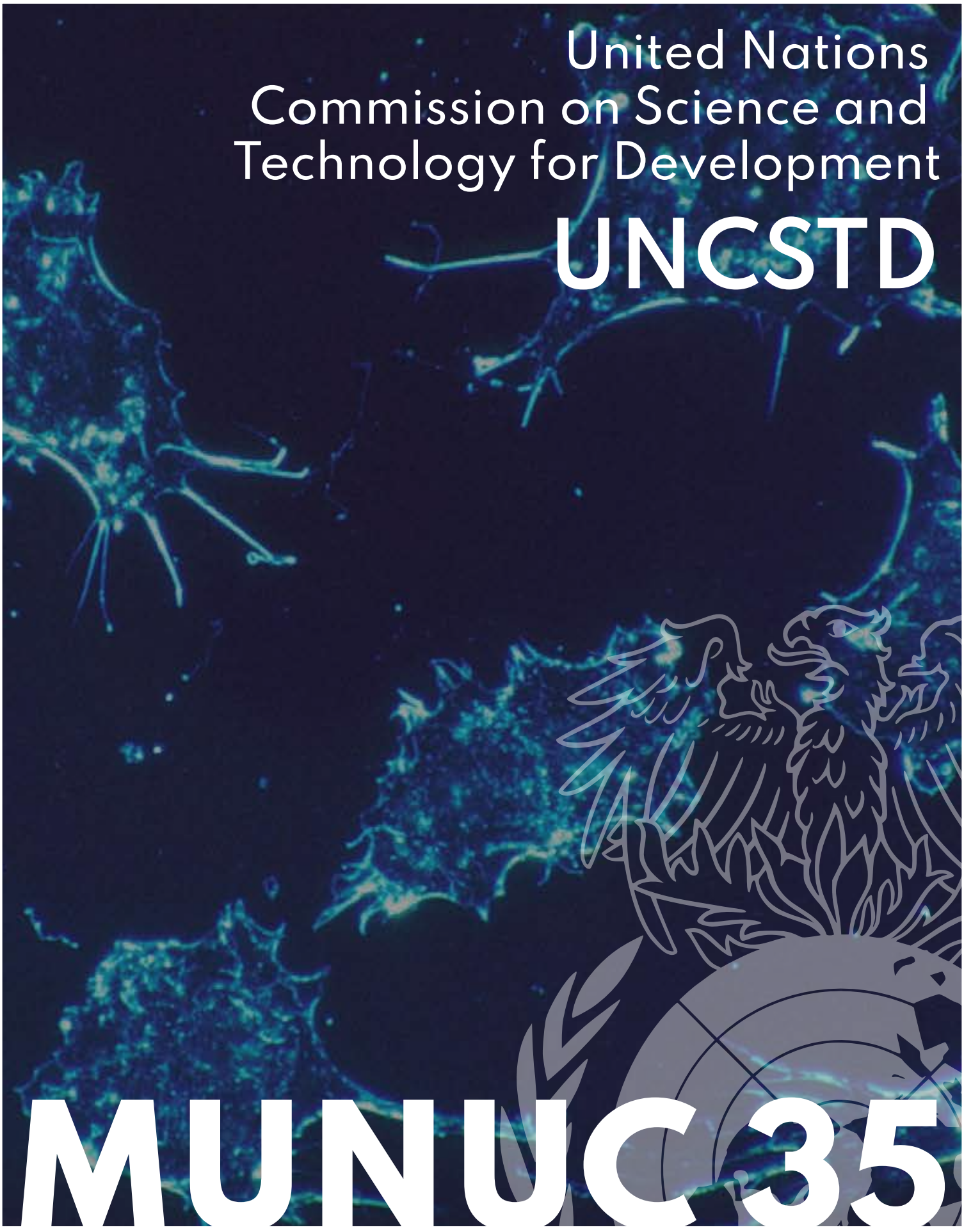

United Nations Commission on Science and Technology for Development

UNCSTD

MUNUC 35

Model United Nations of the University of Chicago

TABLE OF CONTENTS

CHAIR LETTER

Dear delegates,

Welcome to MUNUC 35! My name is Emily Gamboa, and I am looking forward to chairing the Commission on Science and Technology for Development. This committee brings into light a plethora of questions on accessing intellectual property, building a scientific community in least-developed countries, and negotiating the interests of commercial, academic, and policy stakeholders across the globe. I hope you all are as excited as I am to dive into these discussions together!

I am a fourth-year in the College, majoring in the Biological Sciences with a specialization in cancer biology. Born and raised in Chicago, I have a tendency to take over the navigator role amongst my friend group when exploring this great city! Regarding my Model UN experience, I am a part of UChicago's competing Model UN team, as well as the Director-General of UChicago's intercollegiate Model UN conference, ChoMUN! Outside of Model UN, I conduct research at a cancer lab on campus, volunteer with the American Red Cross, and become increasingly popular on Instagram for my outfit reels!

Through this committee, I hope that you all will engage with these two topics with the utmost interest: equitable access to cancer research and intellectual property of public health. In an increasingly urbanized world, least-developed countries still lack the infrastructure to develop a scientific community which seeks to develop various cancer therapeutics for its community. Furthermore, the question of access to intellectual property and the ethical implications it poses on least-developed countries is currently driving debate all around the world. Above all else, I hope you all will get to learn and collaborate from each other throughout the course of the weekend. Please do not hesitate in reaching out if you have any questions.

Kindly,

Emily Gamboa, egamboa1@uchicago.edu

HISTORY OF COMMITTEE

The United Nations Commission on Science and Technology for Development (UNCSTD) is a subsidiary body of the United Nations Economic and Social Council (ECOSOC). The UNCSTD gathers annually during the United Nations Conference on Trade and Development (UNCTAD) to debate and discuss pressing issues on the use, oversight, and development of world-changing technologies.[1] Working with member states, NGOs, and other stakeholders in the global scientific community is key towards creating essential policy impact.

The UNCSTD was first established in 1992 after a successful conference in Vienna paved the way for the United Nations to consider science and technology in international policy-making. It was established to provide a forum to debate how best to accommodate developing countries in an increasingly digital world.[2] Today, as new technologies challenge the way in which we think about health, the climate, and economic opportunities, the UNCSTD is needed more than ever to promote these conversations on how the international community should put forward such innovations in the best interests of member states and the global scientific community.

[1] "About the CSTD." UNCTAD. Accessed June 11, 2022. https://unctad.org/topic/commission-on-science-and-technology-for-development/about.
[2] Ibid.

TOPIC A: EQUITABLE ACCESS TO CANCER RESEARCH

Statement of the Problem

The Gap in Translational Cancer Research

10 million deaths were caused by cancer in 2020, making it the second-leading cause of deaths worldwide. Cancer mortality is especially prevalent in **least-developed countries (LDCs)**, especially in cancer types, such as cervical cancer, that are proven to be preventable and treatable in wealthier countries.[3] This disparity is largely due to lack of infrastructure and resources within LDCs to build a national healthcare system, innovate cancer diagnostic tools and treatments, and promote cancer awareness to the public. More specifically, there is a lack of **translational cancer research** (scientific study of research investigations in which discoveries made in a basic science lab are applied and tested on patients in a hospital setting) in LDCs. Thus, causing a gap between discoveries made in the basic sciences industry and clinical trials testing these discoveries in the healthcare industry. Currently, cancer prevention research receives only 2-9% of global cancer research funding, contributing towards a plateau in cancer mortality rates in recent years.[4] These issues call into question how LDCs can best benefit from additional cancer research and their clinical implications, especially on preventable cancer types.

[3] WHO International Agency for Research on Cancer. Estimated number of deaths in 2020, all cancers, both sexes, all ages. Cancer today. Published 2020. Accessed January 14, 2022. https://gco.iarc.fr/today/online-analysis-pie?v=2020&mode=population&mode_population=income&population=900&populations=900&key=total&sex=0&cancer=39&type=1&statistic=5&prevalence=0&population_group=0&ages_group%5B%5D=0&ages_group%5B%5D=17&nb_items=7&group_cancer=1&include_nmsc=1&include_nmsc_other=1&half_pie=0&donut=0

[4] Bray, Freddie, Jacques Ferlay, Isabelle Soerjomataram, Rebecca L. Siegel, Lindsey A. Torre, and Ahmedin Jemal. "Global Cancer Statistics 2018: Globocan Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries." *CA: A Cancer Journal for Clinicians* 68, no. 6 (2018): 394-424. https://doi.org/10.332/caac.21492.

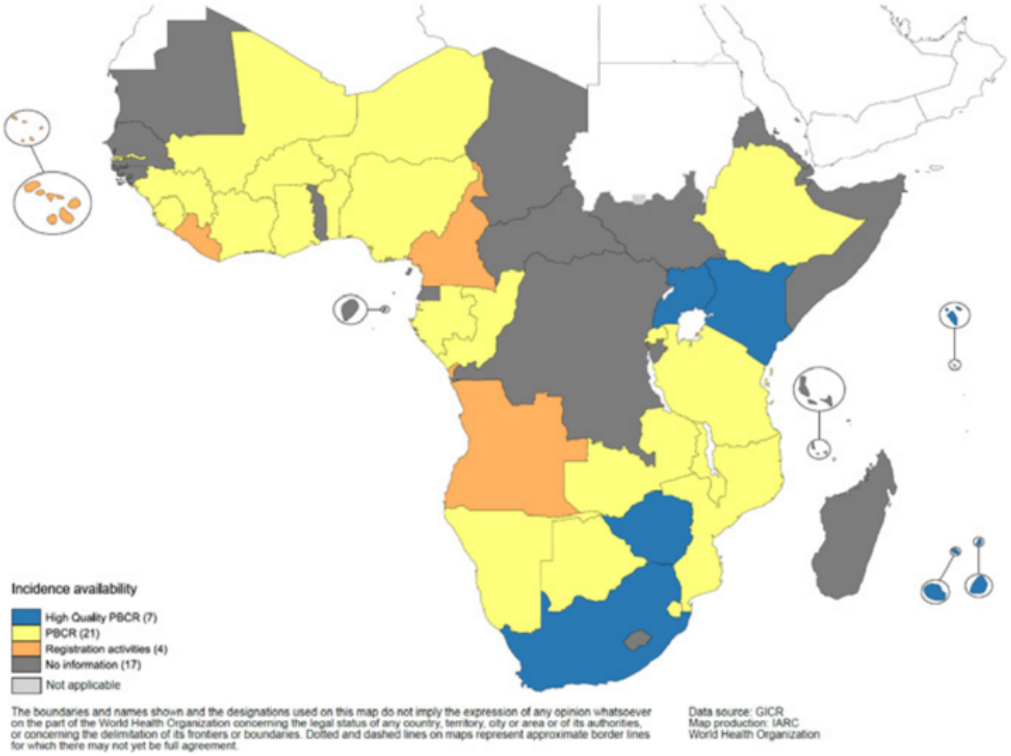

Figure 1: Availability of cancer incidence data in Africa, 2020[5]

One example of the stark difference in resources for conducting translational cancer research in LDCs compared to developed nations is the lack of well-functioning civil registration and vital statistics (CRVS) and population-based cancer registries (PBCR) systems in various African countries. Without this system, the public health sectors in these countries do not have a comprehensive understanding of the survival and mortality rates of various cancer types. More importantly, the scientific community in LDCs need adequate resources to test cancer therapeutic discoveries on patients to conduct translational cancer research that is tailored to the needs of their countries.[6]

[5] The Union for International Cancer Control (UICC), *Cervical cancer elimination in Africa: where are we now and where do we need to be?*, https://www.uicc.org/sites/main/files/atoms/files/UICC-Cervical_Cancer_in_Africa_FA_Single.pdf
[6] "Cervical cancer elimination in Africa: where we are now and where do we need to be?", (International Agency for Research on Cancer, 2020), https://www.uicc.org/sites/main/files/atoms/files/UICC-Cervical_Cancer_in_Africa_FA_Single.pdf.

In addition, while international policies have been in effect to standardize clinical trials, there is a lack of support for LDCs that do not possess resources to begin clinical trials in their communities. In sparsely populated areas, it can be challenging to gather human subjects, educate subjects on how clinical trials work, and make these clinical trials more accessible. Considering how LDCs can work around such challenges in conducting clinical trials is of the utmost importance when it comes to advancing translational cancer research.

