5-29-2024

Socioeconomic Factors Influencing Hematological Health in Latin America

Lina M. Barrios, MS
Thomas Jefferson University

Socioeconomic Factors Influencing Hematological Health in Latin America

Lina M. Barrios, MS

LS 803 Contemporary Topics in Research, Medical Laboratory Sciences and Biotechnology Department, Jefferson College of Health Professions, Thomas Jefferson University, Philadelphia, PA

KEYWORDS

Hematological Malignancies
Leukemia
Lymphoma
Myeloma
Socioeconomic Factors
Poverty
Latin America
Cancer Registries
Blood Cancers
Leucemia
America Latina,
Factores Economicos y Sociales
Malnutricion
Linfomas

ABSTRACT

Hematological malignancies, also known as blood cancers, such as leukemia, lymphomas, and myelomas, are a significant health concern globally. The incidence of these malignancies has dramatically increased over time, leukemias being the leading cause. The incidence of blood cancers in Latin America exhibits regional variability, with leukemia being the emerging cause as the most prevalent type in children and young adults. However, the overall incidences are oddly lower than in developed countries, potentially due to the underreporting of the cases and the lack of cancer registries. This situation implies a critical need for improving surveillance and data collection methods to assess the burden of blood cancers in Latin America accurately. Additionally, socioeconomic factors are vital in contributing to the data collection landscape in Latin America. Poverty, along with limited healthcare infrastructure, healthcare professionals, and restricted supplies, among others, hinder diagnosis and treatment. Furthermore, financial access to healthcare and unequal distribution of resources delayed the delivery of timely and appropriate care to patients. Similarly, people living in poverty are less likely to overcome treatment due to malnutrition and other regional diseases affecting their prompt recovery. We will navigate those obstacles and identify the challenges Latin America faces compared to other developed nations.

Introduction

Hematological malignancies, commonly known as blood cancers, involve myeloid and lymphatic tumors caused by interruptions in average blood cell production. These malignancies usually begin in the immune system and the bone marrow cells, where the production of new blood cells begins. These cancers typically start from a single cancerous cell that undergoes genetic mutations, leading to uncontrolled replication. This process, known as clonal expansion, results in monoclonal malignancies derived from a single mutated cell, although some may be polyclonal, arising from multiple over-replicating cells. These malignancies are commonly categorized as leukemia, multiple myeloma, non-Hodgkin lymphoma, and Hodgkin lymphoma (Qian et al., 2009). While the incidence of leukemia is decreasing globally, it is increasing in developed regions. The distribution of these malignancies varies by country and region due to socioeconomic differences. Although survival rates for hematologic malignancies have improved, understanding the specific patterns and trends in morbidity and mortality remains crucial for developing targeted prevention strategies.

Myeloid neoplasms like acute myeloid leukemia, myelodysplastic syndrome, and myeloproliferative neoplasms originate from abnormal hematopoietic cells. On the other hand, lymphoid neoplasms can arise from malignant transformations at various stages of B or T lymphocyte maturation, presenting as acute or chronic leukemias, lymphomas, or other lymphocytic disorders. "Leukemia" and "lymphoma" generally refer to cancers primarily affecting the bone marrow and peripheral blood or the lymph nodes and lymphatic system, respectively (Qian et al., 2009). However, some hematologic malignancies may involve both categories during their progression.

Diagnosis and Treatment.

Diagnosing blood cancers, also known as hematologic malignancies, involves combining techniques to identify the type of cancer and determine its stage accurately. Some fundamental methods used to diagnose blood cancers include medical history and physical examination of the patient, blood tests, bone marrow biopsy and aspiration, imaging studies, cytogenetic and molecular tests, flow cytometry, and histopathology. The process often starts with a thorough medical history to understand the patient's symptoms, family history, and overall health to have an overview of the patient's tendencies. A physical examination may also reveal signs such as enlarged lymph nodes, abnormal bleeding, or other symptoms indicative of a hematologic malignancy. Blood tests play a crucial role in diagnosing blood cancers. Complete blood count (CBC) helps assess the number and types of blood cells, including red, white, and platelets. Abnormalities in these counts can indicate the presence of a blood cancer. Other blood tests, such as peripheral blood smears and flow cytometry, can provide additional information about the type and characteristics of cancerous cells.

