

Ateneo de Manila University

Archium Ateneo

Ateneo School of Medicine and Public Health
Publications

Ateneo School of Medicine and Public Health

3-1-2023

Disparities in Access to Cancer Diagnostics in ASEAN Member Countries

Nicole Rose I. Alberto

University of the Philippines College of Medicine

Isabelle Rose I. Alberto

University of the Philippines College of Medicine

Corinna Victoria M. Puyat

University of the Philippines College of Medicine

Maria Alexandra R. Antonio

Ateneo de Manila University

Frances Dominique V. Ho

University of the Philippines College of Medicine

See next page for additional authors

Follow this and additional works at: <https://archium.ateneo.edu/asmph-pubs>



Part of the [Neoplasms Commons](#), and the [Oncology Commons](#)

Recommended Citation

Alberto, N.R., Alberto, I.R., Puyat, C.V., Antonio, A.R., Ho, F.D.V., Dee, E.C., Mahal, B.A., & Eala, M.A.B. (2023). Disparities in access to cancer diagnostics in ASEAN member countries. *The Lancet Regional Health - Western Pacific*(32), 100667. <https://doi.org/10.1016/j.lanwpc.2022.100667>

This Article is brought to you for free and open access by the Ateneo School of Medicine and Public Health at Archium Ateneo. It has been accepted for inclusion in Ateneo School of Medicine and Public Health Publications by an authorized administrator of Archium Ateneo. For more information, please contact oadrcw.ls@ateneo.edu.

Authors

Nicole Rose I. Alberto, Isabelle Rose I. Alberto, Corinna Victoria M. Puyat, Maria Alexandra R. Antonio, Frances Dominique V. Ho, Edward Christopher Dee, Brandon A. Mahal, and Michelle Ann B. Eala

Disparities in access to cancer diagnostics in ASEAN member countries



Nicole Rose I. Alberto,^{a,f} Isabelle Rose I. Alberto,^{a,f} Corinna Victoria M. Puyat,^a Maria Alexandra R. Antonio,^b Frances Dominique V. Ho,^a Edward Christopher Dee,^c Brandon A. Mahal,^d and Michelle Ann B. Eala^{a,e,*}



^aCollege of Medicine, University of the Philippines, Manila, Philippines

^bAteneo School of Medicine and Public Health, Pasig City, Philippines

^cDepartment of Radiation Oncology, Memorial Sloan Kettering Cancer Center, New York, NY, USA

^dDepartment of Radiation Oncology, University of Miami Miller School of Medicine/Sylvester Comprehensive Cancer Center, Miami, FL, USA

^eDepartment of Radiation Oncology, University of California Los Angeles, Los Angeles, CA, USA

Summary

Diagnosics, including laboratory tests, medical and nuclear imaging, and molecular testing, are essential in the diagnosis and management of cancer to optimize clinical outcomes. With the continuous rise in cancer mortality and morbidity in the Association of Southeast Asian Nations (ASEAN), there exists a critical need to evaluate the accessibility of cancer diagnostics in the region so as to direct multifaceted interventions that will address regional inequities and inadequacies in cancer care. This paper identifies existing gaps in service delivery, health workforce, health information systems, leadership and governance, and financing and how these contribute to disparities in access to cancer diagnostics in ASEAN member countries. Intersectoral health policies that will strengthen coordinated laboratory services, upscale infrastructure development, encourage health workforce production, and enable proper appropriation of funding are necessary to effectively reduce the regional cancer burden.

The Lancet Regional Health - Western Pacific
2023;32: 100667

Published Online 6 January 2023

<https://doi.org/10.1016/j.lanwpc.2022.100667>

1016/j.lanwpc.2022.100667

Copyright © 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: Cancer diagnostics; Medical imaging; Molecular diagnostics; Southeast Asia; ASEAN; Disparities; Cancer disparities

Introduction

Cancer burden continues to grow globally as a leading cause of death and a significant barrier to increasing life expectancy.¹ Cancer has exerted significant physical, emotional, financial, and psychosocial strain on individuals, families, communities, and health systems. While prevention is the most cost-effective public health strategy in non-communicable disease (NCD) control, millions of people around the world still develop cancer due to its multifactorial nature.² Thus, early detection, through the judicious use of laboratory tests, imaging devices, nuclear equipment, and molecular testing, must be emphasized in cancer control policies and

programs.³ Timely access to comprehensive and affordable cancer diagnostics improves patient survival and quality of life,³ ensures appropriate management decisions for optimal outcomes, and allows subsequent monitoring of cancer progression and recurrence.^{4–6}

Despite the critical role of diagnostics in oncology, strengthening coordinated laboratory services and upscaling the availability of essential imaging devices has frequently been overlooked in efforts to improve cancer care, particularly in low- and middle-income countries (LMICs) and the Association of Southeast Asian Nations (ASEAN) region.^{7–9} Significant disparities among and within ASEAN countries exist with regards to essential diagnostics, imaging devices, nuclear equipment, and molecular testing for cancer, due to the wide economic gaps, varying healthcare systems, differing care priorities, and unique sociocultural patterns.^{9–13} Herein, we synthesize the limited evidence base on factors contributing to disparities in access to cancer diagnostics in ASEAN member countries using the WHO Health Systems Framework.¹⁴ While we do not claim this work to be comprehensive as there is a paucity of high-quality systematic studies, we hope the findings of this work will inform and advance strategies to curb the regional inequities in cancer diagnosis.