Global Disparities of Cancer Research

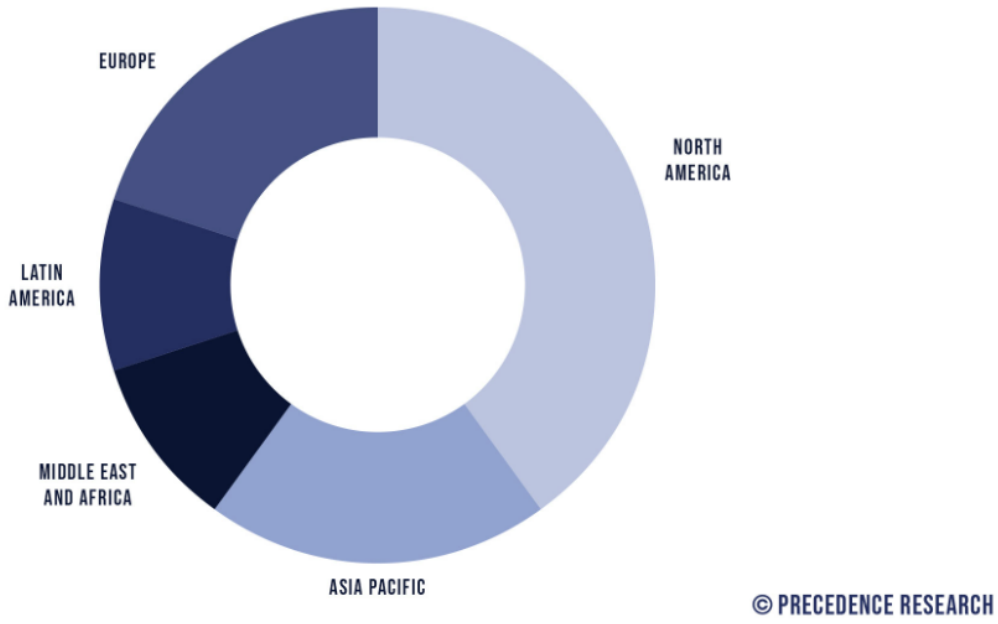

Figure 2: Cancer immunotherapy marker share by region, 2020 (%)[7]

As a result of the gap in translational cancer research, wealthier countries have concentrated much of the available cancer **therapeutics** worldwide amongst themselves. Currently, North America dominates the **pharmaceutical** market with a 37.3% share in 2020.[8] Asia is also a fast-growing regional market because of its increasing disease incidence and implementation of new healthcare technologies to achieve sustainable patient care, such as **artificial intelligence (AI)**. Their immense

[7] "Cancer Immunotherapy Market Size, Share, Report 2021 to 2030," accessed October 5, 2022, https://www.precedenceresearch.com/cancer-immunotherapy-market.
[8] Ibid.

presence in the global pharmaceutical industry is largely due to partnerships between well-established and early-stage kickstart companies.

Alongside this, Precedence Research estimated the global cancer **immunotherapy** market to reach 277.1 billion USD by 2030. This projection is largely based on current disadvantages of using traditional **chemotherapy**, such as organ failure and cancer remission, which incentivizes investments going into technologies such as molecules enhancing the immune system's response to cancer cells and drugs preventing tumor cells from growing and dividing. However, there is very little market share by the Global South in this highly profitable market, according to the figure above. As a result, many LDCs are left out of the global pharmaceutical profits, further distancing themselves from resources that can support their own translational cancer research and greatly benefit their own communities battling with cancer.

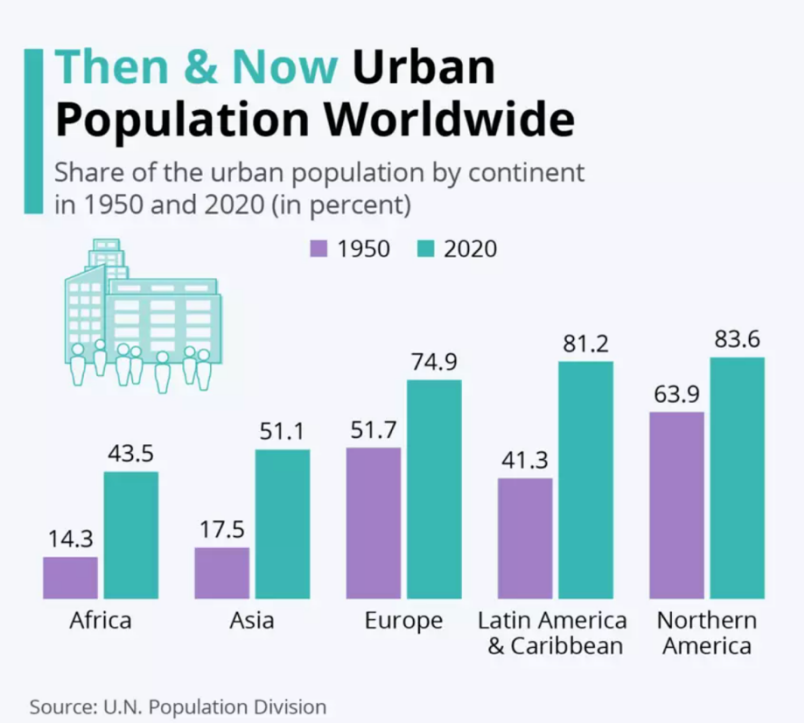

Figure 3: Percent of people living in urban areas by continent[9]

[9] "UN: How Has the World's Urban Population Changed from 1950 to 2020?," World Economic Forum, accessed October 5, 2022, https://www.weforum.org/agenda/2020/11/global-continent-urban-population-urbanisation-percent/.

It is also important to note that people in highly urban regions also experience the most adverse health effects. The UN Population Division reported that urban populations made up the highest share in Northern American countries (83.6%), while African and Latin American countries have the greatest increases in their urban populations as of 2020.[10] As a result, there is a high prevalence of cancer types attributed towards a growing urban population. For example, within the National Cancer Registry Ireland population, researchers such as Linda Sharp found the risk for developing esophageal, stomach, lung, and non-melanoma skin cancers was significantly higher amongst urban residents compared to their rural counterparts, regardless of sex. Sharp and others also found that out of 18 cancers screened in the study and after adjusting for socioeconomic variation, 12 cancer types were associated with significant urban-rural differences.[11] Therefore, while the international community supports urban development in LDCs, within this effort there must also be infrastructure and resources to specifically support translational cancer research as these populations become more at risk for developing cancer.

COVID-19 and Cancer Research Access in LDCs

The COVID-19 pandemic has severely shifted funding and resources away from translational cancer research, calling into question the long-term effects of this public health crisis on cancer therapy development rates and cancer mortality rates. At the start of the pandemic, M. Bishr Omary and others noted that research-intensive institutions struggled with maintaining a certain level of research activity while keeping researchers safe. One example of such measures taken was to temporarily shut down labs conducting "noncritical research" and promote projects that involve research related to COVID-19 and do not require in-person activities.[12] As a result, while research on COVID-19 exploded, research not related to COVID-19 plummeted. This type of categorization has especially slowed down progression in cancer research and therapeutic developments. According to an American Association for Cancer Research survey, over 99% of cancer researchers indicated that

[10] Ibid.
[11] Sharp, Linda et al. "Risk of several cancers is higher in urban areas after adjusting for socioeconomic status. Results from a two-country population-based study of 18 common cancers." *Journal of urban health: bulletin of the New York Academy of Medicine* vol. 91,3 (2014): 510-25. doi:10.1007/s11524-013-9846-3
[12] Omary, M. Bishr, Jeetendra Eswaraka, S. David Kimball, Prabhas V. Moghe, Reynold A. Panettieri, and Kathleen W. Scotto. "The COVID-19 Pandemic and Research Shutdown: Staying Safe and Productive." *Journal of Clinical Investigation* 130, no. 6 (2020): 2745-48. https://doi.org/10.1172/jc/i138646

the pandemic interrupted their cancer research and/or clinical practice.[13] In addition, rapid turnover of potential COVID-19 therapeutics was strongly valued over high quality. This shift of focus from quality to quantity brings concerns when applied in non-COVID-19-related research, such as cancer translational research.[14] However, these observations were made in wealthy countries, where many research institutions exist, thus establishing the notion of a disparity between wealthy and poor countries when it comes to accessing cancer translational research.

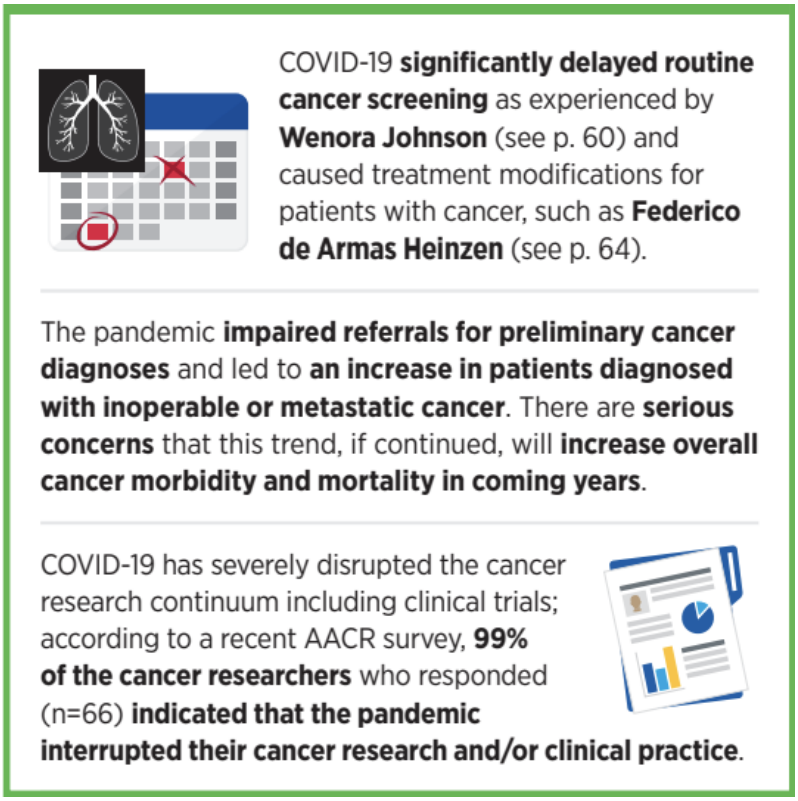

Figure 4: Negative impacts of COVID-19 on cancer research and patient care[15]

[13] American Association for Cancer Research. AACR Report on the Impact of COVID-19 on Cancer Research and Patient Care. https://www.AACR.org/COVIDReport. Published February 9, 2022. Accessed June 19th, 2022.
[14] Ibid.
[15] Omary, M. Bishr, Jeetendra Eswaraka, S. David Kimball, Prabhas V. Moghe, Reynold A. Panettieri, and Kathleen W. Scotto. "The COVID-19 Pandemic and Research Shutdown: Staying Safe and Productive." *Journal of Clinical Investigation* 130, no. 6 (2020): 2745-48. https://doi.org/10.1172/jc/i138646

History of the Problem

Scientific Understanding of Cancer

Cancer is currently known as a large group of diseases involving the abnormal and uncontrollable growth of cells with the potential to grow in other parts of the body. Decades of literature within oncology have revealed multiple causes to the onset of cancer, such as chemical exposure, diet and exercise, heredity, and radiation. It was first thought that cancer was only caused by oncoviruses (a virus that can cause cancer) as a tumor derived from a chicken was transplanted and its cell-free extracts were injected into another chicken, producing the same type of tumor as the first chicken.[16] From that 1908 study came more efforts to find human oncoviruses during the mid-20th century, such as the discovery of the Epstein-Barr virus, hepatitis C virus, and human papilloma virus.[17] However, while these discoveries shocked the scientific community on how seemingly contagious cancer can be, molecular-based studies on cancer viruses showed that tumors from oncoviruses do not increase transmissibility of the virus. In addition, only 18% of worldwide cancer deaths are related to such oncoviruses and a very small proportion infected with these oncogenes develop a tumor, which further shifts the focus for translational cancer research towards other environmental causes which comprise 90-95% of worldwide onset of cancer.[18]

[16] Moore, P., Chang, Y. Why do viruses cause cancer? Highlights of the first century of human tumor virology. *Nat Rev Cancer* **10,** 878–889 (2010). https://doi.org/10.1038/nrc2961

[17] Ibid.