Corresponding Author: Lina.Barrios@students.jefferson.edu

Bone marrow biopsy and aspiration involve extracting a sample of bone marrow from the hip bone using a needle. These samples are then examined under a microscope to look for cancerous cells, assess the bone marrow's cellularity, and determine the extent of infiltration by cancer cells (Erber, 2010).

However, this practice is not routine since it is an invasive procedure. Imaging tests such as X-rays, CT scans, MRI scans, and PET scans may be used to evaluate the extent of cancer spread, identify enlarged lymph nodes, detect organ involvement, and monitor treatment response. Cytogenetic tests, such as karyotyping and fluorescent in situ hybridization (FISH), analyze cancer cells' chromosomes and genetic abnormalities. Molecular tests, including polymerase chain reaction (PCR) and next-generation sequencing (NGS), can detect specific gene mutations, rearrangements, or expression patterns associated with different types of blood cancers. Flow cytometry is a technique that analyzes the characteristics of cells, including their size, shape, and protein expression. It is beneficial for identifying and characterizing abnormal immune cells in blood cancers like leukemias and lymphomas (Colunga-Pedraza, 2022).

In some cases, a lymph node biopsy or a biopsy of other affected organs may be necessary to obtain tissue samples for histopathological examination. This involves studying the tissue structure and cell morphology under a microscope to confirm the diagnosis and classify the type of blood cancer. These diagnostic techniques are often used to establish an accurate diagnosis, determine the specific type and subtype of blood cancer, assess its stage and extent of spread, and guide appropriate treatment decisions.

Environmental and Financial Factors Affecting Treatment of Blood Cancers.

Treatment for blood and bone marrow cancers depends on the type of cancer, the patient's age, how fast the cancer is progressing, where the cancer has spread, and other factors. Some common blood cancer treatments for leukemia, lymphoma, and multiple myeloma include Stem cell transplantation, Chemotherapy, and Radiation therapy. A stem cell transplant infuses healthy blood-forming stem cells into the body. Stem cells may be collected from the bone marrow, circulating blood, and umbilical cord blood of healthy donors compatible with the recipient. Chemotherapy uses anticancer drugs to block the growth of cancer cells in the body. Chemotherapy for blood cancer sometimes involves giving several drugs together in a set treatment. This treatment may also be provided before a stem cell transplant. Lastly, Radiation therapy may be used to destroy cancer cells or to relieve pain or discomfort. It may additionally be administered before a stem cell transplant (City of Hope, 2022).

The issue of cancer drug pricing is especially critical in the United States due to factors related to market authorization, reimbursement, healthcare financing, and funding. While the US has more oncology drugs available than other countries, the high costs limit patient access to innovative treatments. Patients receiving chemotherapy experience significantly higher expenses compared to those not on Chemotherapy, with oral therapies often resulting in higher out-of-pocket costs. Medicare Part D plans cover antineoplastic agents, but patients may face significant costs during coverage gaps, such as for ibrutinib treatment for chronic lymphocytic leukemia, which can amount to nearly $700 per month over 58 months. Medicare-insured patients are prescribed these cancer therapies, which can cost between $7500 and $25,000 per month and often reach their out-of-pocket maximum quickly. Many of the newest oral targeted agents have monthly costs that exceed the Federal Poverty Level annual income threshold for a single-person household. The high prices of cancer drugs are typically not based on innovation or clinical effectiveness but rather on existing therapy prices, leading to excessive costs for patients with limited expected benefits. Drugs approved based on response rate are priced higher than those approved based on overall survival. Launch prices for cancer drugs, including next-generation agents, tend to rise substantially post-licensing, increasing by an average of 10% annually.

Non-Hodgkin Lymphoma

Lymphomas are classified into non-Hodgkin lymphomas (NHLs) and Hodgkin lymphomas (HLs). NHLs rank fifth, while HLs rank sixteenth among non-gender-associated neoplasms.