Abbreviations: ASEAN, Association of Southeast Asian Nations; GDP, Gross domestic product; LMIC, Low- and middle-income country; NCD, Noncommunicable disease; OECD, Organisation for Economic Co-operation and Development; UHC, Universal health coverage; WHO, World Health Organization

*Corresponding author.

E-mail addresses: nialberto@up.edu.ph (N.R.I. Alberto), iialberto@up.edu.ph (I.R.I. Alberto), ccmartinez4@up.edu.ph (C.V.M. Puyat), maria.alexandra.antonio@obf.ateneo.edu (M.A.R. Antonio), fvho@up.edu.ph (F.D.V. Ho), deee1@mskcc.org (E.C. Dee), bmahal@med.miami.edu (B.A. Mahal), mbeal1@up.edu.ph (M.A.B. Eala).

^fNRIA and IRIA contributed equally to this work.

Geographical and epidemiological profile of ASEAN countries

Southeast Asia is home to over 650 million people,¹⁵ approximately twice the population of the United States and thrice the population of Western Europe. The region, commonly defined in the context of the ASEAN, includes ten countries in mainland Asia and nearby archipelagos: Brunei, Singapore, Malaysia, Thailand, the Philippines, Indonesia, Vietnam, Lao PDR, Cambodia, and Myanmar (Burma).¹³ ASEAN is marked by immense diversity among and within countries in terms of health systems, geography, culture, sociodemographic traits, language, religion, history, and genomic ancestry, with critical implications for its people's health.^{13,16} Economies range from powerhouses such as that of Singapore to emerging economies such as that of Lao PDR. Geographies range from the islands of the Visayas to the flood plains of the Mekong River. Genomic ancestry and cultural diversity in the region can trace its roots to influences from neighboring China, India, Oceania, and the Middle East, and more recently, influences from European colonizers over the past ~500 years.^{17,18}

Importantly, the past several decades have seen an epidemiological transition wherein NCDs – including cancer – play an increasing role in morbidity and mortality in the region.¹² In 2020, there were over 1 million new cases of cancer and nearly 700,000 cancer deaths in the ASEAN. The most commonly diagnosed cancers were cancers of the breast, lung, colon, and rectum, while the most common causes of cancer death were cancers of the lung, liver, and breast.¹⁹ Similar to global epidemiology, breast cancer was the most diagnosed cancer in females, followed by cervical cancer.¹⁹ However, while the prostate is the leading cancer site in men, the leading cancer site in ASEAN men is the lung.¹⁹ Within the ASEAN, there is substantial heterogeneity of the commonest cancer site in the male cohort, varying between colorectal, liver, and lung cancer.²⁰ This may pose a challenge in coordinating efforts within the region to improve the various diagnostic modalities per cancer site.

With an aging population and changes in lifestyles and environmental exposures, cancer is expected to play an increasing role in the health of the region.²¹ Cancer is the leading cause of disability-adjusted life years in Brunei, Thailand, and Singapore, and is second only to cardiovascular diseases in Cambodia, Malaysia, the Philippines, Vietnam, Indonesia, and Myanmar (cancer ranks third after cardiovascular diseases and “other NCDs” in Lao PDR).²² Cancer in ASEAN is marked by unique epidemiological traits and risk factors that vary amongst and within nations.²¹ In addition, the relatively younger population results in different cancer burdens, necessitating a focused assessment of the unique needs of the region.²³ Therefore, a greater understanding of the availability of and access to essential cancer diagnostics in the region is critical and timely.

Factors contributing to disparities in access to cancer diagnostics according to the WHO health system framework

Service delivery

Service delivery is a vital input to population health status, and is an immediate reflection of health system investments in workforce, infrastructure, and financing. A good service delivery system is accessible, organized, and efficient, with a strong foundation in primary care.²⁴ Currently, in LMICs, like most ASEAN member countries, basic diagnostic procedures are physically inaccessible for many patients, especially those residing in geographically isolated areas.²⁵ In primary care facilities, the most readily available diagnostic test is for malaria (40%), followed by urine glucose and urine protein (16%). Only 5% of primary care facilities have imaging equipment. Thus, most patients need to travel to secondary and tertiary facilities for basic imaging services such as a chest X-ray and an ultrasound.²⁵ Notably, portable ultrasounds have huge potential for use in low-resource underserved healthcare settings.²⁶ However, the lack of trained healthcare workers to operate these devices and the difficulty in maintaining competencies in resource-constrained areas need to be addressed to bridge the gap in ultrasound diagnostics. Additionally, its widespread adoption is hampered by the limited distribution and support networks, lack of access to replacement parts, and intermittent electric supply to recharge batteries.^{27,28} Overall, the ultimate inaccessibility of essential diagnostic procedures on a primary care level precludes a timely and accurate cancer diagnosis.