[18] Anand P, Kunnumakkara AB, Sundaram C, Harikumar KB, Tharakan ST, Lai OS, Sung B, Aggarwal BB (September 2008). "Cancer is a preventable disease that requires major lifestyle changes". *Pharmaceutical Research*. **25** (9): 2097–116. doi:10.1007/s11095-008-9661-9.

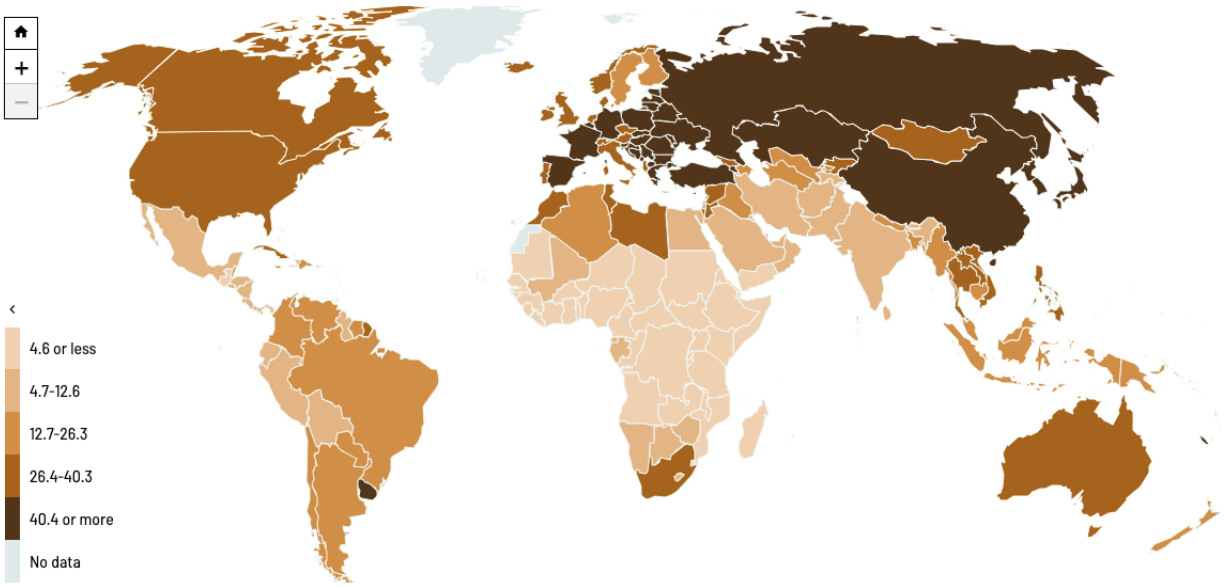

Figure 5: Lung cancer incidence in males, age-standardized (world) per 100,000, 2018[19]

Studies identifying the causes and risk factors for cancer development have shown that tobacco smoke is responsible for about 20% of worldwide cancer deaths, as well as 90% of all lung cancer cases. In addition, Western Europe has some of the highest rates of cancer development because of alcohol exposure, in which 10% of cancer cases in males are attributed to alcohol.[20] A study on 5 million individuals in the UK demonstrated that higher body mass index is related to 10 types of cancer because of overnutrition and physical inactivity.[21] These lifestyle choices weaken the immune system, thus allowing cancer cells to grow with little to no intervention that could help destroy these abnormal cells. Next, ultraviolet radiation from sunlight causes most non-melanoma skin cancers, one of the most common cancer types worldwide.[22] On the other hand, recent data has shown that

[19] Biesalski HK, Bueno de Mesquita B, Chesson A, Chytil F, Grimble R, Hermus RJ, Köhrle J, Lotan R, Norpoth K, Pastorino U, Thurnham D (1998). "European Consensus Statement on Lung Cancer: risk factors and prevention. Lung Cancer Panel". *CA: A Cancer Journal for Clinicians*. **48** (3): 167–76, discussion 164–66. doi:10.3322/canjclin.48.3.167

[20] Irigaray P, Newby JA, Clapp R, Hardell L, Howard V, Montagnier L, Epstein S, Belpomme D (December 2007). "Lifestyle-related factors and environmental agents causing cancer: an overview". *Biomedicine & Pharmacotherapy*. **61** (10): 640–58. doi:10.1016/j.biopha.2007.10.006.

[21] Bhaskaran K, Douglas I, Forbes H, dos-Santos-Silva I, Leon DA, Smeeth L (August 2014). "Body-mass index and risk of 22 specific cancers: a population-based cohort study of 5·24 million UK adults". *Lancet*. **384** (9945): 755–65. doi:10.1016/S0140-6736(14)60892-8.

[22] Little JB (2000). "Chapter 14: Ionizing Radiation". In Kufe DW, Pollock RE, Weichselbaum RR, Bast RC, Gansler TS, Holland JF, Frei E (eds.). *Cancer medicine* (6th ed.). Hamilton, Ont: B.C. Decker. ISBN 978-1-55009-113-7.

ionizing radiation from medical imaging and radioactive gas are not particularly strong mutagens, posing little concern to cancer researchers for therapeutic development.[23]

There have been many options for patients on how to manage their cancer. **Chemotherapy** by far is a very common treatment and it is oftentimes completed alongside radiation therapy. However, not all patients produce positive outcomes from this regimen, sometimes requiring other treatments, such as immunotherapy and surgery, to remove the cancer cells. These treatments have been reportedly producing long-lasting effects such as damage to lung tissue, infertility, and risk of a second cancer. In addition, some cancers need to be treated with chemotherapy drugs that can also kill healthy cells in the process.

Global Perceptions of Cancer

The Ancient Egyptians were the first to describe cancer in 300 BC. The Edwin Smith Papyrus notes that "there is no treatment" for several reported cases of tumors.[24] Furthermore, the word "cancer" was derived from Hippocrates' use of the terms *carcinos* and *carcinoma*, referring to the crab-like shape of tumors.[25] From the Renaissance period emerged the scientific method, laying the groundwork for our modern understanding of cancer. Physicians from the 15th century, such as the Dutch surgeon, Nicolaes Tulp, performed autopsies to learn more about how cancer affected the entire body.[26] Tulp believed that cancer was a contagious poison that spread slowly. However, it wasn't until the invention of the microscope in the 18th century when English surgeon Campbell De Morgan first described the growth of cancer cells to nearby organs, further clarifying the function of cancer.[27] Finally, the 19th century recognized the modern medical field of cancer, oncology, from the Greek term *oncos* ("swelling"). More specifically, the modern microscope was utilized to discover the cellular pathology of cancer and to optimize current surgical methods to remove solid tumors.[28] Post-World War II, chemical agents to treat cancer patients became increasingly available and

[23] Ibid.
[24] "Understanding What Cancer Is: Ancient Times to Present." American Cancer Society, 2018. https://www.cancer.org/treatment/understanding-your-diagnosis/history-of-cancer/what-is-cancer.html#:~:text=The%20origin%20of%20the%20word,forming%20and%20ulcer%2Dforming%20tumors.
[25] Ibid.
[26] Yalom, Marilyn (1998). *A history of the breast* (1 ed.). New York: Ballantine Books. ISBN 978-0-679-43459-7
[27] Grange JM, Stanford JL, Stanford CA (June 2002). "Campbell De Morgan's 'Observations on cancer', and their relevance today". *Journal of the Royal Society of Medicine*. **95** (6): 296–99. doi:10.1258/jrsm.95.6.296.
[28] Ibid.

effective. This initiative was widely led by American scientists such as Sidney Farber, who hypothesized that such chemicals need to target the nutrients that cancer cells use to grow.[29]

Beyond the scientific understandings of cancer, societal and cultural perceptions of cancer made a lasting impression on global efforts to combat this disease. For one, in the United States, cancer was euphemized as "a long illness", caused by one's "cancer personality". As a result, many alternative cancer therapies boomed in popularity during the 1970s, such as talk therapy, victim-blaming, and "positive thinking". These "treatments" were heavily prescribed to breast cancer patients leading to the stigmatization of female-predominant cancers that still persists to this day.[30]

Translational Cancer Research and the Global Pharmaceutical Industry

As cancer research began to look promising in its applicability in the clinical setting, efforts were made by parties worldwide to promote the discovery of novel therapeutics. In the United States, the Nixon administration spearheaded the effort through the enactment of the National Cancer Act of 1971. According to the National Cancer Institute (NCI), this legislation declared the United States' commitment to fighting against the "war on cancer", which was the second-leading cause of death in 1970. The National Cancer Act developed several research institutes, established guidelines for the National Cancer Institute's annual budget, and created several cancer **advisory boards** and panels with full oversight from the NCI director.[31] As a result of the National Cancer Act, research and therapy development for some forms of cancer, such as childhood leukemia, gained significant progress. On a global scale, the World Health Organization (WHO) created the International Agency for Research on Cancer in 1965 to coordinate and conduct cancer research at the international level, as well as collect and publish surveillance data on the incidence of cancer worldwide.[32]

---

[29] FARBER, S, and L K DIAMOND. "Temporary remissions in acute leukemia in children produced by folic acid antagonist, 4-aminopteroyl-glutamic acid." *The New England journal of medicine* vol. 238,23 (1948): 787-93. doi:10.1056/NEJM194806032382301

[30] Olson JS (2005). *Bathsheba's Breast: Women, Cancer, and History*. JHU Press. pp. 145–70. ISBN 978-0-8018-8064-3. OCLC 186453370.

[31] "National Cancer Act of 1971." National Cancer Institute, February 2, 2021.

[32] Colditz, Graham A. (ed.) (2015). *The SAGE Encyclopedia of Cancer and Society (International Agency for Research on Cancer)*. SAGE Publications. pp. 1323–. ISBN 978-1-5063-0126-6.

The completion of the Human Genome Project in 2003 demonstrated even greater promise towards translational cancer research.[33] The Human Genome Project was an international research program which sought to map and understand all the genes encompassing the human genome. As a result of the scientific community's contributions towards this endeavor, translational cancer research on the genetic implications of cancer skyrocketed.[34] More specifically, it was possible for scientists to compare the genome map derived from a tumor to the genome map of a normal human cell, thus gaining a better understanding of which mutations caused cancer in a certain patient. Furthermore, translational cancer research could explore the use of technologies, such as **gene therapy** and editing to identify the cause of cancer at the genetic level.[35] Another international initiative towards expanding translational cancer research started with the 2009 World Cancer Campaign, in which the WHO promoted a healthy lifestyle for children to reduce their risk for cancer development in their adulthood.[36]

[33] Kolata, Gina. "Advances Elusive in the Drive to Cure Cancer." The New York Times. The New York Times, April 24, 2009. https://www.nytimes.com/2009/04/24/health/policy/24cancer.html.
[34] "What Is the Human Genome Project?" Genome.gov. Accessed June 26, 2022. https://www.genome.gov/human-genome-project/What
[35] "How the Human Genome Project Transformed Cancer Research." Kiscan, April 25, 2019. https://kidscan.org.uk/human-genome-project-transformed-cancer-research/
[36] "Cancer." World Health Organization. World Health Organization. Accessed June 11, 2022. https://www.who.int/health-topics/cancer#tab=tab_1.