Non-Hodgkin lymphoma (NHL) is a cancer originating from lymphocytes in the body's immune system and can affect adults and children. It typically begins in lymph nodes or tissue but can also affect other areas like the skin, spleen, bone marrow, thymus, adenoids, tonsils, and digestive tract. NHL is classified based on the type of lymphocyte affected (B cells or T cells) and how fast it grows (indolent or aggressive). The most common types are B-cell lymphomas, with follicular lymphoma being an example of an indolent type and diffuse large B-cell lymphoma (DLBCL) being an aggressive type. NHL can spread to other parts of the lymph system and beyond if left untreated. Classifying NHL types involves systems like the World Health Organization (WHO) classification, which considers lymphocyte type, microscopic appearance, chromosome features, and cell surface proteins (American Cancer Society).

Acute Lymphoblastic Leukemia

Acute lymphocytic leukemia (ALL), also known as acute lymphoblastic leukemia, is a type of leukemia that progresses quickly and can be fatal within months if untreated. It originates from immature lymphocytes, a kind of white blood cell, and primarily affects the bone marrow. However, it can spread to other body parts such as the blood, lymph nodes, liver, spleen, central nervous system, and testicles. Unlike lymphomas, which mainly affect lymph nodes or organs, leukemias, like ALL, primarily impact the bone marrow and blood. Understanding the blood and lymph systems is essential to comprehend leukemia, as it involves blood stem cells developing into red blood cells, platelets, and white blood cells, including lymphocytes (B cells and T cells), granulocytes, and monocytes. ALL arises from early forms of lymphocytes and can start in either early B cells or T cells at different stages of maturity (Pérez-Saldivar, 2011).

Acute Myeloid Leukemia

Acute myeloid leukemia (AML) originates in the bone marrow, where new blood cells are produced, and often progresses rapidly into the bloodstream. It can also spread to other areas such as lymph

Corresponding Author: Lina.Barrios@students.jefferson.edu

nodes, liver, spleen, central nervous system, and testicles. AML typically develops from hemopoietic cells that would become white blood cells, particularly myeloid cells, which can differentiate into red blood cells, platelets, and specific white blood cells (excluding lymphocytes). This leukemia has various names, including acute myelocytic leukemia, acute myelogenous leukemia, acute granulocytic leukemia, and acute non-lymphocytic leukemia (Goméz de Leon et al., 2023).

Socioeconomic Factors Affecting Treatment and Prognosis

When discussing resources or organizations that contribute to accessibility to healthcare and therapies provided by hospitals, the support and resources may vary depending on the country for instance, Meillon-Garcia et al report that in 2022, 66% of hospitals and 70% of the hospital beds and specialized treatment for AML treatment are private, suggesting that people living in poverty or with financial difficulties struggle for admission in a specialized hospital making it harder to get treatment. Patients who get treatment for leukemias in Brazil have a poor outcome and a relapse of 43% (Meillon-Garcia et al., 2020). Latin America and the Caribbean have established an organization called The Pan American Health Organization (OPS in Spanish), this organization is a collaboration between countries for the collection of data about leukemias and other diseases, and to improve the quality of life of the patients. Dr. Vasquez states that the purpose of this initiative is to reduce regional inequalities, enhance collaboration among countries, and decrease the impact factors of childhood cancer mortality, such as late detection, treatment abandonment, lack of oncological support, and insufficient palliative care. Colombia stands out as one of the leading countries in the region for childhood cancer cases, but it also faces a high mortality rate, with 5.3 children per thousand succumbing to cancer. The speaker emphasizes the regional differences, noting that places like Bogota see higher mortality rates, partly due to an influx of children from rural areas. While progress has been made in treating certain types of childhood cancer, leukemia still has a lower survival rate. Dr. Pachón highlights several strategic approaches to improve outcomes, including implementing comprehensive care pathways, adopting a payment-for-results system, improving access to primary healthcare, ensuring access to medications, enhancing palliative care services, and providing social support services (Pachón, 2023).

