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The comprehensive cancer management as an effort to improve the quality of cancer care in Indonesia towards a Golden Indonesia 2045

Ikhwan Rinaldi

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Authors' affiliations:
Faculty of Medicine, University of Indonesia, Jakarta

Corresponding author:
E-mail: *ikhwanrinaldi@gmail.com*

Abstract

Cancer remains a major public health challenge in Indonesia, with increasing incidence and mortality rates. GLOBOCAN 2020 data highlights a growing cancer burden, particularly in developing countries, where late-stage diagnoses and treatment delays contribute to poor outcomes. Breast cancer is the most prevalent cancer in Indonesia, followed by cervical cancer, leukemia, and colorectal cancer. Despite national efforts, a high proportion of patients present at advanced stages, leading to decreased survival rates and increased healthcare costs. This study examines the factors influencing cancer diagnosis and treatment delays in Indonesia. A comprehensive literature review was conducted, analyzing hospital-based cancer registry data, epidemiological trends, and healthcare system challenges. Key barriers include limited screening coverage, inadequate public awareness, reliance on alternative therapies, and systemic delays in referrals, diagnostics, and treatment initiation. Additionally, disparities in access to advanced cancer care exacerbate the issue. Findings emphasize the need for a comprehensive cancer management approach, integrating early detection programs, precision medicine, and multidisciplinary care. Strengthening primary healthcare services, enhancing oncology education for healthcare professionals, and developing comprehensive cancer centers are crucial steps. National cancer control policies must align with global strategies to improve patient outcomes. As Indonesia approaches its "Golden Indonesia 2045" vision, it is essential to prioritize cancer prevention and treatment. Addressing healthcare system inefficiencies, fostering collaborations between government, academia, and private sectors, and ensuring equitable access to quality cancer care will be pivotal in reducing the cancer burden and improving survival rates.

Keywords: *comprehensive cancer management, early detection, Golden Indonesia 2045, multidisciplinary, precision medicine*

Abstrak

Kanker tetap menjadi tantangan utama dalam kesehatan masyarakat di Indonesia, dengan angka kejadian dan mortalitas yang terus meningkat. Data GLOBOCAN 2020 menunjukkan peningkatan beban kanker, terutama di negara berkembang, di mana diagnosis pada stadium lanjut dan keterlambatan pengobatan berkontribusi terhadap luaran yang buruk. Kanker payudara merupakan jenis kanker paling umum di Indonesia, diikuti oleh kanker serviks, leukemia, dan kanker kolorektal. Meskipun berbagai upaya nasional telah dilakukan, proporsi pasien yang terdiagnosis pada stadium lanjut masih tinggi, yang berdampak pada penurunan angka ketahanan hidup dan peningkatan biaya pelayanan kesehatan. Studi ini menganalisis faktor-faktor yang mempengaruhi keterlambatan diagnosis dan pengobatan kanker di Indonesia melalui kajian literatur yang komprehensif, mencakup data registri kanker berbasis rumah sakit, tren epidemiologi, serta tantangan dalam sistem layanan kesehatan. Hambatan utama yang diidentifikasi meliputi keterbatasan cakupan skrining, rendahnya kesadaran masyarakat, ketergantungan pada terapi alternatif, serta keterlambatan sistemik dalam proses rujukan, diagnostik, dan inisiasi pengobatan. Selain itu, ketimpangan akses terhadap layanan kanker tingkat lanjut memperburuk permasalahan yang ada. Hasil studi ini menekankan pentingnya pendekatan manajemen kanker yang komprehensif melalui integrasi program deteksi dini, pengobatan berbasis presisi, dan perawatan multidisiplin. Penguatan layanan kesehatan primer, peningkatan pendidikan onkologi bagi tenaga medis, serta pengembangan pusat kanker terpadu merupakan langkah strategis yang perlu diimplementasikan. Kebijakan pengendalian kanker nasional harus selaras dengan strategi global guna meningkatkan luaran klinis pasien. Seiring dengan visi "Indonesia Emas 2045", pencegahan dan pengobatan kanker harus menjadi prioritas utama. Upaya perbaikan efisiensi sistem kesehatan, penguatan kolaborasi antara pemerintah, akademisi, dan sektor swasta, serta penyediaan akses yang merata terhadap layanan kanker berkualitas menjadi langkah krusial dalam menurunkan beban kanker dan meningkatkan angka ketahanan hidup pasien di Indonesia.

Kata kunci: *deteksi dini, Indonesia Emas 2045, manajemen kanker komprehensif, multidisiplin, pengobatan berbasis presisi*

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GLOBOCAN 2020 data estimates there were 19.3 million new cancer cases and nearly 10 million cancer deaths in 2020. Female breast cancer ranks first as the most common cancer, with an estimated 2.3 million new cases (11.7%), followed by lung cancer (11.4%), colorectal cancer (10%), prostate cancer (7.3%), and stomach cancer (5.6%). Lung cancer remains the leading cause of cancer death, with an estimated 1.8 million deaths (18%), followed by colorectal cancer (9.4%), liver cancer (8.3%), stomach cancer (7.8%), and female breast cancer (6.9%). The mortality rate of female breast cancer and cervical cancer is higher in developing countries (approximately 15 deaths per 100,000 population) compared to developed countries (12.8 deaths per 100,000 population, respectively). The global cancer burden is projected to reach 28.4 million cases by 2040, marking a 47% increase from 2020, with a larger increase in developing countries (64%-95%) compared to developed countries (32%-56%). This is attributed to demographic changes and may be further exacerbated by an increase in risk factors associated with globalization and economic growth.[1]

Research on the incidence, mortality, burden, and trends of early-onset cancer (cancer occurring in individuals under 50 years old) globally shows that the incidence of early-onset cancer increased by 79.1% from 1990 to 2019. During the same period, there was also a 27.7% increase in deaths from early-onset cancer. In 2019, breast cancer in individuals under 50 resulted in a loss of 348.1 years per 100,000 people in terms of healthy life expectancy, while trachea, bronchus, and lung cancers in individuals under 50 caused a loss of 167.6 years per 100,000 people. The greater the loss of time, the heavier the disease burden. Breast cancer poses a higher disease burden than cancers of the trachea, bronchus, and lungs.[2]

Another study indicates that by 2030, there will be a 31% increase in the incidence of early-onset cancer, accompanied by a 21% rise in deaths from early-onset cancer. The increase in early-onset cancer morbidity is associated with higher Sociodemographic Index (SDI) levels, while mortality rates significantly decline as SDI increases from 0.7 to 1. The SDI reflects economic conditions, assessed through per capita income; educational conditions, measured by the proportion of the population completing secondary and higher education; and the birth rate of countries worldwide. This index is expressed on a scale from 0 to 1, with higher SDI values indicating better socioeconomic development, which has a strong impact on the health conditions of a country's population.[2]