Past Actions

Promoting Cancer Research Globally

In 2017, the WHO passed the resolution "Cancer prevention and control in the context of an integrated approach", in which it called for all nations to accelerate current progress in achieving the Global Action Plan for the prevention and control of non-communicable diseases (NCDs), as well as the 2030 UN Agenda for Sustainable Development to reduce premature cancer mortality. More specifically, the resolution entailed collecting high-quality population-based data on cancer incidence and mortality, promoting access to cost-effective vaccinations for infectious diseases associated with cancer, and collaborating with regional partners to mobilize and finance these efforts.[37] In addition, the WHO Global Action Plan for the Prevention and Control of Noncommunicable Diseases called for a 25% reduction in cancer mortality rate worldwide by 2025.[38] As a result, the responsibility for providing access to translational cancer research falls in the hands of governments rather than individual pharmaceutical companies and cancer research centers. However, what lacks in this resolution is a more detailed plan for how LDCs should navigate through accomplishing the Global Action Plan and the UN Agenda for Sustainable Development. Without making the necessary considerations for the needs and resources for certain sub-groups of countries, such as LDCs, these broad goals and strategies to promote cancer research can only go so far.[39]

Supporting Urban Infrastructure and Economic Growth in LDCs

Much of the support for LDCs from the United Nations began with the adoption of the Brussels Programme of Action ("the Programme"), which aimed to halve the number of people living in poverty by 2015. More specifically, the Programme sought to use an integrated approach in creating genuine partnerships between LDCs and their "partner" countries to ensure country-led

[37] World Health Assembly, 70. (2017). Cancer prevention and control in the context of an integrated approach. World Health Organization. https://apps.who.int/iris/handle/10665/275676.
[38] Song, Mingyang, Bert Vogelstein, Edward L. Giovannucci, Walter C. Willett, and Cristian Tomasetti. "Cancer Prevention: Molecular and Epidemiologic Consensus." Science 361, no. 6409 (2018): 1317–18. https://doi.org/10.1126/science.aau3830.
[39] World Health Assembly resolution f66/10, *Follow-up to the political declaration of the high-level meeting of the General Assembly on the prevention and control of non-communicable diseases*, A/RES/66/10 (27 May 2013), available from https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R10-en.pdf?ua=1.

development while maintaining a balance between supporting private and public interests for the LDCs. One prominent example of partnerships between wealthy countries and LDCs is the one between the United States and Zambia from 2007 to 2009 when AIDS researchers at the University of Alabama sought to learn more about the progression of the disease in Zambia and how to best address the epidemic.[40] The Programme also emphasized the need to continually fight diseases prevalent in these LDCs, such as HIV/AIDS, TB, and various reproductive health diseases. However, there was no mention of reducing the **cancer burden** in LDCs, calling into attention the need to revisit the Programme and re-evaluate the current needs of LDCs. In addition, although some progress was made in supporting the "graduation" of several LDCs, 75% of LDCs in 2001 kept their status as an LDC as of 2011.[41]

The UNCTAD Enhanced Integrated Framework ("the Framework") is a multi-donor program which assists LDCs to integrate **global trade** into their national strategy. In addition, the Framework supports LDCs financially to establish infrastructure to enhance trade and technological development. In 2018, the World Trade Organization (WTO) brought representatives from LDCs as well as from other governments, the private sector, and various non-governmental organizations (NGOs), to participate in a forum focusing on creating a more "inclusive" trade environment for LDCs. The forum highlighted LDCs' access to the digital economy, the disparity in women participating in trade, and how global trade can be used to fight poverty within LDCs.[42] These actions seem to be the most promising in providing the necessary expertise and resources for LDCs to grow its share in the cancer therapeutics market. However, there is no emphasis on supporting infrastructure in the scientific communities of these LDCs. This is important because as LDCs become increasingly urban, the health consequences of urban development also increase. Addressing how LDCs can provide adequate healthcare to an increasingly urban population should be a main priority before continuing with such urban development projects.

[40] Syed, S.B., Dadwal, V., Rutter, P. *et al.* Developed-developing country partnerships: Benefits to developed countries?. *Global Health* 8, 17 (2012). https://doi.org/10.1186/1744-8603-8-17.
[41] UN – OHRLLS, *Brussels programme of action: addressing the special needs of the least developed countries* (New York, United Nations, 2001), available from https://www.un.org/ohrlls/sites/www.un.org.ohrlls/files/brussels_programme_of_action.pdf
[42] "The Enhanced Integrated Framework." UNCTAD, July 14, 2021. https://unctad.org/topic/least-developed-countries/enhanced-integrated-framework.

Finally, international support measures for LDCs also entail encouraging participation of LDCs in UN processes and other international forums. This includes covering some travel costs to attend international conferences, as well as providing training for diplomats. Through supporting LDCs by these means, representatives from these countries can learn about research and policy analysis on LDC-specific issues, receive specialized briefing sessions, and create a dialogue space for LDCs to receive feedback from UNCTAD experts.[43] One of the most important international forums for LDCs to engage in is the UN Conference on the Least Developed Countries. The fifth iteration of this conference was held on 17 March 2022 in New York. This conference focused on how LDCs can adopt the Brussels Programme of Action.[44] While this is an important forum to discuss general issues LDCs face, focusing only on this forum limits the scope for which representatives of LDCs can access resources in more specialized committees. Therefore, financially supporting representatives of LDCs in attending international forums must also include funding for attending scientific and economic-based specialized committees, such as ECOSOC, UNCTAD, and UNCSTD.

Addressing Healthcare Disparities in LDCs During the COVID-19 Pandemic

Before the pandemic, 85% of LDCs remained commodity dependent, meaning that they relied on imports from other countries for essential products, such as food, raw materials, and technology. As a result, the COVID-19 pandemic pushed their import dependencies further, given that exporting countries may withhold exportation of personal protective equipment (PPE), hospital equipment, and healthcare staff.[45] Given this, the WHO reported in April 2020 that LDCs accounted for 0.56% of global COVID-19` cases and 0.23% of global deaths.[46] This number may seem small, but it tells a much greater story about the lack of resources LDCs have for contact tracing positive COVID-19 individuals. Furthermore, this shows how important it is to address underdeveloped healthcare

[43] "Support for LDC Participation in International Forums | LDC Portal – International Support Measures for Least Developed Countries." United Nations. United Nations. Accessed July 7, 2022. https://www.un.org/ldcportal/content/support-ldc-participation-international-forums
[44] "On the Road to LDC5." UNCTAD, November 25, 2021. https://unctad.org/topic/least-developed-countries/ldc5
[45] "The Least Developed Countries Report 2021: The Least Developed Countries in the Post-COVID World: Learning from 50 Years of Experience." UNCTAD, September 27, 2021. https://unctad.org/press-material/least-developed-countries-report-2021-least-developed-countries-post-covid-world.
[46] Ibid.

systems in LDCs. On average, LDCs have 113 hospital beds per 100,000 people, which is half of that of other developing countries and 80% less than in wealthy countries.[47]

International policy responses addressing the healthcare systems of LDCs include governments restricting the export of medication and health equipment to LDCs, especially COVID-19 vaccines. Furthermore, there have been efforts from ECOSOC, WHO, and other United Nation member bodies to increase **budget allocations** for healthcare and to provide food and financial assistance for vulnerable populations. However, this isn't completely feasible in most LDCs where populations may be geographically distant from an urban center or lack the technology or knowledge to reach out for government resources.

[47] Ibid.

Possible Solutions

When it comes to addressing the disparity in translational cancer research between LDCs and other developed countries, it is imperative that solutions be made around funding cancer research with a focus on economically accessible therapeutics for populations living in LDCs. This first starts with considering the resources that LDCs already have to implement more efficient and accessible CRVS and PBCR systems for scientists to further understand the cancer burden in their communities. Given that there are unique differences in how populations are spread out in a certain region or the extent to which individuals are aware about public health measures, more work must be done to reach out to these groups and conduct surveys. From this, the funding from the international community can go towards building infrastructure for scientists to conduct translational cancer research, as well as clinical institutions to supplement existing healthcare systems in providing clinical trials and experimental therapeutics for cancer patients in LDCs.

Second, the healthcare supply chain should be made more "inclusive" for LDCs seeking to develop infrastructure to support cancer translational research and therapeutic development. While wealthier countries dominate the market for cancer therapeutics, there is a greater interest in discovering and refining new therapeutics, such as immunotherapies, as well as implementing new healthcare technology, such as AI, in clinical settings, which could mean opportunities for LDCs. Furthermore, LDCs should also be encouraged to engage in these technologies so that they are on an equal playing field as other nations. Therefore, when the scientific communities of LDCs ask for financial support, it should be detailed out what kinds of therapy look promising in investing, such that LDCs can reap the economic and public health benefits of tapping into the therapeutics market.

To address the global gap in cancer research progress, solutions should consider promoting translational cancer research globally, with emphasis on directing resources to LDCs reducing the cancer burden within their populations. Given that the COVID-19 pandemic temporarily halted efforts in cancer therapeutic development, testing, and production, it is of great interest to support translational cancer research. In addition, LDCs should be encouraged to reap the economic benefits of expanding their presence in the therapeutics market to offset the costs of urban development already encouraged by various efforts in the international community. However, with the encouragement of the acceleration of research, there must be strict standards for ensuring that

translational cancer research is being conducted at the highest quality possible. This may entail training scientists in LDCs on basic science and clinical research. Wealthy countries may also provide supplies or scientists to help with new cancer research institutions in LDCs. Despite these benefits, global cooperation between LDCs and wealthy countries can also bring about challenges for LDCs to take advantage of cancer research access. For one, many developed countries may be at first hesitant to share their technologies with developed countries. Therefore, policies on how wealthy countries can be protected in their technologies while also benefiting LDCs must be heavily considered when LDCs choose to work with wealthy countries.

Bloc Positions

When it comes to partnering with other countries to ensure accessibility to translational cancer research, each nation is in a unique position relative to their economic circumstance, cancer burden status, and contributions towards the scientific research community and pharmaceutical industry. More specifically, wealthy and well-resourced countries should support less-resourced countries, especially developing countries experiencing prominent urban population growth. Furthermore, wealthy countries near LDCs or have well-established foreign relations with LDCs should take advantage of these ties to enhance trade of materials necessary for developing infrastructure to support translational cancer research. Lastly, LDCs and landlocked developing countries (LLDCs) should work together to develop a comprehensive message on what the international community can do to best support translational cancer research and cancer therapeutic development. It is imperative that these countries consider how to take advantage of global trade to receive resources from other wealthier countries. The following information is intended to introduce positions taken by different regions on this issue. Please do not feel pressured to assume these blocs, as they are only here to provide additional and specific information to certain countries.

North America, Western Europe, East Asia

These regions currently dominate the pharmaceutical development market, especially in cancer therapeutics due to large government investment in clinical research. This is especially true given the COVID-19 pandemic. Pfizer's revenue grew on average about 19.8% in 2021, reaching sales of over 80 billion USD.[48] Bayer, a pharmaceutical company based in Germany, recently invested towards acquiring manufacturing sites in Latin America, a noted region with several developing countries.[49] While these regions have been largely focusing on supporting their own pharmaceutical companies towards the development of COVID-19 vaccines and treatments, much development of cancer therapeutics have stalled as a result. Therefore, these regions should first consider how to prioritize

[48] Allen, A. (2022, July 6). *How pfizer won the pandemic, reaping outsize profit and influence*. Kaiser Health News. Retrieved September 22, 2022, from https://khn.org/news/article/pfizer-pandemic-vaccine-market-paxlovid-outsize-profit-influence/#:~:text=Pfizer's%202021%20revenue%20was%20%2481.3,the%20U.S.%20and%20European%20markets.

[49] Ibid.

translational cancer research while also meeting current demands from the international community to produce COVID-19 vaccines and treatments.

In addition, such countries should consider how best to support LDCs in conducting translational cancer research by utilizing their pre-existing global trade relations with LDCs. For example, the United States has developed strong foreign relations with countries in Latin America, while China, Japan, Australia, and various southeast Asian countries comprise the largest trade bloc worldwide: The Regional Comprehensive Economic Partnership (RCEP). This 15-member group accounts for about 30% of the world population and 30% of the global GDP, as of 2020.[50] Therefore, this bloc should reach out towards LDCs with pre-existing ties and consider how to reinforce infrastructure around sending resources to support translational cancer research in LDCs. However, the bloc should also consider what this committee should do to best support such well-resourced countries. In addition, there must be regulations in place around modern technologies and how to create accessible networks to these technologies, given that wealthy countries are the main contributors towards developing cancer translational research in this initial period of supporting LDCs.

Least Developed Countries, Landlocked Developing Countries, and Other Developing Countries

According to the United Nations, countries classified as LDCs or landlocked developing countries (LLDCs) represent the poorest and most vulnerable nations of the international community.[51] As mentioned earlier, many LDCs lack well-functioning civil registration and vital statistics (CRVS) and population-based cancer registries (PBCR) systems. Clinical trial resources are also insufficient. Additionally, LLDCs may face socioeconomic challenges due to their remoteness, lack of territorial access to the sea, and significant distance from global trading and markets.