Genetics are also a factor in the development of leukemias. Quiroz et al report that the incidence rate of ALL is higher than non-Latinos, being ALL the most common type of cancer in children. Although they fail to find a relationship between socioeconomic status and incidences, they elaborate on the fact that the survival rate among Latinos living in poverty neighborhoods is worse than patients living in middle/upper-class neighborhoods (Quiroz et al., 2019). On the other hand, Martin-Trejo et al inform about a multicenter cohort MIGICCL study that took place in Mexico to relate the role of malnutrition to the early mortality in children with ALL. The study consisted of 794 pediatric patients with newly diagnosed ALL, 435 were males and 359 were females. The median age was 6 years with 29% of the patients older than 10 years old at diagnosis. 42.9% of the patients were classified as high-risk while 57.1% were a standard risk. 55.2% of the patients were from a low socioeconomic level, and during the induction phase 63.9% had infections, 17.6% had bleeding scenarios, 11.2% interrupted chemotherapy, 4.6% of the patients were underweight and 1.5% were severely underweight according to WHO classification. The mortality rates presented that 50 out of 794 patients died during the induction phase, 73 died in the 6th month of the study, 98 in the 12th month after ALL diagnoses and the abandonment rate was 2.5%, with seven of them dying during the first year of treatment (Martin-Trejo et al., 2017). In the study Martin-Trejo et al state that infections accounted for 51% of the deaths, followed by bleeding (12.2%), hypovolemic and septic shock (12.2%), leukemic activity/lysis tumoral syndrome (10.2%), chemotherapy-related toxicity (7.1%), and other less common causes. Among the patients who died during the induction-to-remission phase 20% had malnutrition. The analysis of malnutrition's impact on mortality in pediatric patients with ALL yielded several key findings. Initially, malnutrition at diagnosis did not serve as a predictor for mortality during the induction-to-remission phase or at the 6th month of treatment. This observation was held even after adjusting for hospital variability, indicating that malnutrition did not elevate the risk of mortality within the first 6 months post-diagnosis (Martin-Trejo et al., 2017). These results align with the study's overall conclusion, which supports the lack of a direct relationship between malnutrition and mortality in this context. However, the analysis did reveal an association between chronic malnutrition, as measured by height-for-age (HFA), and early mortality in high-risk children. Despite this observation, the study acknowledges the absence of a biological basis to explain this correlation and underscores the complexity of factors influencing outcomes in pediatric ALL patients, including socioeconomic status (SES) and treatment protocols.

In a study held by Dr. Goméz from the University of Autonoma de Nuevo Leon in Mexico, he discusses the abandonment of the treatment by the patients. The study took place in a hematological outpatient clinic with 391 participants, 99 of the patients were lost at the follow-up, of which were contacted through telephone calls, while 26 patients could not be contacted. Among the patients contacted, 55 had been diagnosed with acute lymphoblastic leukemia (ALL) and 18 with acute myeloblastic leukemia (AML). Patients with LAL had a median age of 26 years, most were high-risk and were mostly from urban areas. The main caregivers were mostly fathers, belonged to nuclear families, lacked health insurance and social security, and had an elementary educational level. Regarding patients with LAM, the median age was 33 years, high-risk patients also predominated and lived in urban areas. Socioeconomic data showed similar monthly median incomes between both groups and a low socioeconomic classification in all cases according to the modified Kuppuswamy scale (Gomez, 2022). Regarding patients with ALL, the majority experienced late-type abandonment (94.5%), with public transportation being common (87.3%). All patients faced economic limitations, and while none missed appointments due to lack of time, many struggled to cover consultation, laboratory tests, and medication costs (92.7%). The maintenance phase recorded the highest frequency of documented losses (61.8%), with most patients knowledgeable about their disease name (85.5%) and believing in its curability (92.7%). However, many reported fear of chemotherapy's adverse effects, notably nausea/vomiting (81%). Alternative medicine was rarely used (89.1%), and satisfaction rates with medical care were high (100%). After phone contact, a significant portion did not continue

Corresponding Author: Lina.Barrios@students.jefferson.edu

follow-up appointments (76.4%), and among those, a significant number experienced disease relapse (34.5%) or passed away (60%). In this study, risk factors associated with abandoning treatment in patients with acute lymphoblastic leukemia were identified, such as poverty, low family income, illiteracy, distance to the hospital, religious beliefs, and use of alternative therapies, all related to structural financial difficulties. The dropout rate found was 25%, similar to previous studies in pediatric patients and young adults, highlighting that the majority of dropouts were late (Gomez, 2022). Early abandonment was defined as a pause of more than 2 to 4 weeks in the Induction phase and more than 4 weeks in Consolidation and Maintenance, with the predominant type of abandonment being late, especially during the maintenance and consolidation stages in both types of leukemia (Pedrosa, 2000).