Asia is a densely populated and diverse region, housing 60% of the global population. Due to continuous socioeconomic development and improvements in healthcare services, life expectancy in Asia has significantly increased. It is projected that the proportion of individuals aged 60 and above could reach 25% by 2050. This demographic shift is anticipated to substantially increase the cancer burden in Asian countries. Furthermore, lifestyle transitions such as smoking, alcohol consumption, dietary patterns, diabetes, and lipid disorders—driven by urbanization, Westernization, and globalization—may have contributed to the evolving cancer burden in Asia.[3]

In 2020, the cancer incidence in Asia was recorded at 169.1 cases per 100,000 individuals, accounting for 49.3% of the global cancer incidence burden. The most prevalent cancers were lung cancer (13.8%), breast cancer (10.8%), and colorectal cancer (10.6%). Cancer mortality in Asia was 101.6 deaths per 100,000 individuals, representing 58.3% of global cancer-related deaths, with lung cancer (19.2%), liver cancer (10.5%), and stomach cancer (9.9%) being the leading causes of cancer death. The incidence of cancer has notably risen in the female population, particularly in South Korea, with an average annual percentage change of 5.73%. Additionally, cancer incidence has increased in populations under 40 years of age, with the highest rise observed in South Korea, where the average annual percentage change was 8.42% in women and 5.28% in men. Nevertheless, overall cancer mortality has declined. This study concludes that there is a substantial burden of cancer incidence and mortality in Asia. Although mortality rates have decreased, the incidence has increased, especially among women and younger populations. The study suggests further investigation to examine the potential causes behind these epidemiological trends.[3]

Indonesia also conducts hospital-based cancer registry studies. A study at a hospital in Makassar, published in 2022, documented cancer registry data from January 2002 to December 2019. The most frequent cancer types were breast cancer (1008 cases, 12.9%), leukemia (683 cases, 8.7%), and cervical cancer (631 cases, 8.1%), followed by colorectal cancer (551 cases, 7%) and ovarian cancer (496 cases, 6.3%). Leukemia was the leading cause of cancer death (219 cases, 12.7%), followed by breast cancer (198 cases, 11.4%) and colorectal cancer (147 cases, 8.5%). Cancer was more frequently diagnosed in women (4485 cases, 57.3%) compared to men (3339 cases, 42.7%). The youngest cancer patient was 6 months old, and the oldest was 93 years old. Most patients were aged 40-49 years (2035 cases, 26%), followed by 50-59 years (1962 cases, 25.1%), 60 years and above (1653 cases, 21.1%), 30-39 years (935 cases, 12%), under 20 years (633 cases, 8.1%), and 20-29 years (606 cases, 7.7%).[4]

Similarly, a study at a hospital in Jakarta using 2013 patient data found that, out of 4915 cancer cases, women (2963 cases, 60.26%) outnumbered men (1952 cases, 39.74%). The most common cancers were breast cancer (13.33%), cervical cancer (12.55%), and cancers of the hematopoietic and reticuloendothelial systems (8.97%). Among women, cancer was most frequent between ages 44-54 (889 cases, 30%) and least frequent under age 24 (9.79%). Among men, cancer was most common between ages 55-64 (422 cases, 21.64%) and least common under age 24 (18.85%).[5] Another study using 2008-2012 data from a hospital in Jakarta showed that the most common cancers were cervical cancer (2878 cases, 15.8%), breast cancer (2459 cases, 13.5%), hematopoietic and reticuloendothelial system cancers (1422 cases, 7.8%), nasopharyngeal cancer (1338 cases, 7.4%), and lymphatic cancer (1104 cases, 6.1%). The majority of patients were over 39 years old (12,483 cases, 68.3%), while the rest were aged 20-39 (3971 cases, 21.8%) and 0-19 (1807 cases, 9.9%).[6]

Research in Indonesia produces conclusions similar to the global GLOBOCAN 2020 data and studies in Asia, indicating that breast cancer is the most common cancer. Women are more frequently affected than men, and there is a trend of cancer occurring at younger ages, particularly under 50 years. However, there are some differences from Asian and global data, notably that lung cancer does not appear as the most frequent cancer or the leading cause of death in Indonesia, at least in the hospitals studied in Makassar and Jakarta. In Indonesia, the most common cancers are breast cancer, cervical cancer, leukemia, and colorectal cancer, while the leading causes of cancer death are leukemia, breast cancer, and colorectal cancer.

In addition to the increasing incidence of cancer in younger age groups, a study from a hospital in Jakarta revealed that most breast cancer patients presented at the hospital in advanced stages, with 19.9% in stage IV and 13.13% in stage IIIB. Although staging information for 283 patients was unavailable, researchers concluded that a majority of breast cancer cases presented at the hospital in late stages. A similar trend was observed in cervical cancer patients, where most cases presented in locally advanced stages (36.63%). A meta-analysis also showed that cervical cancer is more frequently diagnosed at advanced stages. Data from 25 studies across three global regions, involving 53,233 participants, indicated that the estimated pooled global prevalence of advanced-stage cervical cancer was 60.66%. Subgroup analysis revealed that the prevalence of advanced-stage cervical cancer was 62.6% in Africa, 46.51% in Asia, and 50.16% in North America.[7]

This situation inevitably affects the survival rates of cancer patients. One-year survival rates differ significantly between patients diagnosed at early versus advanced stages. For example, colorectal cancer has a one-year survival rate of 97.7% when detected early, but this drops to 43.9% when detected at an advanced stage. Similarly, lung cancer patients have a one-year survival rate of 87.3% at early stages, which decreases to 18.7% at advanced stages. In the U.S., Caucasians are generally diagnosed at stage I-II, whereas African-Americans are often diagnosed at stage IIB or later. Socioeconomic factors play a critical role, as patients often seek medical treatment only after the disease has progressed significantly. A meta-analysis found that education level and residence location are significant factors influencing the occurrence of advanced-stage cervical cancer. Other reasons for delayed cancer diagnosis and treatment include misinformation about cancer, the lack of screening capabilities in all healthcare facilities, and a reliance on alternative medicine.[8,9]