In Malaysia and the Philippines, a dual healthcare system has therefore surfaced: private services for patients of higher socioeconomic status and public services for the rest. Health service quality is also perceived to be higher in private than public sectors.^{12,29} A significant consideration in care delivery and utilization within ASEAN countries is the cost of treatment. In the Asean CosTs In Oncology (ACTION) study conducted in 2015, researchers found that poor patient outcomes were more common in those who were diagnosed at advanced stages and socioeconomically disadvantaged. Moreover, similarly high costs for diagnostics relative to patient income levels represent major barriers to access.³⁰

Cancer diagnosis, staging, and management are determined by the adequacy of available health infrastructure in related equipment and facilities. Despite the central role of imaging in diagnosis, there is a collective inadequacy of imaging equipment in the ASEAN region when compared to the global average. Based on 2016 estimates of the largest global resources database with a total of 1857 data points in 211 countries,⁹ the number of CT scans available in most ASEAN countries is between 0 and 5 per 1 million population, far lower than the worldwide average of 12.22 per 1 million population. The same evident disproportion is seen in the number of available

MRI and SPECT units, with most ASEAN countries averaging 0–0.25, and 0–2.5 units per 1 million population, respectively. This is in stark contrast with the respective global averages of 6.711 and 3.542 units per 1 million population. While these disparities exist, there are also inequities in imaging equipment availability among ASEAN countries. Singapore, Malaysia, Thailand, and Brunei had 5–10 CT scan units per 1 million population, notably still below the global average of 12.22 units per 1 million population, while its neighboring countries have an average of 0–5 units per 1 million population.²⁰

Genomic and molecular biomarkers, which aid in clinical diagnosis and prognostication of many cancers, are also not readily available and accessible in many ASEAN countries. In the Philippines, biomarker testing for breast, colorectal, and lung cancer is available in only six centers – all of which are located in the capital of Manila. These centers serve a population of more than 110 million. Consequently, 60% of medical oncologists in the Philippines have reported that the unavailability of these tests in their area of practice hindered testing.¹¹ Substantial investment in ASEAN's health infrastructure and diagnostic capacity is necessary to overcome common barriers to timely cancer diagnosis.

Health workforce

The availability of qualified medical personnel to perform, supervise, interpret, and validate imaging and laboratory analysis is a significant determinant of a health system's capacity to deliver diagnostic services to a population.³¹ Adequately trained laboratory personnel are needed to ensure compliance with nationally recognized standards for safety, procurement, and supply management.⁸ Although limited information is available on the aggregate level of medical and radiation technologists in the region, a systematic review assessed the shortages and distribution challenges in human resources for health in ASEAN and found that at a national level, Cambodia, Indonesia, Lao PDR, Myanmar, and Vietnam fall below the WHO-recommended critical shortage threshold of 2.28 doctors, nurses, and midwives per 1000 population.³² Low production and employment capacities in resource-poor countries such as Lao PDR, Myanmar, and Vietnam are significant contributory factors to this workforce shortage. Production of doctors ranged from 8 per 100,000 population/year in Singapore and Malaysia to 4 per 100,000 population/year in Brunei to <1 per 100,000 population/year in Lao PDR and Myanmar.³²

Although a shortage in healthcare workers can significantly constrain access to diagnostic services, workforce adequacy should be assessed in conjunction with other factors affecting the demand for these services. For example, while Lao PDR falls below the WHO's shortage threshold, the workforce is underemployed in many cases, with less than one patient per healthcare worker per day, reflecting the limited use of

health facilities due to socioeconomic and possibly cultural barriers to care.³²

Notably, urban-rural disparities in the health workforce exist due to the uneven distribution of health facility infrastructure, poorer working conditions in rural areas, and the concentration of income-making opportunities in urban areas.^{29,33,34} For Vietnam, shortages in healthcare workers are evident in the mountainous and remote areas, with the number of physicians per population in the North West, Central Highland, and Mekong Delta Regions being lower than the national average.³⁵ In Malaysia, there is a severe imbalance in health manpower distribution between the private and public sectors. In the private sector, 46.2% of all doctors were responsible for 20.3% of hospital beds, while in the public sector, 53.8% of doctors were accountable for 79.7% of hospital beds.³⁶ In the Philippines, more than half of medical oncologists practiced in the capital Manila, and two-thirds of them were affiliated with private hospitals or clinics.¹¹

