging Demand

Like most countries worldwide, Singapore has experienced significant growth in the demand for imaging examinations, and this trend is only set to accelerate in the coming years, owing to several factors. Singapore has a rapidly aging population due to rising life expectancy coupled with a declining birth rate. The old-age support ratio (defined as the ratio of residents aged 20–64 years to those aged 65 years or older) has steadily declined from 7.4 in 2010 to 4.3 in 2020 and is projected to reach 2.3 by 2030 [1]. By 2026, Singapore will be classified as a "super-aged" society, as the proportion of its population aged 65 years and above will exceed 21%. Increasing prevalence of chronic diseases, such as hypertension (19.8% in 2010 vs. 37.0% in 2022) and hyperlipidemia (26.2% in 2010 vs. 31.9% in 2022), has also been observed [2], with 16.3% of the population having more than one chronic condition [3]. This increase in chronic diseases is attributed to changes in diet and lifestyle, including rising sodium intake and reduced physical activity, which have also led to a growing prevalence of obesity. The combination of a rapidly aging population and increasing multimorbidity is anticipated to drive a marked increase in our national healthcare needs. To prepare for this, the Singapore government is implementing sweeping healthcare reforms, with a strong emphasis on preventive care and population health, including improved disease screening efforts. It is also building up our tertiary healthcare capacity, with seven new hospitals and specialist centers slated to be completed by 2030. This will increase our public hospital bed capacity by approximately 1900 beds, which is an increase of almost 20%. Along with the rise in healthcare needs and number of care facilities, imaging volume (including screening studies) and demand for radiologists in Singapore are anticipated to increase significantly. Singapore is also affected by global trends of rising affluence, progressive advances in medical technology, and demand from physicians and patients, which are all strong drivers of increased imaging use [4].

Challenges in Radiology Manpower

The number of registered radiologists has grown steadily from 370 in 2018 to 446 in 2022, an increase of 20.5% [5]. With 7.6 radiologists per 100000 population, Singapore lags behind Europe at 13 per 100000 and the

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United Kingdom, at 8.5 per 100000 [6]. Owing to rising demand, public hospitals anticipate unfilled vacancies of more than 40 radiologists in the next five years (Tan A, personal communication). Several factors may contribute towards this future shortfall. First, the training capacity for radiologists is limited. While radiology residency intake has steadily increased from 30 places in 2019 to 36 in 2023, the training capacity of our residency programs is limited by the number of qualified radiologists available to conduct teaching, especially in view of the high reporting workload. An increase in training numbers must be implemented judiciously to avoid compromising the training quality. Second, in the wake of the COVID-19 pandemic, attrition and burnout has increased among all medical practitioners, including radiologists. A survey conducted in 2020 by Huang et al. [7] among the staff of the Division of Radiological Sciences at Singapore General Hospital found that 17.8% suffered from burnout, while 6.7% experienced moderate-to-severe anxiety. When not addressed, burnout leads to increased attrition, which can, in turn, increase the workload of the remaining staff, potentially causing a domino effect. Third, increasing subspecialization and demand for subspecialty reporting may result in an imbalance between practitioners in different subspecialties and inadequate coverage of general radiology workloads [8].

Strategies to Combat Radiologist Shortages

Numerous strategies have been developed to meet imaging demands (despite the limited number of radiologists) as well as to improve work-life balance, increase coverage, and reduce attrition. First, teleradiology and remote work have been widely adopted, rapidly accelerated due to the COVID-19 pandemic. Video conferencing software, such as Zoom, has enabled radiologists to remotely share imaging studies for multidisciplinary case discussions and education. This has augmented, or, in many cases, replaced, face-to-face meetings. Through virtual private network connections, radiologists can participate in meetings at other hospitals or from home, thus reducing travel time and increasing productivity. Furthermore, most public and private radiology practices have implemented telereporting of studies to various extents, permitting reporting from home, which has proven to be especially useful when social distancing or quarantine is required. Remote reporting has also enabled the centralization of practices with cross-site coverage, with several of our restructured hospitals providing remote reporting services to numerous other hospitals and primary care facilities. Second, efforts have been made to reduce unnecessary imaging. Efforts include reducing duplicate imaging through the screening of imaging requests, implementing appropriateness criteria into clinical decision support systems (including CT/MRI brain, MRI lumbar spine, and chest radiograph requests [9]), and tying subsidies for imaging to appropriate use (for example, fluorodeoxyglucose PET/CT subsidies are only provided for a subset of oncological indications). Third, advanced practice radiography is being explored to augment radiologist manpower, such as the preliminary reporting of ultrasound studies by sonographers or the initial detection of abnormalities by radiographers on image acquisition. Finally, there has been significant interest in the deployment of artificial intelligence (AI) and machine learning techniques into radiology workflows in Singapore [10]. Numerous local studies have developed and evaluated AI-powered algorithms for workflow optimization and image interpretation, which can reduce the time and manpower required for reporting and improve turnaround time. Applications are diverse, including assessing the appropriateness of imaging [11], triaging [12], right siting of studies for reporting, abnormality detection (e.g., fractures [13], infection [12], masses, or hemorrhage), classification (e.g., lumbar spine stenosis grading [14]), and measurement. The primary focus presently is on the smooth integration of AI into reporting workflows and the demonstration of its efficacy in daily practice.

CONCLUSION

With increasing imaging demands due to an aging population and rising chronic diseases, and a relative shortage of radiologists, Singapore will have to leverage technology, reduce unnecessary imaging, and upskill its staff to meet the challenges on the road ahead.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Charles Xian Yang Goh. Writing—original draft: Charles Xian Yang Goh. Writing—review & editing: all authors.

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