Another issue in Indonesia is delayed cancer treatment. A study conducted at a hospital in Jakarta from May to August 2015 on 294 outpatient cancer patients in the radiation oncology department revealed significant treatment delays. Among the patients, 86% experienced delays in receiving treatment. Delayed treatment was observed in 153 patients, 43% of whom had a history of using alternative therapies. Advanced age, low education levels, and a history of alternative medicine use were statistically significant factors associated with delayed treatment, with p-values of 0.047, 0.047, and <0.001, respectively. Additionally, 214 patients experienced delays caused by service providers, with proportions of 9%, 36%, and 80% for physician-related delays, diagnostic system delays, and treatment system delays, respectively. All types of service provider delays were statistically significant in relation to treatment delays. [10]

Service provider delays are classified into physician delays and system delays. Physician delays are defined as a referral delay of more than 30 days from the first medical consultation to a specialist or healthcare provider at a referral hospital capable of performing diagnostic procedures. System delays are further divided into diagnostic system delays (more than 30 days from the first visit to a specialist or referral hospital to cancer diagnosis) and treatment system delays (more than 30 days from diagnosis to the initiation of definitive treatment). It is estimated that 47% of cervical cancer patients experience treatment delays, with stage IIIB being the most common stage. Treatment delays occurred in 48.3% of breast cancer patients diagnosed with stage IIIB, and in nasopharyngeal cancer patients, delays were most common in stage IVB, followed by stage III.[10] Thus, most treatment delays occur in patients with advanced-stage cancer. Research indicates that a 12-week treatment delay negatively affects prognosis,[11] while another study in Asia found that treatment delays of more than six months lead to worse disease-free survival.[12]

Delayed breast cancer screening (when patients seek diagnosis after the recommended time, often when the cancer is already in stage III) and the factors contributing to such delays have been studied in a hospital in Riau in 2016. This research found that 60.6% of women (123 patients) delayed their breast cancer screenings. Women with insufficient knowledge were 3.11 times more likely to experience delays compared to those with adequate knowledge. Other factors included low income, which increased the likelihood of delays by 2.852 times, and the distance to healthcare facilities, where patients living farther from healthcare services were 2.466 times more likely to delay screenings compared to those living closer. Additionally, the absence of symptoms increased the likelihood of delay by 2.324 times compared to patients who experienced specific symptoms.[13]

The delay in cancer treatment in Indonesia is also attributed to the use of complementary and alternative therapies, which are common among the population. A qualitative study conducted in two hospitals in North Sumatra on 15 advanced-stage cancer patients from July to December 2013 revealed that patients often preferred complementary and alternative therapies over medical treatment, viewed medical treatment as a last resort, or integrated complementary therapies as supportive care alongside medical treatment. External influences, religious beliefs, and limited involvement of primary healthcare services were also factors in these decisions. [14]

Advanced-stage cancer not only worsens patient prognosis and survival rates but also significantly increases healthcare costs. A study involving an insurance institution found that from 2016-2020, 20,422 members were diagnosed with cancers such as breast cancer, cervical cancer, colorectal cancer, lung cancer, ovarian cancer, or prostate cancer. Average healthcare costs increased annually and cumulatively up to four years post-diagnosis, with the most dramatic cost increases occurring in stage IV cancers. For most cancer types, such as cervical and lung cancer, costs remained relatively stable or fluctuated only slightly across different stages, while for ovarian cancer, costs in stages III and IV rose sharply compared to stages I and II. Annual and cumulative healthcare costs up to four years after diagnosis were significantly higher for members diagnosed in later stages than for those diagnosed in earlier stages. This highlights the importance of early cancer detection to reduce both annual and cumulative healthcare costs. [15]

Higher costs in later cancer stages are closely tied to advancements in cancer treatment. In recent years, newer drugs have emerged as treatment options, especially for advanced-stage cancers. These newer treatments fall under the categories of targeted therapies and immunotherapies, which are chosen based on specific diagnostic tests that predict the success of the treatment. Advanced-stage adenocarcinoma of the lung requires testing for PDL-1, EGFR mutations, and ALK mutations to determine the appropriate therapy. PDL-1 positivity greater than 50% indicates eligibility for immunotherapy, such as pembrolizumab. Positive EGFR mutations in exon 19 and 21 make patients eligible for anti-EGFR drugs such as osimertinib, gefitinib, erlotinib, and afatinib. Positive ALK mutations indicate eligibility for anti-ALK drugs such as brigatinib, alectinib, entrectinib, and ceritinib. If all these markers are negative, chemotherapy remains the treatment of choice.[16]

In advanced breast cancer with triple-negative receptor status (negative estrogen receptor, negative progesterone receptor, and negative HER-2 receptor), the BRCA-1 and BRCA-2 genes, as well as PDL-1, have been introduced as determinants for treatment options. For patients who test positive for BRCA-1 and BRCA-2 mutations, treatment options include anti-BRCA therapies, such as Olaparib (a PARP-1 inhibitor). For patients with PDL-1 scores greater than 1%, immunotherapy can be administered in conjunction with chemotherapy, such as atezolizumab with nab-paclitaxel or pembrolizumab with any chemotherapy regimen. If both markers are negative, the treatment choice is chemotherapy. These treatment guidelines are supported by various cancer treatment protocols worldwide based on reliable scientific evidence. Immunotherapy works by activating the patient's immune cells to attack cancer cells, while targeted therapy involves drugs that inhibit specific pathways involved in cancer development. For example, in lung cancer driven by EGFR mutations, targeted therapy aims to block these mutations effectively.[17-20]

Immunotherapy and targeted therapy require specific testing to determine the presence of biomarkers, ensuring appropriate drug administration. The accuracy of treatment and testing has given rise to the term Precision Medicine. Precision medicine is a therapeutic and disease prevention approach that takes into account the variability in genes, environment, and lifestyle of each individual. Although relatively new, the concept of precision medicine has existed since the classification and matching of blood donors with patients in need of transfusions. This concept has reduced the risk of complications and improved outcomes.[21]

In the era of precision medicine, molecular testing plays a crucial role. A literature review I conducted on Chronic Myeloid Leukemia (CML) highlighted the necessity of testing for BCR-ABL1 mutations in CML patients, as these mutations are the most common cause of resistance to tyrosine kinase inhibitors. Tyrosine kinase inhibitors represent the first-line therapy for CML patients, except during pregnancy. Patients resistant to tyrosine kinase inhibitors are offered alternative medications that remain effective for their specific mutations. For example, patients with the T315I mutation are recommended to receive ponatinib alone, as they are resistant to other tyrosine kinase inhibitors. Patients with mutations Y253H, E255V/K, and F359V/I/C can be treated with dasatinib, bosutinib, or ponatinib. [22]