Institutional mechanisms that coordinate an inter-sectoral health workforce agenda covering appropriate compensation, rural retention, and continuing professional development are needed to overcome these disparities.³⁷ To achieve full impact, these strategies must be aligned with the existing national service delivery system. In Vietnam, in-service training, financial incentives, and professional support were employed to build a strong rural health workforce. However, these did not directly expand the pool of rural health workers. Various socioeconomic factors, such as the increased autonomy of public hospitals and decentralization in Vietnam, have attracted healthcare workers to transfer from rural primary facilities to higher-level hospitals. Meanwhile, the existing primary healthcare package in Cambodia guided its planning of the primary health workforce. Because of Cambodia's weak economy and high educational dropout rates, the government focused on the medical education of mid-level health workers (i.e., midwives and nurses) by establishing short and accessible educational courses, providing free tuition at provincial training centers, and implementing pro-poor health financing policies. It is well-recognized that no single intervention would be suitable across all ASEAN countries, and the differences in the impact of similar health workforce interventions highlight the importance of effective evaluation of local contexts.³⁸

Health information systems

Health information systems provide the underpinnings for decision-making in health. Particularly, health data generation is a prominent factor that influences the accessibility of cancer diagnostics.³⁹ In ASEAN, significant disparities exist in research and innovation. Although an increasing amount of biomedical research is coming out of Asia, ASEAN is dwarfed by output from China, Japan, and Korea, due

to an amalgam of forces that include limited resources overall and lower priority given to research by national/government funding agencies.⁴⁰ Meta-science research may aid in quantifying research disparities and identifying areas of need. A recent study of stroke research from Southeast Asia found that over 40% of studies came from Singapore.⁴¹ Another survey of studies on headaches from Southeast Asia similarly found that Malaysia, Singapore, and Thailand represented the majority of research output from the region; output was associated with percent GDP dedicated to research and development.⁴² Research focusing on cancer diagnostics likely follows similar patterns, underscoring the need for increased funding allocation towards biomedical research. ASEAN-specific work is needed not just in the identification of diagnostic methods and parameters tailored to the region's population, but also in health systems and implementation science research aimed at identifying feasible, cost-effective ways to mitigate disparities in and improve access to cancer diagnostics.^{43–45}

Through research and innovation, public health education and literacy can be pursued. In ASEAN, the role of common cultural themes, including fatalism towards illness and conceptualizations of femininity, must be recognized in the effort to improve cancer diagnostics, as they are considerable influences on health literacy. The diagnosis and treatment of female cancers, such as breast and cervical cancer, may be hampered by prevailing ideals of femininity. A diagnosis of breast cancer is often feared due to its perceived implications on a woman's role as a wife, mother, and/or female (e.g., physical changes of hair loss and mastectomy, long treatment plans which subtract time from motherly/wifely duties). Diagnosis may be delayed due to sensitivity towards healthcare personnels' gender. Commonly, women feel embarrassed when examined by males, preferring female personnel.^{46,47} Paternalism may also be a hindrance or opportunity towards earlier cancer diagnosis. Since it is common in the region for wives to seek permission from their husbands to pursue medical help, it is often important to include them in health education and planning. Additionally, sexual taboos may also discourage women from pursuing cervical cancer diagnosis, due to associations with promiscuity.⁴⁸

Cancer fatalism consists of perceptions that contracting cancer is beyond one's control, death is inevitable, and screening, treatment, and diagnosis are futile. For example, a cohort of Malay and Singaporean patients with breast, cervical, or colorectal cancer were less likely to pursue diagnosis due to this belief.^{46,49,50} Cancer fatalism is a result of varying cultural beliefs, including pessimism, naïve dialecticism, and superstition, and manifests as disparities in cancer prevention behaviours among Singaporeans.⁵¹ Thus, culturally targeted interventions to communicate current cancer causes, prevention, and treatment should be implemented in these populations.

Leadership and governance

Government legislation guides service delivery, infrastructure development, and national insurance coverage of cancer diagnostics. This has significant implications for the availability and affordability of care and contributes to disparities in access. Legislation towards universal health coverage (UHC) is a crucial step to ensure access to cancer diagnostics, and many ASEAN countries have made progress toward UHC due to strong political support.¹² This includes Thailand's National Health Security Act, Cambodia's Master Plan for Social Health Insurance, Indonesia's National Social Security System, Vietnam's UHC Master Plan, and most recently, the Philippines' UHC Act. The Philippines has also enacted the National Integrated Cancer Control Act, with the goal of preventing cancer and improving cancer survivorship through better screening, prompt diagnosis, and optimal management through the disease continuum. It also aims to 'make cancer treatment and care more equitable and affordable for all, especially for the underprivileged, poor and marginalized.'⁵² However, while ASEAN countries have expressed a political commitment to UHC,⁵³ financial and logistic challenges of implementation remain.