Comparison of High-Income Countries and Low-Income Countries

In the United States, leukemia diagnosis involves a comprehensive approach starting with a thorough medical history and physical examination, focusing on symptoms, risk factors, and signs of leukemia. Blood tests such as Complete Blood Count and Differential, are typically the initial step, followed by bone marrow samples obtained by aspiration and biopsy for detailed cellularity analysis. Spinal fluid tests if there is a concern of the central nervous system involvement. Molecular tests help to diagnose and classify leukemia subtypes. Similarly, imaging tests such as X-rays, MRI, and CT scans provide insight into organ involvement and disease progression. Dieguez et al report the care of blood cancers is annually $156,000 per patient in the first year after diagnosis. The spending varies depending on the type of blood cancer, but it could range between $200,000 for CML to $800,000 for AML (Dieguez et al., 2018). Having insurance can have a great impact on patients' cost of treatment which typically consists of sharing the cost, however, most insurance companies have a limit on how much patients are allowed to use during a year (Dieguez et al., 2018). Even though insurance can help, patients still struggle to pay their treatment costs like those who live in Latin American countries, although, low-income countries rely on insurance provided by the government. Finally, we can infer that the accessibility to treatment in the United States and Latin American countries is based on financial struggles, however, in Latin America, lack of resources and location also impact the treatment of patients.

Conclusion

Summary

This review paper analyzed the socioeconomic factors impacting health care in Latin America. Factors including poverty, limited healthcare infrastructure, restriction of supplies, and lack of healthcare professions result in underlying hematological incidence compared to developed countries. Resources and distribution of resources compared to other developed countries and ethnicities are unequal and present financial hardship to those affected. Hematological malignancies, referred to as blood cancers, involve myeloid and lymphatic tumors that stem from bone marrow disorders, such as hematopoiesis or the creation of blood cells. Although the incidence of leukemia is decreasing globally, Latin American countries face challenges in healthcare that lead to prolonged diagnosis and treatment.

Limitations

While many underserved populations also face challenges in healthcare, this paper focused on mainly Latin American countries, more specifically on those suffering from poverty. Meillon-Garcia et al report in 2022 concluded that over half of the hospitals and patient beds for treatment of AML are private (Meillon-Garcia et al., 2020). This suggests that those living in poverty or financial hardships are unable to receive admission for treatment of AML, which requires specialized treatment. This paper highlighted socioeconomic factors affecting those living in poverty, as the accessibility to healthcare or services is very limited in Latin American countries compared to their developed counterparts, such as the United States. However, the same challenges and barriers are prevalent among minorities overall. Instances of racial discrimination, stigma, and prejudices have led to unequal treatment of minorities in healthcare and other services. Efforts should focus on promoting and advocating equal treatment among all populations, including those struggling financially and other underserved populations such as non-native speakers, those with disabilities, and individuals' part of the LGBTQAI+. All these groups are underserved in healthcare, as well as socially, due to stigma and preconceived notions.

Future Direction

Although current economic and social boundaries have led to misdiagnosis or prolonged treatment among Latin American countries, efforts should focus on the complex relationship between Latin America and healthcare to challenge hematologic malignancies. This requires a multistep approach that takes into consideration environmental factors, social barriers, and collaborative efforts involving healthcare organizations to educate employees. First, it is important to improve cancer surveillance and data collection by current cancer registries to assess the burden of disease and aliquot resources as necessary. Collaborations with government bodies and nongovernmental organizations are needed to strengthen healthcare infrastructure and provide comprehensive supportive services for underserved populations such as those in Latin America. This can be achieved through education and awareness programs that help empower communities to advocate for themselves. The responsibility belongs to healthcare professions and patients advocating for equal treatment and timely and timely medical care to help reduce the stigma associated with hematological malignancies. Individually, barriers to equal healthcare are overwhelming; however, efforts that address challenges comprehensively will improve outcomes for affected individuals who are underserved in healthcare.