Molecular testing also plays a role in determining treatment outcomes for patients. I previously researched the relationship between FLT3-ITD mutations and one-year survival rates in acute myeloid leukemia (AML) patients in Indonesia. In that study, 11 out of 51 patients had FLT3-ITD mutations. No correlation was found between FLT3-ITD mutations and one-year survival, indicating that the one-year survival of AML patients is not influenced by FLT3-ITD mutations. These findings align with another study conducted on 320 patients in China and 100 patients in Italy, which also found that one-year survival in AML patients was unaffected by FLT3-ITD mutations. Prior to this research, systematic reviews and meta-analyses I conducted with my team suggested that FLT3-ITD mutations adversely impact the survival of AML patients.[23] The differing results between these two studies may be due to racial influences on the prognosis of AML patients. Homogeneous cytogenetic cohort studies have indicated that race does indeed affect prognosis; Caucasian patients generally have better survival outcomes compared to African and Hispanic patients.[24]

It is undeniable that precision medicine comes at a high cost. Testing for genetic and protein alterations can be expensive, especially when numerous changes are assessed, and insurance may not cover all tests. Genetic mutation testing can increase the overall costs of cancer management. In other words, early detection is often less expensive than conducting precision testing. For patients needing the best treatment options, specific targeted therapies or immunotherapies based on genetic or protein alterations can be costly to obtain. [21]

Based on data from BPJS Kesehatan from 2019 to 2021, cancer is one of the eight diseases with the largest funding burden in Indonesia, ranking second. The number of cancer cases peaked in 2019, with a total of 2,743,858 cases and funding reaching Rp 4.12 trillion. In 2020, the number of cancer cases decreased to 2,553,033, with total funding of Rp 3.58 trillion. However, the number of cases rose again in 2021 to 2,595,520, with funding amounting to Rp 3.5 trillion. The total funding for cancer during this period reached Rp 11.21 trillion, which constitutes 18.26% of the total BPJS Kesehatan funds.[25]

A study attempted to compare the relationship between health expenditure and cancer outcomes in various countries. Health expenditure is measured by health expenditure per capita (HEpc), which is the total expenditure of a country on health, both from the public and private sectors, divided by the population. Cancer outcomes are assessed using site-standardized proxy relative survival (SS-RS), which reflects the age-standardized cancer mortality/incidence ratio. The higher the SS-RS value, the lower the mortality rate due to cancer. The three countries with the highest SS-RS values are Korea, Australia, and Norway, all of which have high HEpc. The study estimated that to achieve SS-RS values of 0.35, 0.45, and 0.55, health budgets of US$328, US$1260, and US$4840, respectively, would be needed, or approximately 5 million, 19.5 million, and 75 million rupiah.[26,27] Indonesia, with an HEpc of US$132.96 in 2020 (around 2 million rupiah), still faces significant challenges. To achieve an SS-RS value of 0.55, each individual in Indonesia would need to increase their health budget by 73 million rupiah.[28] The research concluded that countries with lower-middle incomes, including Indonesia, need to consider increasing health budgets to improve cancer survival rates.[29]

The high proportion of advanced-stage cancer patients coming to hospitals may be related to the low coverage of early detection, particularly for breast and cervical cancer. The coverage of early detection for cervical cancer (Visual Inspection with Acetic Acid/IVA) and breast cancer (Clinical Breast Examination/SADANIS) in 2017 was only 3,038,296, or about 8.1%.[30] This figure is significantly lower than that in the United States, which achieved 57.1% for breast cancer, 39% for cervical cancer, and 36.3% for prostate cancer.[31] Early detection plays a crucial role in reducing the cancer burden. A study in the UK showed that routine early detection of cervical cancer can reduce the incidence of stage 1A cervical cancer by 67% and advanced cervical cancer by 95%. In 2013, it was estimated that early detection of cervical cancer in the UK could prevent 70% of cervical cancer deaths across all ages. If everyone underwent regular early detection, up to 83% of cervical cancer deaths could be prevented.[32]

Another study on national cancer screening programs in Asia indicates that South Korea is one of the countries that has successfully reduced the incidence of cervical cancer through the implementation of a national cancer screening program. The national cervical cancer screening program in South Korea has been in place since 1999. By 2015, the incidence of cervical cancer decreased from 16.3 cases per 100,000 population to 9.1 cases per 100,000 population. This national cancer screening program is accessible to recipients of Medical Aid and participants in the National Health Insurance scheme. South Korea has a single public health insurance system with universal coverage, operated by the National Health Insurance Service (NHIS). The Medical Aid program is designed for individuals with low income who are unable to afford healthcare services. Currently, South Korea's national cancer screening program provides screening for gastric, liver, colorectal, breast, cervical, and lung cancers. The national cervical cancer screening program offers free cytology screening every two years. The target population for cervical cancer screening was women aged 30 and above until 2015; however, in 2016, it was expanded to include women aged 20 and above.[33]

The increasing trend of cancer occurrence in individuals under 50 years of age, particularly among females, along with the high proportion of cancer diagnosed at advanced stages, poses a significant threat to the world, especially Indonesia, which is projected to reach its demographic bonus peak by 2045. The demographic bonus refers to the rise in the population of productive age (16-65 years) in a country, accompanied by a decline in birth and death rates. As of June 2022, Indonesia's population reached 275.36 million, of which 190.83 million (69.3%) are classified as productive age, 67.16 million (24.39%) as non-productive age, and 17.38 million (6.31%) as elderly. From 2020 to 2030, Indonesia will experience a demographic bonus, with the peak of the productive age population expected to coincide with Indonesia's 100th anniversary in 2045. This condition is referred to as "Indonesia Gold 2045." Consequently, preparations must be made to prevent potential disasters, which include enhancing the quality of the population through health and education interventions.[34,35]

The projected peak of the demographic bonus in 2045 (Indonesia Gold 2045) may increase the cancer burden, given the global trend of rising early-onset cancer. Efforts are needed to prevent such possibilities. In fact, approximately one-third to one-half of cancer cases have the potential to be prevented. This proportion is expected to continue rising with a better understanding of cancer risk factors and the development of cancer prevention interventions.[36]

The first crucial step in cancer prevention efforts is education. Education serves as an independent protective factor that supports health. Education delivered in comfortable settings for the community (e.g., community centers or schools) and in easily understandable language plays a vital role in cancer prevention. The primary goal of education is to help the community understand cancer, particularly regarding cancer prevention closely related to cancer risk factors.[37]

Primary Health Care Facilities (PHCF) serve as the frontline in cancer prevention through promotional and preventive efforts. Healthcare providers working in PHCF need to be equipped with adequate knowledge regarding oncology to provide effective education to the community. However, a study in the UK analyzing the learning experiences of medical students in oncology indicated that medical students' satisfaction with the quality and quantity of oncology teaching during their medical education remains low.[38] A survey conducted among final-year medical students in Australia and New Zealand revealed that less than half of the students felt confident in conducting anamnesis or physical examinations of cancer patients.[39] Other research in Canada showed that oncology ranked as the least well-taught specialty during medical education according to both medical students and faculty members.[40] No similar studies have been conducted in Indonesia, presenting an opportunity for Indonesian medical education researchers to explore this area. Nonetheless, we must anticipate such conditions arising in Indonesia.