Altogether, there is a present dilemma when it comes to addressing LDC's needs in developing the resources for conducting cancer translational research. While the international community supports urban development in LDCs, within this effort there must also be infrastructure and resources to

[50] "World Bank: RCEP Initiator is Indonesia, Not China". *CNBC*. 30 November 2020.
[51] United Nations. (n.d.). *Least developed countries (ldcs) | Department of Economic and Social Affairs*. United Nations. Retrieved September 22, 2022, from https://www.un.org/development/desa/dpad/least-developed-country-category.html#:~:text=Least%20developed%20countries%20(LDCs)%20are,low%20levels%20of%20human%20assets.

specifically support translational cancer research as growing populations in developing countries become more at risk for developing cancer. The input of LDCs and LLDCs is very important to keep in mind when considering how this committee could support building infrastructure around translational cancer research. Given this, it can be beneficial for LDCs and LLDCs to work together and bring forth their agenda.

Glossary

Advisory boards: Voluntary group formed to give advice and support to a board of directors.

Artificial intelligence (AI): Systems that mimic human intelligence to perform tasks and can improve themselves based on the information they collect.

Budget allocations: Amount of maximum funding an organization is willing to spend on a given item or program.

Chemotherapy: Treatment that uses powerful chemicals to kill fast-growing cells.

Gene therapy: Technique that uses a gene or multiple genes to treat, prevent, or cure a disease or medical disorder.

Global trade: Exchange of capital, goods, and services across international borders or territories to support a need for goods or services.

Immunotherapy: Treatment that uses a person's own immune system to fight cancer.

Least-developed countries (LDCs): UN-established category denoting low-income countries confronting several structural impediments to economic and human asset development.

Pharmaceuticals: Pertaining to the discovery, development, production, and marketing of drugs for use as medications to be administered to patients.

Therapeutics: treatments used to alleviate or prevent a particular disease.

Translational cancer research: Scientific study of research investigations connecting the laboratory and clinical settings, such as testing novel cancer treatments and methodologies for detecting, diagnosing, and preventing cancer.

Bibliography

Allen, A. (2022, July 6). *How pfizer won the pandemic, reaping outsize profit and influence*. Kaiser Health News. Retrieved September 22, 2022, from https://khn.org/news/article/pfizer-pandemic-vaccine-market-paxlovid-outsize-profit-influence/#:~:text=Pfizer's%202021%20revenue%20was%20%2481.3,the%20U.S.%20and%20European%20markets.

American Association for Cancer Research. AACR Report on the Impact of COVID-19 on Cancer Research and Patient Care. https://www.AACR.org/COVIDReport. Published February 9, 2022. Accessed June 19th, 2022.

Anand P, Kunnumakkara AB, Sundaram C, Harikumar KB, Tharakan ST, Lai OS, Sung B, Aggarwal BB (September 2008). "Cancer is a preventable disease that requires major lifestyle changes". *Pharmaceutical Research*. **25** (9): 2097–116. doi:10.1007/s11095-008-9661-9.

Bhaskaran K, Douglas I, Forbes H, dos-Santos-Silva I, Leon DA, Smeeth L (August 2014). "Body-mass index and risk of 22 specific cancers: a population-based cohort study of 5·24 million UK adults". *Lancet*. **384** (9945): 755–65. doi:10.1016/S0140-6736(14)60892-8.

Biesalski HK, Bueno de Mesquita B, Chesson A, Chytil F, Grimble R, Hermus RJ, Köhrle J, Lotan R, Norpoth K, Pastorino U, Thurnham D (1998). "European Consensus Statement on Lung Cancer: risk factors and prevention. Lung Cancer Panel". *CA: A Cancer Journal for Clinicians*. **48** (3): 167–76, discussion 164–66. doi:10.3322/canjclin.48.3.167.

Bray, Freddie, Jacques Ferlay, Isabelle Soerjomataram, Rebecca L. Siegel, Lindsey A. Torre, and Ahmedin Jemal. "Global Cancer Statistics 2018: Globocan Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries." *CA: A Cancer Journal for Clinicians* 68, no. 6 (2018): 394-424. https://doi.org/10.332/caac.21492.

Bruckner, Mathias, and Roland Mollerus. "UN/DESA Policy Brief #66: Covid-19 and the least developed countries | Department of Economic and Social Affairs." United Nations. United, Nations, May 1, 2020. https://www.un.org/development/desa/dpad/publication/un-desa-policy-brief-66-covid-19-and-the-least-developed-countries/.

Written by Katharina Buchholz, Data Journalist. "UN: How Has the World's Urban Population Changed from 1950 to 2020?" World Economic Forum. Accessed June 15th, 2022. https://www.weforum.org/agenda/2020/11/global-continent-urban-population-urbanisation-percent/#:~:text=Overall%2C%20more%20people%20in%20the,of%20less%20than%20500%2C000%20inhabitants.

"Cancer." World Health Organization. World Health Organization. Accessed June 11, 2022. https://www.who.int/health-topics/cancer#tab=tab_1.

"Cancer immunotherapy market" (Precedence Research, 2021).

"Cervical cancer elimination in Africa: where we are now and where do we need to be?", (International Agency for Research on Cancer, 2020), https://www.uicc.org/sites/main/files/atoms/files/UICC-Cervical_Cancer_in_Africa_FA_Single.pdf.

Colditz, Graham A. (ed.) (2015). *The SAGE Encyclopedia of Cancer and Society (International Agency for Research on Cancer)*. SAGE Publications. pp. 1323–. ISBN 978-1-5063-0126-6.

"The Enhanced Integrated Framework." UNCTAD, July 14, 2021. https://unctad.org/topic/least-developed-countries/enhanced-integrated-framework.

FARBER, S, and L K DIAMOND. "Temporary remissions in acute leukemia in children produced by folic acid antagonist, 4-aminopteroyl-glutamic acid." *The New England journal of medicine* vol. 238,23 (1948): 787-93. doi:10.1056/NEJM194806032382301.

Full Fact. (2022, April 14). *The great reset: What is it?* Full Fact. Retrieved August 13, 2022, from https://fullfact.org/online/great-reset-conspiracy-theory/.

Grange JM, Stanford JL, Stanford CA (June 2002). "Campbell De Morgan's 'Observations on cancer', and their relevance today". *Journal of the Royal Society of Medicine*. **95** (6): 296-99. doi:10.1258/jrsm.95.6.296.

"Home | Sustainable Development." United Nations. United Nations. Accessed August 16, 2022. https://sdgs.un.org/.

"How the Human Genome Project Transformed Cancer Research." Kiscan, April 25, 2019. https://kidscan.org.uk/human-genome-project-transformed-cancer-research/.

Irigaray P, Newby JA, Clapp R, Hardell L, Howard V, Montagnier L, Epstein S, Belpomme D, (December 2007). "Lifestyle-related factors and environmental agents causing cancer: an overview". *Biomedicine & Pharmacotherapy*. **61** (10): 640–58. doi:10.1016/j.biopha.2007.10.006.

Kolata, Gina. "Advances Elusive in the Drive to Cure Cancer." The New York Times. The New York Times, April 24, 2009. https://www.nytimes.com/2009/04/24/health/policy/24cancer.html.

"The Least Developed Countries Report 2021: The Least Developed Countries in the Post-COVID World: Learning from 50 Years of Experience." UNCTAD, September 27, 2021. https://unctad.org/press-material/least-developed-countries-report-2021-least-developed-countries-post-covid-world.

Little JB (2000). "Chapter 14: Ionizing Radiation". In Kufe DW, Pollock RE, Weichselbaum RR, Bast RC, Gansler TS, Holland JF, Frei E (eds.). *Cancer medicine* (6th ed.). Hamilton, Ont: B.C. Decker. ISBN 978-1-55009-113-7.

Moore, P., Chang, Y. Why do viruses cause cancer? Highlights of the first century of human tumor virology. *Nat Rev Cancer* **10,** 878–889 (2010). https://doi.org/10.1038/nrc2961.

"National Cancer Act of 1971." National Cancer Institute. Accessed August 16, 2022. https://www.cancer.gov/about-nci/overview/history/national-cancer-act-1971.

Olson JS (2005). *Bathsheba's Breast: Women, Cancer, and History*. JHU Press. pp. 145–70. ISBN 978-0-8018-8064-3. OCLC 186453370.

Omary, M. Bishr, Jeetendra Eswaraka, S. David Kimball, Prabhas V. Moghe, Reynold A.

Panettieri, and Kathleen W. Scotto. "The COVID-19 Pandemic and Research Shutdown: Staying Safe and Productive." *Journal of Clinical Investigation* 130, no. 6 (2020): 2745-48. https://doi.org/10.1172/jc/i138646.

"On the Road to LDC5." UNCTAD, November 25, 2021. https://unctad.org/topic/least-developed-countries/ldc5.

Sharp, Linda et al. "Risk of several cancers is higher in urban areas after adjusting for socioeconomic status. Results from a two-country population-based study of 18 common cancers." *Journal of urban health: bulletin of the New York Academy of Medicine* vol. 91,3 (2014): 510-25. doi:10.1007/s11524-013-9846-3.

Song, Mingyang, Bert Vogelstein, Edward L. Giovannucci, Walter C. Willett, and Cristian Tomasetti. "Cancer Prevention: Molecular and Epidemiologic Consensus." Science 361, no. 6409 (2018): 1317–18. https://doi.org/10.1126/science.aau3830.

"Support for LDC Participation in International Forums | LDC Portal – International Support Measures for Least Developed Countries." United Nations. United Nations. Accessed July 7, 2022.

Syed, S.B., Dadwal, V., Rutter, P. *et al.* Developed-developing country partnerships: Benefits to developed countries?. *Global Health* **8,** 17 (2012). https://doi.org/10.1186/1744-8603-8-17.

"Understanding What Cancer Is: Ancient Times to Present." American Cancer Society, 2018. https://www.cancer.org/treatment/understanding-your-diagnosis/history-of-cancer/what-is-

cancer.html#:~:text=The%20origin%20of%20the%20word,forming%20and%20ulcer%2Dforming%20tumors.

United Nations. (n.d.). *Least developed countries (ldcs) | Department of Economic and Social Affairs*. United Nations. Retrieved September 22, 2022, from https://www.un.org/development/desa/dpad/least-developed-country-category.html#:~:text=Least%20developed%20countries%20(LDCs)%20are,low%20levels%20of%20human%20assets.

UN – OHRLLS, *Brussels programme of action: addressing the special needs of the least developed countries* (New York, United Nations, 2001), available from https://www.un.org/ohrlls/sites/www.un.org.ohrlls/files/brussels_programme_of_action.pdf.

"What Is the Human Genome Project?" Genome.gov. Accessed June 26, 2022. https://www.genome.gov/human-genome-project/What.

WHO International Agency for Research on Cancer. Estimated number of deaths in 2020, all cancers, both sexes, all ages. Cancer today. Published 2020. Accessed January 14, 2022. https://gco.iarc.fr/today/online-analysis-pie?v=2020&mode=population&mode_population=income&population=900&populations=900&key=total&sex=0&cancer=39&type=1&statistic=5&prevalence=0&population_group=0&ages_group%5B%5D=0&ages_group%5B%5D=17&nb_items=7&group_cancer=1&include_nmsc=1&include_nmsc_other=1&half_pie=0&donut=0.

"World Bank: RCEP Initiator is Indonesia, Not China". *CNBC*. 30 November 2020.

World Health Assembly resolution f66/10, *Follow-up to the political declaration of the high-level meeting of the General Assembly on the prevention and control of non-communicable diseases*, A/RES/66/10 (27 May 2013), available from https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_R10-en.pdf?ua=1.

World Health Assembly, 70. (2017). Cancer prevention and control in the context of an integrated approach. World Health Organization. https://apps.who.int/iris/handle/10665/275676

Yalom, Marilyn (1998). *A history of the breast* (1 ed.). New York: Ballantine Books. ISBN 978-0-679-43459-7.