Ensuring accessibility and availability of cancer diagnostics is integral to UHC. However, the challenge is greater for countries like Indonesia and the Philippines, whose archipelagic geography hampers the distribution of essential diagnostic equipment. For example, Filipinos residing in the island of Luzon, where the capital is located, have better access to healthcare and can more easily access X-ray and MRI machines compared to Filipinos residing in the island of Mindanao.⁴³ National ministries of health, in coordination with local community leaders and local health units, play a critical role in addressing this problem. Performing a comprehensive needs assessment will guide the development of relevant policies and the appropriation of funding. Additionally, partnering with logistic experts to organize a nationwide supply and distribution chain for diagnostic equipment may help improve the availability and accessibility of diagnostic services for vulnerable populations in geographically isolated and disadvantaged areas.

Financing

Adequate health financing allows individuals to use essential services without the risk of severe financial hardship or financial catastrophe.⁵⁴ Fear of financial catastrophe, financial constraints, and lack of health insurance are significant causes of delay in seeking primary care and cancer diagnosis.³ These result in later stages at presentation, poorer prognosis, increased morbidity from treatment, and higher costs of care.

Out-of-pocket (OOP) expenditure for health, including diagnostic services, is above 30% in all ASEAN countries except Brunei and Thailand.¹² Additionally, the ACTION Study showed that 48%

experienced financial catastrophe with OOP medical costs exceeding 30% of household income. Only 23% were alive with no financial catastrophe within one year of diagnosis. As for health insurance, coverage breadth, which refers to the population groups covered by any form of pre-payment system or social protection, varies between an estimated 1% (Myanmar) and 100% (Brunei, Malaysia, Singapore, and Thailand). Similarly, the scope of services covered by health insurance differs between basic benefit packages covering select outpatient and inpatient services (Philippines and Lao PDR) and comprehensive benefit packages that completely cover services ranging from preventive and primary health care to tertiary hospital care (Brunei and Malaysia).³⁰ In a study analysing the economic impact of cancer on Filipino patients, health insurance was found to be statistically insignificant in reducing the risk of financial catastrophe for patients with cancer due to limited coverage and financial protection provided by the current national health insurance program.⁵⁵

National health systems financing is vital as it can restrict the availability and accessibility of related health infrastructure and services. The regional health expenditure as a share of GDP is 4.72%, although an increasing trend over the years, is far less than both the Organisation for Economic Cooperation and Development (OECD) and global average of 12.36% and 9.97%, respectively.⁵⁶ Despite these international disparities, there are also considerable differences between ASEAN countries in terms of health expenditure. During the period 2002 to 2011, Thailand, Brunei, Malaysia, and Vietnam topped health expenditure as a percentage of their GDP with more than 2% on average. On the other hand, the Philippines, Singapore, Cambodia, Indonesia, and Lao PDR are at the bottom with 1.5% or less on average. Furthermore, on per capita government health expenditure, Brunei tops the list with 1000 USD per capita, followed by Singapore, Malaysia, and Thailand, leaving Cambodia and Lao PDR in last place.⁵⁷

A cancer diagnosis poses a considerable economic burden to patients and their families, leading to a significant decrease in household income, and in some cases, impoverishment. Patients with cancer become less economically productive with decreases in personal income and dependence on pension and other sources of passive income.⁵⁵ Financial barriers must be comprehensively assessed and addressed through the creation of national policies and programs that support early detection, reduction of financial hindrances to cancer diagnosis, and provision of adequate financial protection.³

Effect of the COVID-19 pandemic on diagnostic disparities

The COVID-19 pandemic has severely aggravated the existing economic burden of cancer by simultaneously

inducing loss of household income and prolonged unemployment within the region,⁵⁸ with grave implications for ASEAN countries with already limited national health insurance coverage (e.g., Myanmar, Philippines, Lao PDR). The pandemic was compounded by the inadequacy of financial protection and legislative support to combat the financial toxicity associated with a cancer diagnosis. Moreover, the pandemic brought about disruptions in the continuity of care, including halting of screening and preventive services,⁵⁹ as both public and private healthcare institutions attempted to focus available resources and cater to the abrupt surge in COVID-19 patients.⁵⁸ These factors have resulted in patients with fewer resources delaying consult and timely diagnosis, resulting in later stages of cancer presentation and requiring overall costlier treatment.⁵⁸ The pandemic has highlighted existing diagnostic disparities and worsened the socioeconomic gap among patients with cancer, both of which may impact long-term health outcomes.

Existing cancer care plans in ASEAN countries

With the differences in health system needs and priorities among individual ASEAN countries, comprehensive cancer plans that cover the full continuum of cancer care are critical to ensure equitable access to cancer diagnostics. For example, the Philippines has one of the most comprehensive plans in the region, but its implementation has been put on hold due to its wavering commitment to cancer planning.⁶⁰ Malaysia, on the other hand, has only recently updated its 2008–2015 program to cover diagnosis, palliative care, and rehabilitation. Rather than a stand-alone plan, Vietnam's cancer policy is part of a larger prevention plan that tackles cancer, diabetes, cardiovascular disease, and stroke.