One study indicated that medical students who frequently have clinical exposure to cancer cases show improved competence in cancer prevention counseling.[41] Another study demonstrated that medical students' confidence in conducting cancer prevention counseling can be enhanced by watching counseling recordings and participating in role-playing exercises related to cancer prevention, accompanied by peer feedback.[42] Research conducted on medical students in Australia and other countries indicated that those who adopted healthy lifestyle behaviors during their medical education found it easier to counsel patients on similar preventive measures.[43-45] From these studies, it is evident that frequent clinical exposure and various oncology learning methods can enhance medical students' understanding of cancer. The adoption of healthy lifestyle behaviors during medical education plays a critical role in efforts to educate the community about cancer prevention.

Another important point regarding cancer that healthcare professionals need to understand relates to early detection. As previously mentioned, early detection plays a crucial role in cancer control efforts in many countries. Mammography, breast ultrasound, and self-breast examination, commonly known as SADARI, are some of the screening modalities for breast cancer. Self-breast examination is very easy to perform and can be taught by healthcare professionals in Primary Health Care Facilities (PHCF) to the community. Early detection of cervical cancer can be conducted through IVA (Visual Inspection with Acetic Acid) or Pap Smear examinations at PHCF.[46] However, for certain types of cancer, such as lung cancer that requires low-dose lung computed tomography (LDCT) for early detection, or colorectal cancer that necessitates fecal occult blood tests (FOBT) for early detection, these examinations cannot be performed at PHCF. Nevertheless, healthcare professionals play a vital role in explaining these modalities before ultimately referring patients to Advanced Health Care Facilities (AHCF). Therefore, understanding early detection methods is essential for healthcare professionals, particularly those working in PHCF.

Studies indicate that patients who understand their disease and the treatments they will receive are more compliant with therapy, ultimately leading to better treatment outcomes.[47] Therefore, doctors have an important role in providing education related to cancer, especially regarding treatment options that patients can accept. Doctors who can explain cancer treatment methods to patients will enhance their understanding of cancer therapies. Although cancer treatments are carried out in AHCF, healthcare professionals in PHCF should be able to explain evidence-based treatments so that cancer patients are aware of therapies whose efficacy and safety have been tested. Thus, strengthening oncology education becomes crucial.

Enhancements in oncology education also need to be made at the residency stage. A survey conducted in Canada indicated that 63% of internal medicine residents felt that oncology education was insufficient. They reported feeling unprepared to handle diseases related to oncology after completing their oncology rotation. Additionally, 82% of oncologists in Canada believe that oncology education during the internal medicine residency is still lacking. They also mentioned that diseases related to oncology are taught less frequently than those unrelated to oncology. These oncologists suggested that clear learning objectives and education through books or the internet could be beneficial for learners.[48]

Another study showed that about one-third of internal medicine residents who completed a hematology-oncology rotation at comprehensive cancer centers reported an increase in oncology knowledge. The study also stated that most internal medicine residents developed an interest in the field of hematology-oncology after their clinical rotation.[49] However, the opposite was found in another study, which indicated that internal medicine residents experienced a decline in interest in hematology-oncology after their rotation in inpatient hematology-oncology services.[50] It seems that residents' perceptions of the oncology learning experience are influenced by the learning environment.[51]

Strengthening oncology education at the level of general practitioners and residents can be achieved by ensuring that learners possess sufficient competencies to practice clinically after graduation. To ensure that learners have adequate competencies, adequate assessment instruments are needed. Entrustable Professional Activities (EPA) are one of the instruments that can be used to evaluate learners' competencies in clinical work environments. EPA can be defined as professional practices that can be entrusted to learners once they are considered capable of performing entrusted professional practices without supervision. EPA encompasses a combination of various competencies, such as patient care, interpersonal communication, medical knowledge, systems-based practice, practice-based learning and improvement, and professionalism. According to this concept, there needs to be 'inherent' supervision over students or residents in achieving a trustworthy professional activity in the clinical learning environment. An EPA is something that can be performed, observed, and measured independently in both process and outcomes. Through EPA, competency assessments of learners can be conducted. Activities or professional practices that can be categorized as EPA can be determined through review and discussion with experts in the relevant field. Established EPAs will still need to be validated for application.[52]

A study found that Entrustable Professional Activities (EPA) can be effectively applied in the clinical education of medical students. EPAs are said to have the potential to optimize the assessment of medical students' competencies.[53] Education on cancer prevention, early detection, and treatment for patients could be included as one of the EPAs in medical education. In the field of oncology education at the residency stage, the EPAs could involve planning patient management, monitoring patients undergoing cancer treatment, prescribing systemic therapy, discussing health issues with patients, preparing for potential oncology emergencies, coordinating healthcare services for patients, and documenting various cancer services provided to patients in medical records. Each of these EPAs includes milestones that can serve as guidance for learners.[54] My colleagues and I from the Department of Internal Medicine, the Internal Medicine College, and the Faculty of Medicine at Universitas Indonesia conducted a study to determine EPAs for internal medicine residents. This study identified 28 EPAs.[55]

Cancer is caused by various risk factors, which can be categorized into non-modifiable and modifiable risk factors. Non-modifiable risk factors include genetics, age, sex, and race.[56,57] A study revealed that the primary modifiable risk factors contributing to the significant years of healthy life lost per 100,000 population for patients under 50 years old with various cancers are modifiable risk factors. For breast cancer, alcohol consumption can increase the risk by 4.5%, smoking can increase the risk by 4.4%, high red meat consumption can increase the risk by 2.9%, physical inactivity can increase the risk by 0.6%, and high fasting blood sugar can increase the risk by 2.6%. Conversely, for tracheal, bronchial, and lung cancers in patients under 50 years old, smoking can increase the risk by 41.4%, infrequent fruit consumption can increase the risk by 4.4%, and high fasting blood sugar can increase the risk by 3.2%.[2] A meta-analysis indicated that the risk factors influencing colorectal cancer occurring in those under 50 years old include inflammatory bowel disease, which increases the risk by 4.43 times, obesity increasing the risk by 1.52 times, metabolic syndrome increasing the risk by 1.29 times, smoking increasing the risk by 1.44 times, alcohol consumption increasing the risk by 1.41 times, a sedentary lifestyle increasing the risk by 1.24 times, processed meat consumption increasing the risk by 1.53 times, and sugary beverage consumption increasing the risk by 1.55 times.[58]