TOPIC B: INTELLECTUAL PROPERTY OF PUBLIC HEALTH

Statement of the Problem

Intellectual Property of Frontier Healthcare Technologies

Intellectual Property (IP) is the development of ideas, inventions, designs, and methods for commercial use. Some examples include **copyrights**, **patents**, and **trade secrets**. Given how IP can be crucial towards the success of a company, it is often the case that corporations will withhold IP from being used by competing companies. However, laws have been established worldwide to balance the interests of such inventors and the greater public when certain products are greatly needed.[52] Furthermore, such laws also encourage competition and further production of innovative goods, progressing the global technological state as a result.[53] For example, patents and copyrights are granted to a company by the government, stating that the inventor can exclude others from selling, using, creating, and importing an invention for a limited amount of exchange. However, to be granted such IP, the inventor must be willing to disclose the invention to the public.[54]

According to the World Intellectual Property Organization, **frontier technologies** are inventions at the intersection of scientific development and real-world implementation, with the potential to address global issues many countries face today, such as poverty, refugee migration, and natural disaster relief. Some examples of frontier technologies include artificial intelligence (AI**),** 3D printing, **genetic engineering**, and other hardware innovations.[55] Such "frontier technologies" have undergone rapid development in recent years. In an increasingly global and digital market, the current filing process for granting IP rights must be able to match this speed and become more efficient.

[52] "What Is Intellectual Property (IP)?" WIPO. Accessed June 11, 2022. https://www.wipo.int/about-ip/en/#:~:text=Intellectual%20property%20(IP)%20refers%20to,and%20images%20used%20in%20commerce.
[53] Goldstein, Paul; Reese, R. Anthony (2008). *Copyright, Patent, Trademark and Related State Doctrines: Cases and Materials on the Law of Intellectual Property* (6th ed.). New York: Foundation Press. ISBN 978-1-59941-139-2.
[54] Simon, Stokes (2001). *Art and copyright*. Hart Publishing. pp. 48–49. ISBN 978-1-84113-225-9.
[55] "IP and Frontier Technologies." Intellectual Property for Frontier Technologies. Accessed June 11, 2022. https://www.wipo.int/about-ip/en/frontier_technologies/.

An efficient system to promote, file, and publicize IP is especially important in the context of public health, in which there is a greater need for frontier technologies to combat the COVID-19 pandemic. In recent years, the pharmaceutical industry and many research corporations and academic institutions have shifted to focus on developing pandemic-related technologies, such as vaccines, viral treatments, and ventilators. Therefore, there should be a greater focus on the healthcare system and granting and protecting intellectual property that can benefit public health, especially during the COVID-19 pandemic.

The Gap in IP Infrastructure

There exists a gap in resources between wealthy and less-developed countries to develop IP **infrastructure** in an increasingly technological and innovative world. More specifically, LDCs may struggle with processing IP applications, promoting innovation and discovery within domestic corporations, and falling further behind wealthier countries when it comes to depending on imports rather than their own production of commodities. As a result, this can potentially widen the wealth gap between LDCs and wealthy countries. According to the most recent reporting on the Global Innovation Index (GII), many countries in the top 25% rankings are of European or East Asian origin (light green and light blue, respectively). Furthermore, in this ranking list overall, there is a heavy correlation between GII rank and income rank. This can potentially mean that how much a country invests in IP infrastructure can affect that country's overall economic status. In addition, countries scoring in the lowest 25% of the rankings are primarily LDCs located in sub-Saharan Africa, Latin America, and South and Southeast Asia. Given this, it goes to show the power of developing frontier technologies to economically benefit a country.

GII rank	Economy	Score	Income group rank	Region rank
1	Switzerland	65.5	1	1
2	Sweden	63.1	2	2
3	United States of America	61.3	3	1
4	United Kingdom	59.8	4	3
5	Republic of Korea	59.3	5	1
6	Netherlands	58.6	6	4
7	Finland	58.4	7	5
8	Singapore	57.8	8	2
9	Denmark	57.3	9	6
10	Germany	57.3	10	7
11	France	55.0	11	8
12	China	54.8	1	3
13	Japan	54.5	12	4
14	Hong Kong, China	53.7	13	5
15	Israel	53.4	14	1
16	Canada	53.1	15	2
17	Iceland	51.8	16	9
18	Austria	50.9	17	10
19	Ireland	50.7	18	11
20	Norway	50.4	19	12
21	Estonia	49.9	20	13
22	Belgium	49.2	21	14
23	Luxembourg	49.0	22	15
24	Czech Republic	49.0	23	16
25	Australia	48.3	24	6
26	New Zealand	47.5	25	7
27	Malta	47.1	26	17
28	Cyprus	46.7	27	2
29	Italy	45.7	28	18
30	Spain	45.4	29	19
31	Portugal	44.2	30	20
32	Slovenia	44.1	31	21
33	United Arab Emirates	43.0	32	3

99	Pakistan	24.4	17	7
100	Namibia	24.3	32	6
101	Guatemala	24.1	33	16
102	Rwanda	23.9	1	7
103	Tajikistan	23.9	2	8
104	Bolivia (Plurinational State of)	23.4	18	17
105	Senegal	23.3	19	8
106	Botswana	22.9	34	9
107	Malawi	22.9	3	10
108	Honduras	22.8	20	18
109	Cambodia	22.8	21	15
110	Madagascar	22.5	4	11
111	Nepal	22.5	22	9
112	Ghana	22.3	23	12
113	Zimbabwe	21.9	24	13
114	Côte d'Ivoire	21.0	25	14
115	Burkina Faso	20.5	5	15
116	Bangladesh	20.2	26	10
117	Lao People's Democratic Republic	20.2	27	16
118	Nigeria	20.1	28	16
119	Uganda	20.0	6	17
120	Algeria	19.9	29	18
121	Zambia	19.8	30	18
122	Mozambique	19.7	7	19
123	Cameroon	19.7	31	20
124	Mali	19.5	8	21
125	Togo	19.3	9	22
126	Ethiopia	18.6	10	23
127	Myanmar	18.4	32	17
128	Benin	18.0	33	24
129	Niger	17.8	11	25
130	Guinea	16.7	12	26
131	Yemen	15.4	13	19
132	Angola	15.0	34	27

Figure 1: Global Innovation Index (top and bottom 25% respectively)[56]

In addition to these economic benefits underlying IP infrastructure, there are also social benefits that have been noted in wealthier countries, such as a 0.3% increase in life expectancy between 2009 and 2019. However, supporting IP does have its negative outcomes, such as a 1.48% increase in carbon dioxide emissions between 2009 and 2019. Therefore, even if there is a way that the gap in IP infrastructures can be resolved, there remains the issue of how supporting IP can be a sustainable practice.

There also exists a concern that LDCs cannot support IP and spur innovation within their own communities without first addressing more foundational issues in their developing economy and under-resourced governments. More specifically, the recent publication of the World Intellectual Property Report noted that the issues such countries face with supporting innovation are substantially different compared to issues they currently face with development.[57] For example, if a

[56] "Global Innovation Index 2021: Tracking Innovation through the COVID-19 Crisis," accessed October 5, 2022, https://www.wipo.int/wipo_magazine/en/2021/03/article_0002.html.
[57] *World Intellectual Property Report 2022: The direction of innovation.* Geneva: WIPO.

country is especially lacking in highways, hospitals, and a functioning healthcare system, it would be hard to create or import frontier technologies to these countries in the first place. The added difficulty would be making these frontier technologies useful and tailor-made in such an environment with these resources, even if there was a way to successfully create such a frontier technology, patent it, and make it publicly available for other corporations to innovate other beneficial technologies.

Implications of IP on Global Health Disparities

The disparities in IP resources and frontier technologies between wealthy and low-income countries especially comes to light when addressing large-scale public health crises. This is especially of importance when LDCs are pressed to address not only the public health consequences of living in a low-income country (malnutrition, chronic illnesses, tropical-borne diseases, etc.), but also the impact of the COVID-19 pandemic. A 2021 study noted that many IP laws are "too restrictive", inhibiting access to essential medicines, especially COVID-19 vaccines. Furthermore, the commodification of these resources pushes LDCs into even greater debt to selling countries, increasing the wealth gap between LDCs and wealthy countries. These issues are especially present in the Global South, where many developing countries are geographically situated. Several factors for these tight restrictions around IP laws come from the politicization of vaccinations, pharmaceutical companies prioritizing making profit instead of saving lives, and vague declarations from international bodies towards countries to loosen these restrictions to "protect public health". Thus, while establishing systems to support IP and innovation of frontier technologies, including laws, may be beneficial generally, in the context of the COVID-19 pandemic, these resources can prove more detrimental than initially realized by policymakers.[58]

One study notes the use of the *Drugs for Neglected Diseases Initiative* as a model for countries to promote collaboration between corporations and public health markets to create public health IP to maximize health outcomes instead of corporate profits. This idea stems from the "public health paradox" observed in many countries by Phelan and Link in their 2005 study. They note that

[58] Sekalala S, Forman L, Hodgson T, *et al*. Decolonizing human rights: how intellectual property laws result in unequal access to the COVID-19 vaccine. *BMJ Global Health* 2021;**6**:e006169. doi:10.1136/bmjgh-2021-006169.

"controlling disease through costly interventions creates or increases health disparities, as people with more knowledge, money, and beneficial social connections have greater access and ability to harness medical advances and treatments than those with less".[59] Therefore, there is a larger issue causing a "healthcare gap" between wealthy countries and LDCs: dysfunctions of current drug development. Interestingly, current IP laws are to blame for skyrocketing drug costs because pharmaceutical corporations work closely with politicians and government officials through lobbying efforts. This is to develop laws and regulations to maximize production of newly patented products for rare and non-communicable diseases at the cost of minimizing their focus on larger, unmet public health needs.[60] The reason for focusing on "rare diseases" comes from the currently limited resources in treating such conditions. Given such a lack of supply, the demand for pharmaceutical corporations to create treatments and continue research in rare diseases often results in large monetary value for these supplies and thus greater profits. Therefore, these relationships establish a conflict of interest which allows such government-backed monopolies to charge up to 50 times the manufacturing price of drugs to the public health market.[61] Thus, while generating medical products that are tailor-made to public health needs and the healthcare sector at large, current IP laws contradict this effort because of how easily pharmaceutical lobbyists can convince government officials to change these laws to favor making corporate profits instead of saving lives.

[59] Light DW (2020) Addressing Health Care Disparities: A Radical Perspective and Proposal. *Front. Sociol.* 5:29. doi: 10.3389/fsoc.2020.0029.
[60] Ibid.
[61] Ibid.

History of the Problem

Copyright and Patent Laws

Intellectual property was first understood as ideas and inventions protected under various copyright and patent laws established by governments. More specifically, IP was first conceptualized as "literary property" in Britain during the mid-18th century to protect the works of authors and publishers.[62] Looking further back into history, Venice in the 14th century was credited to be the first to grant exclusive rights to the practice of certain labors, such as implementing a system for grain storage, in exchange for introducing these ideas into the local economy after a limited period of time.[63] These spurred other laws to encourage and protect the creation of IP, resulting in a large influx of skilled immigrants and a boom in the local economy with the rise of industrialization and economic power. Therefore, these were early signs that protecting IP held economic potential.