In terms of cancer registries, Indonesia, Philippines, and Vietnam only have regional registries of cancer data and lack a national-level registry that may inform the development of cancer care initiatives and policies.⁶⁰ Additionally, these cancer registries, experience several drawbacks in the adequacy of core funding, clear direction of the governing body, continuity and swiftness of operation, and quality of death certificate information. This is in contrast to Malaysia, whose ministry of health consistently collates high-quality data and constantly publishes reports from their registries.⁶¹ Collectively, there is a need to emphasize the important role of strong leadership and governance in supporting the implementation of these policies.

Conclusion

In this paper, we summarized and discussed contributory factors hindering the accessibility of these diagnostics,

covering existing gaps in health service delivery, health workforce, health information systems, governance, and health financing in the ASEAN region. In addressing these disparities, emphasis must be made on improving service delivery systems, investing in health infrastructure, reevaluating information systems, proper appropriation in health system financing, adequate financial protection from disease costs, strong governance and legislation, as well as culturally targeted interventions. Moreover, an appropriate understanding of the multifactorial nature of inaccessibility is required for its effective implementation. Inequities in cancer diagnostic services mirror inequities in health outcomes. Improving accessibility is key to mitigating one of the biggest contributors to the region's morbidity and mortality.

Contributors

Conceptualization: ECD, BAM, MABE; writing: NRIA, IRIA, CVPM, MARA, MABE, ECD; review and editing: NRIA, IRIA, CVPM, MARA, FVH, ECD, BAM, MABE; supervision: NRIA, IRIA, BAM, MABE; All authors have read and agreed to the published version of the manuscript.

Declaration of interests

BAM received research grants from the Prostate Cancer Foundation, the American Society for Radiation Oncology, the United States Department of Defense, and the Sylvester Comprehensive Cancer Center. ECD is funded in part through the Cancer Center Support Grant from the National Cancer Institute (P30 CA008748). All other authors declare no conflicts of interest.

Acknowledgments

Funding: This research received no external funding.

References

- Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2021;71:209–249.
- Clavel J. Progress in the epidemiological understanding of gene-environment interactions in major diseases: cancer. *C R Biol*. 2007;330:306–317.
- World Health Organization. *Guide to cancer early diagnosis*. Geneva, Switzerland: World Health Organization; 2017.
- Langer A. A systematic review of PET and PET/CT in oncology: a way to personalize cancer treatment in a cost-effective manner? *BMC Health Serv Res*. 2010;10:283.
- Brown LC, Ahmed HU, Faria R, et al. Multiparametric MRI to improve detection of prostate cancer compared with transrectal ultrasound-guided prostate biopsy alone: the PROMIS study. *Health Technol Assess (Rockv)*. 2018;22:1–176.
- Scott AM, Gunawardana DH, Kelley B, et al. PET changes management and improves prognostic stratification in patients with recurrent colorectal cancer: results of a multicenter prospective study. *J Nucl Med*. 2008;49:1451–1457.
- Policy and priorities for national cancer control planning in low- and middle-income countries: lessons from the Association of Southeast Asian Nations (ASEAN) Costs in Oncology prospective cohort study. *Eur J Cancer*. 2017;74:26–37.
- World Health Organization. *Asia Pacific strategy for strengthening health laboratory services*. Geneva: World Health Organization; 2010.
- Hricak H, Abdel-Wahab M, Atun R, et al. Medical imaging and nuclear medicine: a lancet oncology commission. *Lancet Oncol*. 2021;22:e136–e172.
- Calaguas MJC, Gubat JA. South East Asia, differing socioeconomic factors, differing access to radiotherapy: the Philippines, a microcosm. *Semin Radiat Oncol*. 2017;27:176–183.