The World Health Organization (WHO) recommends measures to reduce risk factors through policy-making and prevention programs. Cost-effective policies should be implemented to reduce the burden of cancer, such as raising taxes on tobacco and alcohol;

eliminating exposure to tobacco smoke or implementing tobacco marketing strategies; restricting unhealthy food and beverage marketing to children; ensuring quality public open spaces with adequate infrastructure for physical activity; reducing air pollution; and providing human papillomavirus (HPV) vaccines. Research on the causes of cancer in humans and carcinogenesis should also be pursued.[36]

The WHO also recommends that each country develop policies and plans for the prevention and control of non-communicable diseases, including national cancer control plans that focus on equity and access.[36] Many countries around the world already have national cancer control programs. These programs are derivatives of national cancer control plans aimed at addressing the cancer burden in a country. As of 2000, based on WHO estimates, 48% of countries had national plans for the control of non-communicable diseases, including cancer, or national cancer control plans. This estimate increased to 87% by 2015. According to data from the International Cancer Control Partnership (ICCP), in 2013, there were 91 national cancer control plans from 42 countries available on the ICCP website. This number increased to 115 from 50 countries in 2015 and 224 from 93 countries in 2018.[59]

A study analyzing national cancer control plans worldwide found that countries with national cancer control plans have more comprehensive, coherent, and consistent national plans compared to countries that only have national non-communicable disease control plans. Countries with national cancer control plans focus on more comprehensive cancer control components than those that only address non-communicable disease control. Generally, countries with only non-communicable disease control plans focus on managing risk factors related to non-communicable diseases and cancer, without encompassing all aspects of comprehensive cancer management. National cancer control plans can play a crucial role in determining necessary policies to enhance the capacity and coverage of cancer management, palliative care, and research compared to non-communicable disease control plans. The implementation of national cancer control plans is more effective in addressing the national cancer burden than the cancer control measures included in non-communicable disease control plans. This is suspected to be due to a greater commitment from the government in countries with national cancer control plans compared to those with only non-communicable disease control plans.[59]

National cancer control plans are an integral part of comprehensive cancer centers. The World Health Organization (WHO) recommends that every country have a national cancer control plan that includes prevention, screening, diagnosis, treatment, survivorship, and palliative care. Comprehensive cancer centers have the potential to serve as focal points in national cancer control and influence the development of health systems and cancer management.[60]

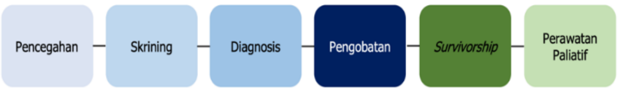

Figure 1. Components of the Cancer Control Plan[60]

(Adapted and modified from Gospodarowicz M, Trypuc J, D'Cruz A, Khader J, Omar S, Knaul F. Cancer Services and the Comprehensive Cancer Center. Disease Control Priorities, Third Edition (Volume 3))

A comprehensive cancer center serves as a central force for the national cancer control plan and is tasked with developing innovative approaches to cancer prevention, diagnosis, and treatment. This can be achieved through basic and clinical research, patient care, training new clinicians and scientists, and community engagement, as well as enhancing education and training. The excellence of a cancer center is often correlated with the strength of its educational and training programs. Cancer management in this era requires a multidisciplinary approach, necessitating that the education and training offered encompass various fields. Improving the quality of education and training, especially in oncology as a significant support for comprehensive cancer centers, is expected to enhance the quality of cancer prevention and management for patients.[61]

In implementing education and training, most comprehensive cancer centers are affiliated with university medical schools. In this affiliation, the executives of the comprehensive cancer center must establish strong collaboration with colleagues in hospitals, clinical practices, medical faculties, and other health science experts. This cooperation can maximize funding from various sources, including national and local grants, institutional funds, private donations, and industry contributions.[62]

Cancer patient care and related research are closely linked to the academic support of the faculty and career advancements that result in ongoing research in the field of cancer specialization. Major lecture programs featuring internal or external speakers can educate staff and students about new scientific discoveries. Comprehensive cancer centers also form partnerships with communities, governments, and industries to develop community outreach programs aimed at improving health literacy, establishing early detection programs, and raising funds for cancer research.[62] Thus, comprehensive cancer centers are inseparable from universities. Both hospitals and universities play crucial roles in education, so the loss of one component can impact educational outcomes. As previously mentioned, residents in internal medicine reported a better learning experience in oncology when they studied at comprehensive cancer centers compared to solely at inpatient cancer services.[49,50] The Faculty of Medicine at Universitas Indonesia (FKUI), Dharmais Cancer Hospital, and Dr. Cipto Mangunkusumo Hospital (RSCM) hold significant potential to serve as comprehensive cancer centers as described above. The Faculty of Medicine, through its programs involved in cancer control from preventive to palliative care, needs to collaborate with hospitals to enhance competencies in oncology through education and training within the hospitals. Referring to the recommended comprehensive cancer center model, it seems that education and training in oncology cannot be separated from the academic role of a medical faculty.

The structure of a comprehensive cancer center is derived from its mission and the framework necessary to support that mission. The primary mission of a comprehensive cancer center is to reduce cancer incidence and improve the quality of life and survival rates of patients with malignant diseases. There are three main areas in cancer care: research, clinical care, and education, which collaborate to achieve these goals. Several interconnected departments are required to meet the objectives of the cancer center. Department heads may be filled by physicians, scientists, or administrators, depending on the focus of the department. Department leaders report to the director of the comprehensive cancer center, who is assisted by a deputy director and a hospital advisory board. The director of the comprehensive cancer center is typically a distinguished individual trained in a specific area of cancer research but possesses a vision for the broad research and clinical foundation required by the center. The responsibilities of the cancer center director include setting departmental goals, coordinating efforts between departments, recruiting and retaining scientific staff, securing national, state, and philanthropic funding, creating new programs, and monitoring the financial aspects of the center.[62]