Interestingly, the phrase "intellectual property" was first recorded in "The Medical Repository of 1808", in which a New England Association of physicians wrote "in factor of inventors and discoverers, and particularly for the protection of intellectual property".[64] In this document, it specified that the United States House of Representatives ordered that a list be created of patents already granted to inventors in 1805, establishing the first bare-bones system for IP oversight by the government. From this arose various associations and societies consisting of inventors and artists advocating for the establishment of copyright and patent laws.[65] They wrote various arguments for the creation of such legislation, noting that the public has every right to create an invention and that the rights to utilize it are protected under law. Furthermore, they argued that unless the inventor complied with the government to publicize their inventions, the inventor has every right to withhold

[62] Mitchill, Samuel L., and Edward Miller. "New-England Association in Favour of Inventors and Discoverers, and Particularly for the Protection of Intellectual Property." Essay. In *The Medical Repository: Comprehending Original Essays and Intelligence Relative to Medicine, Chemistry, Natural History, Agriculture, Geography, and the Arts, More Especially as They Are Cultivated in America: And a Review of American Publications on Medicine, and the Auxiliary Branches of Science*, 303–4. New-York, New York: Printed and sold by T. & J. Swords ..., 1808.
[63] Ragavan, S. (2012). Correlation Between Patents and Development: Lessons From History. In *Patent and trade disparities in developing countries* (pp. 1-29). Essay, Oxford University Press.
[64] Ibid.
[65] Ibid.

their wealth and knowledge from their invention. Therefore, important questions regarding the limitations of IP protections were postulated as early as the formulation of a new nation.[66]

Globalizing Health Issues

In general terms, **global health** refers to the worldwide context of health in various populations. More specifically, such issues within global health are not exclusive to resolving domestic health concerns, but rather tackle on such health concerns that span national borders or have a global political and economic consequence in their nature.[67] When the United Nations and the World Health Organization were established in 1945, there was also a concurrent cholera epidemic in Egypt at that time. Therefore, the WHO was positioned to provide the first policy recommendations to the international community that centered around addressing global health. As a result of this epidemic, the WHO published a Model List of Essential Medicines and the Alma-Ata Declaration to emphasize the importance of health care across the globe.[68]

In 2000, the United Nations Summit declared the Millennium Development Goals (MDGs) to improve upon various global issues in a 15-year span.[69] Despite these ambitious plans, the MDGs failed to account for reproductive, maternal, and children health. This finding led the UN to reconvene in 2015 and build upon the MDGs to declare the 17 Sustainable Development Goals for the years 2016-2030, which did address global health issues related to poverty, such as reproductive and childhood diseases.[70] Nevertheless, between 2000 and 2015, several measures were enacted through the UN to mediate global health concerns regarding providing vaccinations, funding HIV/AIDS research, and allocating resources to fight off tuberculosis in malaria in various parts of the globe.[71]

---

[66] Ibid.
[67] Macfarlane SB, Jacobs M, Kaaya EE (December 2008). "In the name of global health: trends in academic institutions". *J Public Health Policy*. **29** (4): 383–401. doi:10.1057/jphp.2008.25.
[68] Primary Health Care: Report of the International Conference on Primary Health Care (PDF) (Report). Geneva: World Health Organization. 1978.
[69] Kumar, Sanjiv (January–March 2016). "Millennium development goals (MDGS) to sustainable development goals (SDGS): Addressing unfinished agenda and strengthening sustainable development and partnership". *Indian Journal of Community Medicine*. **41** (1): 1–4. doi:10.4103/0970-0218.170955.
[70] "Transforming our world: the 2030 Agenda for Sustainable Development .:. Sustainable Development Knowledge Platform". *sustainabledevelopment.un.org*. Retrieved 2016-02-26.
[71] Hoffman S.J. (2011). "Ending Medical Complicity in State-Sponsored Torture". *The Lancet*. **378** (9802): 1535–1537. doi:10.1016/S0140-6736(11)60816-7.

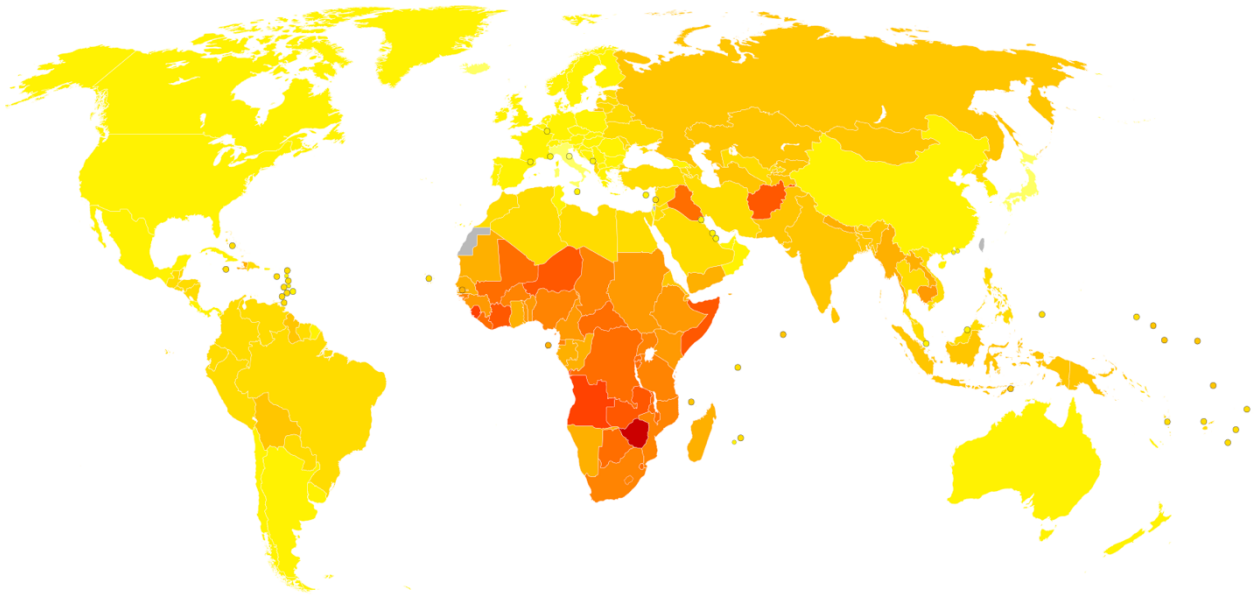

Figure 2: Global Disability-adjusted life years per 100,000 people, 2004 (red is most years lost, yellow is least years lost)[72]

Global health uses several metrics to determine what pressing issues exist in certain parts of the world, such as disability-adjusted life years (DALYs) and mortality rates.[73] DALYs are summary measures of how a particular disease, disability, or other medical condition affects the lifespan of an individual. Mortality rates are used to generally represent the health condition of a population. More specific mortality rates have been widely used and can be age-specific, such as infant and child mortality.[74] Global health research on the health disparities experienced in low-income countries oftentimes utilize infant and child mortality as a significant marker to represent this trend.

In recent years, the focus of global health drastically shifted towards how the COVID-19 pandemic would impact low-income countries and their under-developed healthcare systems. In 2020, an article from the Annals of Global Health proposed a mechanism to review investment in health

[72] Etches V, Frank J, Di Ruggiero E, Manuel D (2006). "Measuring population health: a review of indicators". *Annu Rev Public Health*. **27**: 29–55. doi:10.1146/annurev.publhealth.27.021405.102141.
[73] Ibid.
[74] Mulholland E, Smith L, Carneiro I, Becher H, Lehmann D (May 2008). "Equity and child-survival strategies". *Bulletin of the World Health Organization*. 86 (5): 399–407. doi:10.2471/BLT.07.044545.

research in low-income countries, with a focus on vaccine and treatment development for COVID-19.[75]

How IP and frontier technologies have shaped global health extends far and wide. For example, virtual reality (VR) devices have been of great use in hospitals and clinics to manage chronic pain. Although the neurobiological basis for how VR works is still up for debate, it is agreed that there is less signaling towards pain receptors when the patient is "distracted" by the stimuli the VR device provides.[76] Given the amount of technology being experimented in healthcare (and the amount of IP created as a result), it is important to improve the process in which frontier technologies are tested and approved for use in healthcare. Meanwhile, it is also crucial that IPs are properly regulated. Cost-effective blood testing for a variety of physiological features and diseases was extremely promising with the rise of Theranos, an American biohealthcare corporation. Nevertheless, the company ceased operations in 2018 over allegations of fraud and forging patient blood test results.

[75] Kilmarx PH, Maitin T, Adam T, Akuffo H, Aslanyan G, Cheetham M, Corrêa-Oliveira R, Kay S, Khelef N, Kunaratnam Y, Kupfer L, Olesen OF. A Mechanism for Reviewing Investments in Health Research Capacity Strengthening in Low- and Middle-Income Countries. Annals of Global Health. 2020; 86(1): 92, 1–4. doi: https://doi.org/10.5334/aogh.2941.
[76] Li, Angela et al. "Virtual reality and pain management: current trends and future directions." *Pain management* vol. 1,2 (2011): 147-157. doi:10.2217/pmt.10.15

Past Actions

Geographical Indications Identifying IP Products

Figure 3: Examples of geographical indications within India, specifying various regions in which certain agricultural products are protected[77]

In addition to utilizing copyrights, patents, and trademarks to signify a product of IP, **geographical indications (GIs)** can be used as a sign on products to indicate a specific geographic origin. In addition, it contains qualities and a reputation due to that origin, establishing a connection between a product of IP and the original place of production.[78] In practical terms, this new indication of IP means that a product with a GI can only be produced within the indicated geography. Most GIs are granted for agricultural products, foodstuffs, and various industrial products. As a result, GIs can be granted to a generalized yet localized group of innovators, producers, and manufacturers while ensuring that the region producing these products of IP reap the economic benefits of promoting and protecting IP.[79]

[77] *Geographical indications*. What do they specify? (n.d.). Retrieved September 19, 2022, from https://www.wipo.int/geo_indications/en/
[78] Ibid.
[79] Ibid.

One large caveat to using GIs is that it doesn't grant the right to the holders of the GI to prevent someone from making a product if they are using the same production techniques and are within the specified geographical indication.[80] Therefore, there is nothing within GI laws that prevents overseas and wealthy corporations from producing a product of IP within its specified geographical indication and utilizing the same techniques within the agreement of the GI. This can greatly put low-income countries at risk of not reaping the economic product of their own IP because of the vagueness of current GI laws. Furthermore, there also exists great promise to implement IP in public health, which is of great importance for this committee. Therefore, GIs can be extremely promising to be used in protecting medical innovations and various healthcare technologies, techniques, and other inventions.

WIPO Initiatives on IP

Most work involving changing IP laws to better suit the needs of global issues has been done under the World Intellectual Property Organization (WIPO). One of the largest initiatives enacted by this committee was the WIPO Development Agenda of 2007, which contained a list of 45 recommendations to adjust WIPO's priorities towards supporting low-income countries in accessing and using IP infrastructure.[81] Since these recommendations were enacted, multiple talks have taken place regarding patient access to medicine, student access to online **databases**, and programmers' access to source code. While many wealthy countries have already implemented their own IP initiatives and policies to support their needs, the Development Agenda was unique in that it called for a collection of international bodies to support low-income countries that cannot allocate resources to support IP.

In addition, WIPO established a public-private partnership in 2011 program called WIPO Re:Search.[82] It was tasked to share innovation tools to support research and healthcare endeavors in resolving neglected tropical diseases, such as malaria and tuberculosis. More specifically, Re:Search grants organizations to share IP and other resources royalty-free with researchers around the world fighting

[80] Ibid.
[81] Morin, Jean-Frédéric. "Paradigm Shift in the Global IP Regime: The Agency of Academics." *Review of International Political Economy* 21, no. 2 (2013): 275–309. https://doi.org/10.1080/09692290.2013.819812.
[82] Ibid.

tropical diseases. It also includes sharing private-sector compounds and libraries to repurpose drugs for tropical diseases. This program works more with the early-stage research and development aspect of resolving these epidemics, allowing for a significant head-start in developing IP for low-income countries.

Next, Technology Innovation Support Centers have helped provide on-the-ground IP information and support to innovators around the world.[83] Some services offered by this program include access to resources and IP-related publications, training in database searching, monitoring sector competitors, and informing innovators on property laws, management skills, and technological marketing. This program has been especially useful for low-income countries who cannot attend international conferences or travel outside of their country to receive professional advice and resources like these.

Finally, in collaboration with the World Economic Forum, WIPO has sought to use this program to match innovators in low-income countries to patent attorneys who provide **pro bono** legal assistance in securing protection of IP products.[84] However, only a few countries are actively in this program (Chile, Colombia, Ecuador, Morocco, Peru, the Philippines, South Africa), raising concerns as for how this program is marketed to and accessed by low-income countries, as many low-income countries may not be aware of such a program or know how to take advantage of its resources.

Changes to the International IP Ecosystem

Appropriate IP policies, effective legal frameworks, robust operational infrastructure, and effective education are fundamental in promoting innovation and competitiveness. Within the Sustainable Development Goals established in 2015, SDG 9 focuses on bettering industry, innovation, and infrastructure. The accomplishment of SDG 9 is the focus of WIPO, in which it aims to lead the development of the international IP system for all countries to benefit from. Alongside this, the innovation of products of IP is essential towards achieving SDGs 2 (Zero Hunger), 3 (Good Health and

[83] Ibid.
[84] Ibid.