References

American Cancer Society. What is Non-Hodgkin lymphoma?: Types of non-hodgkin lymphoma. Types of Non-Hodgkin Lymphoma |. (n.d.). https://www.cancer.org/cancer/types/non-hodgkin-lymphoma/about/what-is-non-hodgkin-lymphoma.html

Corresponding Author: Lina.Barrios@students.jefferson.edu

City of Hope. (2022). Blood cancer: Types, symptoms, treatment & survival rate. City of Hope. https://www.cancercenter.com/blood-cancers

Colunga-Pedraza, P. R., Colunga-Pedraza, J. E., Peña-Lozano, S. P., Gómez-De León, A., Ruiz-Delgado, G. J., & Ribeiro, R. C. (2022). Diagnosis and treatment of acute lymphoblastic leukemia in latin america. Hematology, 27(1), 971-976.

Dieguez, G., Ferro, C., & Rotter, D. (2018, October). The cost burden of blood cancer care. (www.lls.org). https://www.lls.org/sites/default/files/Milliman study cost burden of blood cancer care.pdf

Erber, W. N. (2010). Diagnostic techniques in hematological malignancies. Google Books. https://www.google.com/books/edition/Diagnostic_Techniques_in_Hematological_M/4kyLvR96I3MC?hl=en&gbpv=1

Gómez-De León, A., Demichelis-Gómez, R., da Costa-Neto, A., Gómez-Almaguer, D., & Rego, E. M. (2023). Acute myeloid leukemia: Challenges for diagnosis and treatment in latin america. Hematology, 28(1), 2158015.

Gómez Gómez, E. T. (2022) Pérdida del seguimiento en pacientes con leucemias agudas, causas y desenlaces. Especialidad thesis, Universidad Autónoma de Nuevo León.

Implementación de la iniciativa global para el cáncer infantil en américa latina y el caribe: Avances y desafíos - OPS/OMS | organización panamericana de la salud. Retrieved Mar 4, 2024, from https://www.paho.org/es/eventos/implementacion-iniciativa-global-para-cancer-infantil-america-latina-caribe-avances

Martín-Trejo, J. A., Núñez-Enríquez, J. C., Fajardo-Gutiérrez, A., Medina-Sansón, A., Flores-Lujano, J., Jiménez-Hernández, E., Amador-Sanchez, R., Peñaloza-Gonzalez, J. G., Alvarez-Rodriguez, F. J., Bolea-Murga, V., Espinosa-Elizondo, R. M., de Diego Flores-Chapa, J., Pérez-Saldivar, M. L., Rodriguez-Zepeda, M.,del Carmen, Dorantes-Acosta, E. M., Núñez-Villegas, N. N., Velazquez-Aviña, M. M., Torres-Nava, J. R., Reyes-Zepeda, N. C., . . . Mejía-Aranguré, J. M. (2017). Early mortality in children with acute lymphoblastic leukemia in a developing country: The role of malnutrition at diagnosis. A multicenter cohort MIGICCL study. Leukemia & Lymphoma, 58(4), 898-908. https://10.1080/10428194.2016.1219904

Meillon-Garcia, L.A., Demichelis-Gómez, R. Access to Therapy for Acute Myeloid Leukemia in the Developing World: Barriers and Solutions. Curr Oncol Rep 22, 125 (2020).

Pérez-Saldivar, M.L., Fajardo-Gutiérrez, A., Bernáldez-Ríos, R. et al. Childhood acute leukemias are frequent in Mexico City: descriptive epidemiology. BMC Cancer 11, 355 (2011). https://doi.org/10.1186/1471-2407-11-355

Pedrosa, Francisco M.D.; Bonilla, Miguel M.D.; Liu, Aiyi Ph.D.; Smith, Karen R.D., C.N.S.D., M.S.; Davis, Diana B.S.; Ribeiro, Raul C. M.D.; Wilimas, Judith A. M.D.. Effect of Malnutrition at the Time of Diagnosis on the Survival of Children Treated for Cancer in El Salvador and Northern Brazil. Journal of Pediatric Hematology/Oncology 22(6):p 502-505, 2000.

Quiroz, E., Aldoss, I., Pullarkat, V., Rego, E., Marcucci, G., & Douer, D. (2019). The emerging story of acute lymphoblastic leukemia among the latin american population – biological and clinical implications. Blood Reviews, 33, 98-105. https://10.1016/j.blre.2018.08.002

Corresponding Author: Lina.Barrios@students.jefferson.edu