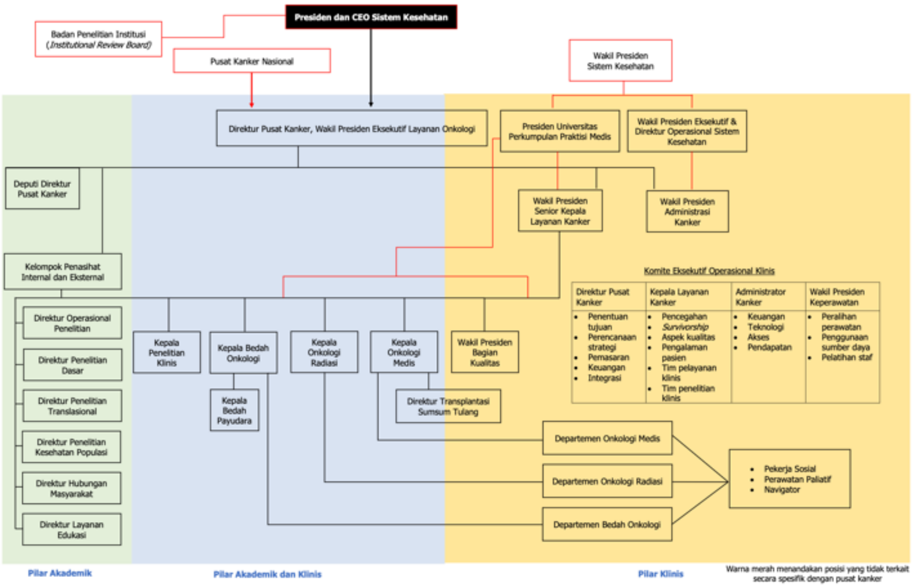

Figure 2. Framework of the Comprehensive Cancer Center[62]

(Adapted and modified from Aljurf M, Majhail NS, Koh MBC, Kharfan-Dabaja MA, Chao NJ. The Comprehensive Cancer Center)

Cancer patients require multidisciplinary care to achieve optimal outcomes. Therefore, clinicians involved in the oncology multidisciplinary team participate in direct patient care by establishing oncology diagnoses and providing appropriate management. The oncology multidisciplinary team may consist of medical hematology-oncology, radiation oncology, radiology, hematology, pathology, nuclear medicine, surgery, and nursing. This team will hold regular meetings, referred to as tumor board meetings, to discuss patients concerning key radiographic and pathological findings, diagnostic and/or therapeutic options, and the best management for each patient.[63]

Tumor board meetings typically begin with a presentation regarding the patient's history, including comorbid conditions, clinical, and psychological status, as well as clinical findings obtained prior to the meeting. Clinical staging will then be determined by each specialty, such as pathologists or radiologists, before agreeing on an optimal treatment plan. The average duration of these meetings is 76 minutes.[64]

A systematic review of colorectal multidisciplinary team meetings found that in the United States, these meetings significantly influence preoperative decision-making, such as staging methods and neoadjuvant treatment selection. Since the implementation of multidisciplinary meetings or tumor board meetings, there has been an improvement in postoperative mortality in Denmark. The systematic review concluded that multidisciplinary team meetings play a crucial role in enhancing patient care measures and should produce clear recommendations for each patient.[64]

A systematic review of 16 studies on the benefits of tumor board meetings for gastrointestinal cancer patients showed that tumor board meetings could alter diagnoses formulated by individual doctors in 18.4% to 26.9% of evaluated cases, with this finding noted in four studies. Two studies reported that tumor board meetings could accurately formulate diagnoses in 89% and 93.5% of evaluated cases; nine studies indicated that treatment plans changed in 23.0% to 41.7% of evaluated cases; and four studies found that the outcomes of discussions in tumor board meetings were implemented in 90% to 100% of evaluated cases.[65]

A study conducted in the UK aimed to assess the benefits of multidisciplinary oncology teams for colorectal cancer patient care. In this study, there were 310 patients, of which 176 were not treated by a multidisciplinary oncology team (as the team had not yet been established), and 134 were treated by the multidisciplinary oncology team. The results showed that the group treated by the multidisciplinary oncology team had a three-year survival rate of 66%, whereas the group not treated by the multidisciplinary oncology team had a three-year survival rate of 58%. This difference was statistically significant. The disparity may have arisen because, after the establishment of the multidisciplinary oncology team, there was an increase in the administration of adjuvant chemotherapy, which in turn improved the three-year survival rate of patients.[66]

The presence of a multidisciplinary oncology team also positively impacts patient safety. Studies have reported that the rate of medication errors in outpatient chemotherapy patients ranges from 3% to 19%, varying across different clinical practice sites.[67] Another study analyzing the impact of multidisciplinary teams indicated improvements in cancer diagnosis and treatment, leading to increased patient survival rates of over 50% in many developed countries, with figures now approaching 60% for long-term survival.[68]

The establishment of a well-functioning multidisciplinary oncology team is closely linked to interprofessional education at both undergraduate and postgraduate (specialist) levels. This education shapes healthcare professionals with expertise in their respective fields and the ability to collaborate with specialists from other disciplines. The benefits of interprofessional education have been systematically reviewed in Best Medical Education (BEME). Overall, learners responded positively to interprofessional education, their attitudes toward collaborative learning improved, and they gained the knowledge and skills necessary for collaborative practice. The review found that faculty development, facilitator preparation, reflection on learners' practices, and pedagogy play crucial roles in interprofessional learning. Additionally, relationships with the healthcare system, cost-effectiveness of services, and collaboration between institutions should also be considered when implementing interprofessional education.[69]

As previously mentioned, research in Asia indicates that while cancer mortality has decreased, its incidence has increased, suggesting a rise in the number of cancer survivors. In the United States, the number of cancer survivors rose from about 3 million in 1971 to 13.7 million in 2012, with projections estimating nearly 18 million survivors by 2022. The Institute of Medicine

(IOM) emphasizes the importance of policies that ensure access and coverage of health insurance for all aspects of cancer survivor care, including psychosocial services.[70]

A study in the Netherlands found an increase in consultations with primary care services among cancer patients diagnosed for 2 to 5 years compared to a control group of the same age and sex without cancer. The proportions for each type of cancer were 15% for colorectal cancer, 24% for breast cancer, and 33% for prostate cancer. Although a study in the U.S. showed a smaller increase in primary care utilization among breast cancer survivors (a 10% increase in the fourth year post-diagnosis; $P<0.05$), these results highlight the critical role of primary care in the management of cancer survivors.[70]

In addition to their role in cancer survivor care, primary care services are also vital in palliative care for cancer patients. It is estimated that there are 40 million individuals with terminal illnesses who require palliative care, yet 86% do not receive it, including 98% of children in low- to middle-income countries. Access to such care is often challenging because most patients prefer to remain in their homes and communities. Primary health services, being the closest to the community, are ideally positioned to deliver this care. Consequently, WHO recommends integrating palliative care into primary care services to enhance accessibility for the population.[71]