- Catedral LI, Tan HN, Chua A, Benedict Sacdalan D, Sacdalan DL. Patterns of biomarker use in cancer treatment among medical oncologists in the Philippines. *JCO Glob Oncol*. 2020;1593–1608.
- van Minh H, Pocock NS, Chaiyakunapruk N, et al. Progress toward universal health coverage in ASEAN. *Glob Health Action*. 2014;7:25856.
- Chongsuvivatwong V, Phua KH, Yap MT, et al. Health and health-care systems in southeast Asia: diversity and transitions. *Lancet*. 2011;377:429–437.
- World Health Organization. *Monitoring the building blocks of health systems: a handbook of indicators and their measurement strategies*. Geneva, Switzerland: World Health Organization; 2010.
- The World Bank Group. *Population, total - Philippines; 2022*. <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=PH>. Accessed January 12, 2022.
- Dee EC, Paguio JA, Yao JS, Lim J, Lasco G. Asian minorities in Asian countries: intersecting disparities affecting minoritised groups. *Lancet Oncol*. 2021;22:e381.
- Abdulla MA, Ahmed I, Assawamakin A, et al. Mapping human genetic diversity in Asia. *Science*. 2009;326:1541–1545.
- McColl H, Racimo F, Vinner L, et al. The prehistoric peopling of Southeast Asia. *Science*. 2018;361:88–92.
- World Health Organization - International Agency for Research on Cancer. South-eastern Asia. <https://gco.iarc.fr/today/data/factsheets/populations/920-south-eastern-asia-fact-sheets.pdf>; 2021. Accessed September 10, 2022.
- International Atomic Energy Agency. IMAGINE - IAEA medical imaging and nuclear medicine global resources database. <https://humanhealth.iaea.org/HHW/DBStatistics/IMAGINEMaps.html>; 2016. Accessed January 12, 2022.
- Kimman M, Norman R, Jan S, Kingston D, Woodward M. The burden of cancer in member countries of the association of Southeast Asian nations (ASEAN). *Asian Pac J Cancer Prev APJCP*. 2012;13:411–420.
- Institute for Health Metrics and Evaluation. GBD compare. <https://vizhub.healthdata.org/gbd-compare/heatmap/>; 2019. Accessed January 12, 2022.
- Alvarez EM, Force LM, Xu R, et al. The global burden of adolescent and young adult cancer in 2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Oncol*. 2022;23:27–52.
- World Health Organization. Health service delivery. https://www.who.int/healthinfo/systems/WHO_MBHSS_2010_section1_web.pdf; 2010. Accessed January 12, 2022.
- Fleming KA, Horton S, Wilson ML, et al. The Lancet Commission on diagnostics: transforming access to diagnostics. *Lancet*. 2021;398:1997–2050.
- Shaddock L, Smith T. Potential for use of portable ultrasound devices in rural and remote settings in Australia and other developed countries: a systematic review. *J Multidiscip Healthc*. 2022;15:605–625.
- Shah S, Bellows BA, Adedipe AA, Totten JE, Backlund BH, Sajed D. Perceived barriers in the use of ultrasound in developing countries. *Crit Ultrasound J*. 2015;7:11.
- Becker DM, Tafoya CA, Becker SL, Kruger GH, Tafoya MJ, Becker TK. The use of portable ultrasound devices in low- and middle-income countries: a systematic review of the literature. *Trop Med Int Health*. 2016;21:294–311.
- Dayrit M, Lagrada L, Picazo O, Pons M, Villaverde M. The Philippines health system review. <https://apps.who.int/iris/bitstream/handle/10665/274579/9789290226734-eng.pdf?sequence=1&isAllowed=y>; 2018. Accessed January 14, 2022.
- The Action Study Group. Catastrophic health expenditure and 12-month mortality associated with cancer in Southeast Asia: results from a longitudinal study in eight countries. *BMC Med*. 2015;13:190.
- World Health Organization. The world health report 2006: working together for health. https://www.who.int/whr/2006/whr06_en.pdf; 2006. Accessed January 12, 2022.
- Kanchanachitra C, Lindelow M, Johnston T, et al. Human resources for health in southeast Asia: shortages, distributional challenges, and international trade in health services. *Lancet*. 2011;377:769–781.
- Heywood PF, Harahap NP. Human resources for health at the district level in Indonesia: the smoke and mirrors of decentralization. *Hum Resour Health*. 2009;7:6.
- Prasad A, Kano M, Dagg KA-M, et al. Prioritizing action on health inequities in cities: an evaluation of urban health equity assessment