Well-Being), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 8 (Decent Work and Economic Growth), 11 (Sustainable Cities and Communities), and 13 (Climate Action).[85]

Figure 4: United Nations Sustainable Development Goals[86]

For one, WIPO has supported nations in building their IP ecosystem by facilitating the creation, development, and protection of IP as listed in the National Intellectual Property Strategies.[87] Furthermore, legal frameworks have been supported by WIPO to further encourage businesses to invest in developing IP and its products. With 26 international IP treaties and providing legislative advice to developing countries, WIPO has been crucial in fulfilling the SDGs in innovation and infrastructure. In addition, a judicial system for IP has been strongly advocated in order to keep up with the speed of innovation and support the pace of policy responses to account for new technologies. Asking important legal questions on the implications of certain IP, especially pertaining to public health responses, will impact stakeholders of IP nationwide, as well as internationally.[88] Interestingly, artificial intelligence has taken a liking within the international IP

[85] Ibid.
[86] United Nations. (n.d.). *Home | Sustainable Development*. United Nations. Retrieved August 16, 2022, from https://sdgs.un.org/
[87] "The Impact of Innovation." WIPO and the Sustainable Development Goals. Accessed June 11, 2022. https://www.wipo.int/sdgs/en/story.html.
[88] Ibid.

ecosystem for its services in processing copyrights, patents, and other challenges IP offices may face alongside the rapid pace of innovation. Some examples include creating AI applications as well as other software to remove the language barrier in transferring knowledge on certain technologies.[89]

[89] Ibid.

Possible Solutions

When it comes to addressing the needs of both innovators and global public health, it is imperative that LDCs are in talks with wealthier countries to establish IP trade agreements, such as trading exports of an IP product in exchange for including a group of scientists in a patent to continue the production of healthcare technologies. This can look like LDCs asking for financial support from wealthy countries, NGOs, or various United Nations bodies to build IP infrastructure and promote innovation and development of "frontier technologies" in healthcare. In exchange, wealthier countries can ask for imports of these IP products, strengthening the involvement of LDCs in international trading. In addition, LDCs should leverage the various resources of WIPO, such as patent attorneys and technology support assistants, to train overseas scientists and innovators on using their IP. Yet, without addressing the foundational issues of the under-resourced economy, it can be extremely difficult for LDCs to create IP infrastructure. Therefore, economic development should not be overlooked under the topic of supporting IPs in LDCs.

WIPO and other international bodies may consider creating a universal filing system for IP, in which it can take advantage of AI and other software to keep up with the pace of developing frontier technologies. Moreover, if LDCs are expected to have the resources to contribute towards the global IP ecosystem, a universal database of copyrights, patents, and trade secrets should also be created and granted to LDCs to further negotiations and talks with countries to establish trade agreements as previously explained.

Most importantly, asking LDCs to develop and expand upon its IP infrastructure can seem promising in solving various global health issues, but there may be an even greater risk to public health imposed by such resources: **climate change**. In an increasingly digital global market, the infrastructure supporting this sector remains environmentally unfriendly, increasing carbon dioxide emissions from factories, construction vehicles, and industrial machinery. Therefore, it is important to keep in mind how a digital global market can promote and achieve environmental protection in fulfillment of various Sustainable Development Goals.

Bloc Positions

Partnering with other countries to secure IP infrastructure for LDCs is of paramount importance. Given IP's ability to shape global health by promoting technological innovations, it is essential that countries not only improve the IP system to enable more innovations but also make access to technological innovations more equitable. More specifically, well-resourced countries should support less-resourced countries, especially developing countries experiencing public health crises, such as tropical diseases and HIV/AIDS. Furthermore, countries should utilize global trade to facilitate technology exchange and support IP infrastructure, especially in LDCs and land-locked developing countries (LLDCs). The following information is intended to introduce positions taken by different regions on this issue. Please use them as a starting point for your own research and do not feel pressured to assume these blocs.

North America, Europe, and East Asia

As referenced in the statement of the problem section, there exists a positive correlation between a country's monetary investment in IP infrastructure and its overall wealth. This bloc contains a group of countries which make up the highest 25% of the rankings on the Global Innovation Index (GII), a standard established by the World Intellectual Property Organization. Therefore, these countries are in the best position to continue creating such infrastructure for IP, especially in public health. Many of these countries on this bloc are also large stakeholders in developing pharmaceuticals, conducting research, and implementing global health policies in the international community, especially given the current nature of the COVID-19 pandemic. While this bloc may be compelled to solely shift their resources towards developing more public health-oriented IP systems, this committee will urge this bloc to consider how it can advocate for making IP infrastructure more equitable and accessible to low-income countries. This bloc should also consider how their own involvement in other international organizations and committees can inform them on how best to balance the needs of frontier technologies from a public health perspective while also respecting IP laws which protect innovators and businesses.

Latin America, Sub-Saharan Africa, and South/Southeast Asia

This bloc contains countries ranking in the lowest 25th percentile of the Global Innovation Index. These rankings also correlate with a low ranking in their income status. Given this, such countries are faced with a much different set of challenges to address intellectual property integration in public health. For one, given how this bloc may not have many IP resources in their respective countries, it may prove better for this bloc to address the public health issues shared by the global low-income country community. Unlike the previous bloc, which is better positioned to provide IP resources, this bloc should focus on how such resources received can benefit the public health sphere in LDCs. This way, both blocs can come together in agreement on how supporting IP globally can address global disparities experienced by LDCs, especially given the prevalence of the COVID-19 pandemic. For example, this bloc can consider how IP can be better utilized to distribute vaccines and antiviral treatments in rural and isolated populations. Furthermore, with increasing concerns about the global health effects of climate change, it is even more pressing for this bloc to consider the use of IP to alleviate diseases and health conditions associated with climate change. Lastly, this bloc should also consider how IP can promote preventative measures against global health crises in the long-term. This is critical given the ever increasing impact of climate change on public health.

Glossary

Climate change: Long-term shifts in temperatures and weather patterns.

Copyright: Type of IP which grants the owner the exclusive right to copy, distribute, adapt, display, and perform a creative work, usually for a limited time.

Database: Organized collection of structures information, or data, typically stored electronically in a computer system. It is set up for easy access, management, and updating.

Frontier technologies: Inventions at the intersection of scientific development and real-world implementation, with the potential to address global issues such as poverty, migration, and natural disaster relief.

Genetic engineering: Deliberate modification of the characteristics of an organism by manipulating its genetic material.

Geographical indications (GIs): Type of protection on products to indicate a specific geographic origin, containing qualities and a reputation due to that origin.

Global health: Worldwide context of health in various populations.

Infrastructure: Basic physical and organizational structures and facilities needed for the operation of a society or enterprise. Examples include buildings, roads, and power supplies.

Intellectual Property (IP): Development of ideas, inventions, designs, and methods for commercial use.

Patent: Type of IP which grants the owner the exclusive right to prevent or stop others from commercially exploiting the patented invention. It cannot be commercially made, used, distributed, imported, or sold by others without the patent owner's consent.

Pro bono: Derived from the Latin phrase "pro bono publico", which means "for the public good". The offering of free services, specifically in the context of legal advice.

Trade secret: Type of IP on confidential information, such as a secret device or technique used by a company in manufacturing its products.

Bibliography

Etches V, Frank J, Di Ruggiero E, Manuel D (2006). "Measuring population health: a review of indicators". *Annu Rev Public Health*. **27**: 29–55. doi:10.1146/annurev.publhealth.27.021405.102141.

Goldstein, Paul; Reese, R. Anthony (2008). *Copyright, Patent, Trademark and Related State Doctrines: Cases and Materials on the Law of Intellectual Property* (6th ed.). New York: Foundation Press. ISBN 978-1-59941-139-2.

Hoffman S.J. (2011). "Ending Medical Complicity in State-Sponsored Torture". *The Lancet*. **378** (9802): 1535–1537. doi:10.1016/S0140-6736(11)60816-7.

"IP and Frontier Technologies." Intellectual Property for Frontier Technologies. Accessed June 11, 2022. https://www.wipo.int/about-ip/en/frontier_technologies/.

Kilmarx PH, Maitin T, Adam T, Akuffo H, Aslanyan G, Cheetham M, Corrêa-Oliveira R, Kay S,

Khelef N, Kunaratnam Y, Kupfer L, Olesen OF. A Mechanism for Reviewing Investments in Health Research Capacity Strengthening in Low- and Middle-Income Countries. Annals of Global Health. 2020; 86(1): 92, 1–4. doi: https://doi.org/10.5334/aogh.2941.

Kumar, Sanjiv (January–March 2016). "Millennium development goals (MDGS) to sustainable development goals (SDGS): Addressing unfinished agenda and strengthening sustainable development and partnership". *Indian Journal of Community Medicine*. **41** (1): 1–4. doi:10.4103/0970-0218.170955.

Lemley, Mark A. "Property, Intellectual Property, and Free Riding." *SSRN Electronic Journal*, August 26, 2004. https://doi.org/10.2139/ssrn.582602.

Light DW (2020) Addressing Health Care Disparities: A Radical Perspective and Proposal. *Front. Sociol.* 5:29. doi: 10.3389/fsoc.2020.0029.

Macfarlane SB, Jacobs M, Kaaya EE (December 2008). "In the name of global health: trends in academic institutions". *J Public Health Policy*. **29** (4): 383–401. doi:10.1057/jphp.2008.25.

Mitchill, Samuel L., and Edward Miller. "New-England Association in Favour of Inventors and Discoverers, and Particularly for the Protection of Intellectual Property." Essay. In *The Medical Repository: Comprehending Original Essays and Intelligence Relative to Medicine, Chemistry, Natural History, Agriculture, Geography, and the Arts, More Especially as They Are Cultivated in America: And a Review of American Publications on Medicine, and the Auxiliary Branches of Science*, 303–4. New-York, New York: Printed and sold by T. & J. Swords ..., 1808.

Morin, Jean-Frédéric. "Paradigm Shift in the Global IP Regime: The Agency of Academics." *Review of International Political Economy* 21, no. 2 (2013): 275–309. https://doi.org/10.1080/09692290.2013.819812.

Mulholland E, Smith L, Carneiro I, Becher H, Lehmann D (May 2008). "Equity and child-survival strategies". *Bulletin of the World Health Organization*. **86** (5): 399–407. doi:10.2471/BLT.07.044545. Primary Health Care: Report of the International Conference on Primary Health Care (PDF) (Report). Geneva: World Health Organization. 1978.

Ragavan, S. (2012). Correlation Between Patents and Development: Lessons From History. In *Patent and trade disparities in developing countries* (pp. 1-29). Essay, Oxford University Press.
Sekalala S, Forman L, Hodgson T, *et al*. Decolonizing human rights: how intellectual property laws result in unequal access to the COVID-19 vaccine. *BMJ Global Health* 2021;**6**:e006169. doi:10.1136/bmjgh-2021-006169.

Simon, Stokes (2001). *Art and copyright*. Hart Publishing. pp. 48–49. ISBN 978-1-84113-225-9.

"Sustainable Development Goals and Intellectual Property." Sustainable Development Goals and IP. Accessed June 11, 2022. https://www.wipo.int/sdgs/en/.

"The Impact of Innovation." WIPO and the Sustainable Development Goals. Accessed June 11, 2022. https://www.wipo.int/sdgs/en/story.html.

"Transforming our world: the 2030 Agenda for Sustainable Development .:. Sustainable Development Knowledge Platform". *sustainabledevelopment.un.org*. Retrieved 2016-02-26.

"What Is Intellectual Property (IP)?" WIPO. Accessed June 11, 2022. https://www.wipo.int/about-ip/en/#:~:text=Intellectual%20property%20(IP)%20refers%20to,and%20images%20used%20in%20commerce.

WIPO (2021). *Global Innovation Index 2021: Tracking Innovation through the COVID-19 Crisis*. Geneva: World Intellectual Property Organization.

World Intellectual Property Report 2022: The direction of innovation. Geneva: WIPO.