There is a need to reassess whether general practitioners, as frontline providers in primary care, are adequately prepared to deliver quality palliative and cancer survivor care. A study in the UK revealed that general practitioners recognized the importance of their roles in providing palliative care; however, they also felt a lack of experience and training, which hindered their ability to offer optimal service.[72] A systematic review also indicated that primary care physicians lacked sufficient skills and confidence to provide cancer survivor care.[73] This issue is tied to the limited education on palliative and survivor care that medical students receive. A study of final-year medical students in the Netherlands found that nearly 60% felt unprepared to deliver palliative care and lacked adequate knowledge in this area. One reason cited for this was the limitations within the medical education curriculum, with only 5.6% of respondents feeling they had received sufficient training in palliative care. This educational gap is particularly evident in the psychosocial and spiritual aspects of care.[74] Additionally, studies showed that final-year medical students and oncology fellows lacked sufficient knowledge regarding cancer survivor care, with final-year students answering only 56% of questions correctly, while oncology fellows performed slightly better with 67%.[75]

To effectively provide palliative care in primary services, there needs to be better integration of palliative and survivor care into the medical education curriculum, alongside training for healthcare providers working in primary care. This aligns with the mission of comprehensive cancer centers, which focus not only on treatment but also on education and training. The Entrustable Professional Activities (EPA) concept mentioned earlier for cancer prevention could also strengthen oncology education related to palliative and survivor care for medical students, particularly those with limited exposure to cancer patients. A study demonstrated that implementing an EPA-based curriculum for medical students in the Netherlands increased their opportunities for case exposure, decision-making participation, and familiarity with seeking feedback on their learning. The feedback and sense of accomplishment from applying EPA principles helped boost students' confidence in managing patients in the future.[76]

Improving the quality and quantity of oncology education through the EPA approach can produce graduates prepared to implement preventive, promotive, survivorship, and palliative care strategies in comprehensive cancer management at various service levels, including primary care. This is expected to address WHO's recommendations for strengthening palliative care and cancer survivor services in primary health settings.[60]

In terms of training, a systematic review indicates that training in cancer survivor care can enhance the skills and confidence of healthcare providers. This training should utilize a standardized curriculum, tailored to local needs, and be conducted periodically with appropriate learning models to ensure better long-term outcomes.[73]

Additionally, primary care services need to be equipped with safe, effective, and cost-efficient medications and tools to adequately respond to palliative care needs. However, there should also be arrangements for primary care health workers to consult with more experienced doctors regarding complex or unusual palliative care issues. The consultation mechanism should be straightforward to ensure there are no barriers to providing palliative care at the primary level. Furthermore, it is essential to establish a system that enables primary care providers who are actively engaged in the community to transfer patients quickly and efficiently to higher-level healthcare institutions when necessary to address challenging health issues. Therefore, involving and strengthening primary care services in cancer management is crucial.[71]

Various issues related to cancer care currently include the increasing incidence of cancer among individuals under 50 years old, the high proportion of cancer patients diagnosed at advanced stages, and delays in cancer treatment.[2,5,10] These problems are closely linked to the quality of cancer services, research, and oncology education. As mentioned in various studies, the high proportion of patients diagnosed at advanced stages and the issues of delayed treatment are significantly influenced by public knowledge about cancer.[13] This aspect of public knowledge is tightly connected to the educational competence of healthcare professionals, which should encompass not just prevention but also early detection, diagnosis, treatment, survivorship, and palliative care. The implementation of Entrustable Professional Activities (EPA) in education can assist in assessing the competencies of students.[52]

The national cancer control plan, which includes prevention, screening, diagnosis, treatment, survivorship, and palliative care as recommended by the WHO, can be implemented through comprehensive cancer centers. These centers not only focus on service delivery but also on research and education.[60,62] Medical schools, such as the Faculty of Medicine Universitas Indonesia, along with educational hospitals like Rumah Sakit Kanker Dharmais and Rumah Sakit Dokter Cipto Mangunkusumo, can serve as models to support the establishment of these comprehensive cancer centers. Besides comprehensive cancer centers, the WHO also recommends that primary care services can play a role in cancer control through prevention, screening, survivorship, and palliative care.[71] The integration of primary care with comprehensive cancer centers can enhance the quality of cancer services.

As we approach the demographic bonus, the government has launched the Long-Term National Development Plan (LTNDP) 2045, known as Indonesia Emas 2045. This plan outlines a vision for Indonesia by 2045 as a sovereign, advanced, just, and prosperous nation based on four pillars: human development and mastery of science and technology; sustainable economic development; equitable development; and strengthening national resilience and governance. Comprehensive cancer management through the integration of comprehensive cancer centers and primary care aligns with the pillar of human development and mastery of science and technology, aiming to improve the quality of the Indonesian population through better education, culture, health standards, life expectancy, quality of life, productivity, and broad scientific and technological knowledge.[77]

We have just faced the COVID-19 pandemic together and successfully navigated through it. The United Nations (UN) even praised our efforts. We were able to mobilize all our strength and resources to address the COVID-19 pandemic.[78] It is certainly not impossible to undertake similar efforts to improve the quality of cancer care in Indonesia. Collaboration among healthcare professionals, the government, the private sector, and educational institutions is essential to tackle the cancer issues in Indonesia. The development of comprehensive cancer centers integrated with primary care can serve as a solution to the problems of cancer care and enhance the quality of cancer services in Indonesia. Medical students who will become general practitioners working in primary care, as well as internal medicine residents and residents from other disciplines related to cancer care, must prepare themselves with the necessary competencies to face the future challenges of cancer burden. The medical faculty along with its teaching hospitals, particularly the Faculty of Medicine of Universitas Indonesia, Dharmais Cancer Hospital, and Cipto Mangunkusumo Hospital, have a significant responsibility to produce general practitioners and specialists capable of meeting the challenges of comprehensive cancer management as advocated by the WHO. Let us unite and work together to confront the various challenges in cancer care by realizing comprehensive cancer management as part of our efforts toward achieving Indonesia Emas 2045.

For the internal medicine specialization students of FKUI-RSCM whom I cherish, the overview of cancer issues in the world and Indonesia presented above serves as food for thought for us to prepare ourselves to address these challenges. There are numerous cancer cases managed in our beloved teaching hospitals. This provides us with a foundation to study cancer cases comprehensively. With this foundation, the internal medicine students of FKUI-RSCM should become internists with enhanced capabilities in the comprehensive management of cancer in the community, while also serving as catalysts for education and training at the primary care level.

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