- and response tool (urban HEART) in 15 cities from Asia and Africa. *Soc Sci Med.* 2015;145:237–242.
- 35 Takashima K, Wada K, Tra TT, Smith DR. A review of Vietnam's healthcare reform through the Direction of Healthcare Activities (DOHA). *Environ Health Prev Med.* 2017;22:74.
 - 36 Thomas S, Beh L, Nordin R. Health care delivery in Malaysia: changes, challenges and champions. *J Public Health Afr.* 2011;2:23.
 - 37 World Health Organization. *Decade for health workforce strengthening in the South-East Asia Region.* 2018. 2018.
 - 38 Zhu A, Tang S, Thu NTH, Supheap L, Liu X. Analysis of strategies to attract and retain rural health workers in Cambodia, China, and Vietnam and context influencing their outcomes. *Hum Resour Health.* 2019;17:2.
 - 39 World Health Organization. Health information systems. https://www.who.int/healthinfo/statistics/toolkit_hss/EN_PDF_Toolkit_HSS_InformationSystems.pdf; 2008. Accessed January 12, 2022.
 - 40 Marshall IJ, L'Esperance V, Marshall R, et al. State of the evidence: a survey of global disparities in clinical trials. *BMJ Glob Health.* 2021;6:e004145.
 - 41 Apor ADAO, Pagaling GT, Espiritu AI, Jamora RDG. Stroke research disparity in Southeast Asia: socioeconomic factors, healthcare delivery, and stroke disease burden. *J Stroke Cerebrovasc Dis.* 2021;30:105481.
 - 42 dela Vega MPD, Yu JRT, Espiritu AI, Jamora RDG. Primary headache research output and association with socioeconomic factors in Southeast Asia: a bibliometric analysis. *Neurol Sci.* 2021;42:2683–2693.
 - 43 Eala MAB, Dee EC, Ting FIL, Tangco ED. Medical imaging and nuclear medicine: points to note. *Lancet Oncol.* 2021;22:e226.
 - 44 Ward ZJ, Atun R, Hricak H, et al. The impact of scaling up access to treatment and imaging modalities on global disparities in breast cancer survival: a simulation-based analysis. *Lancet Oncol.* 2021;22:1301–1311.
 - 45 Ward ZJ, Scott AM, Hricak H, Atun R. Global costs, health benefits, and economic benefits of scaling up treatment and imaging modalities for survival of 11 cancers: a simulation-based analysis. *Lancet Oncol.* 2021;22:341–350.
 - 46 Malhotra C, Bilger M, Liu J, Finkelstein E. Barriers to breast and cervical cancer screening in Singapore: a mixed methods analysis. *Asian Pac J Cancer Prev.* 2016;17:3887–3895.
 - 47 Khan TM, Leong JPY, Ming LC, Khan AH. Association of knowledge and cultural perceptions of Malaysian women with delay in diagnosis and treatment of breast cancer: a systematic review. *Asian Pac J Cancer Prev APJCP.* 2015;16:5349–5357.
 - 48 Salehiniya H, Momenimovahed Z, Allahqoli L, Momenimovahed S, Alkatout I. Factors related to cervical cancer screening among Asian women. *Eur Rev Med Pharmacol Sci.* 2021;25:6109–6122.
 - 49 Wee LE, Lim LY, Koh GC-H. Two sides of the coin: a qualitative study of patient and provider perspectives on colorectal, breast and cervical cancer screening in a low-income Asian community. *Proc Singapore Healthc.* 2016;25:80–91.
 - 50 Yip CH, Bhoo Pathy N, Teo SH. A review of breast cancer research in Malaysia. *Med J Malaysia.* 2014;69(Suppl A):8–22.
 - 51 Kim HK, Lwin MO. Cultural determinants of cancer fatalism and cancer prevention behaviors among Asians in Singapore. *Health Commun.* 2021;36:940–949.
 - 52 National Council on Disability Affairs. *RA 11215 – An Act Institutionalizing A National Integrated Cancer Program And Appropriating Funds Therefor.* 2012.
 - 53 Dee EC, Ang CDU, Ting FIL, Tangco ED, Eala MAB. Improving cancer care in the Philippines: The need for deliberate and careful implementation of the National Integrated Cancer Control Act. *Lancet Reg Health West Pac.* 2022;28:100615.
 - 54 World Health Organization. *Health Systems Financing.* Geneva, Switzerland: World Health Organization; 2008.
 - 55 Ngelangel CA, Lam HY, Rivera AS, Kimman ML, Real IO, Baleta SL. Philippine costs in oncology (PESO): describing the economic impact of cancer on Filipino cancer patients using the ASEAN costs in oncology study dataset. *Acta Med Philipp.* 2018;52. <https://doi.org/10.47895/amp.v52i2.418>.
 - 56 Rahman MM, Khanam R, Rahman M. Health care expenditure and health outcome nexus: new evidence from the SAARC-ASEAN region. *Global Health.* 2018;14:113.
 - 57 Sagarik D. Determinants of health expenditures in ASEAN region: theory and evidence. *Millennial Asia.* 2016;7:1–19.
 - 58 Kong Y-C, Sakti V-V, Sullivan R, Bhoo-Pathy N. Cancer and COVID-19: economic impact on households in Southeast Asia. *Ecancermedicalscience.* 2020;14. <https://doi.org/10.3332/ecancer.2020.1134>.
 - 59 Jazieh AR, Akbulut H, Curigliano G, et al. Impact of the COVID-19 pandemic on cancer care: a global collaborative study. *JCO Glob Oncol.* 2020:1428–1438.
 - 60 The Economist Intelligence Unit Limited. Cancer preparedness in Asia Pacific: progress towards universal cancer control. https://worldcancerinitiative.economist.com/pdf/Roche-cancer-preparedness-in-asia/Roche_Cancer_White_paper.pdf; 2020. Accessed January 12, 2022.
 - 61 Azizah A, Hashimah B, Nirmal K, et al. Malaysia national cancer registry report 2012–2016. [https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/2012-2016%20\(MNCRR\)/MNCRR_2012-2016_FINAL_\(PUBLISHED_2019\).pdf](https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/2012-2016%20(MNCRR)/MNCRR_2012-2016_FINAL_(PUBLISHED_2019).pdf); 2019. Accessed January 14, 2022.