Revista MedEs
Revista Científica Estudiantil de Matanzas
MedEst. 2025 Vol.5; e370 ISSN: 2789-7567 RNPS: 2524

ORIGINAL ARTICLE

# Characterization of patients with sickle cell disease in the pediatric hematology service, Santiago de Cuba, 2024

*Caracterización de pacientes con sicklemia en servicio de hematología pediátrica, Santiago de Cuba, 2024*

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**Received:** 10/01/2025

**Accepted:** 15/07/2025

**How to cite this article:** Márquez-Perera MdlM, Boris-Miclín CD, Milán-Soto A, Torres-Coello MA, Ferrer-Malfrán MM, Oviedo-Pérez K. Characterization of patients with sickle cell disease in the pediatric hematology service, Santiago

de Cuba, 2024. MedEst. [Internet]. 2025 [cited access date]; 5:e370. Available in: https://revmedest.sld.cu/index.php/medest/article/view/370

## ABSTRACT

**Introduction:** Sicklemia is the most common structural hemoglobinopathy worldwide. It is characteristic of people of African descent and populations with a high level of racial mixing. In Cuba, the prevalence is estimated at approximately 4 000 patients nationwide.

**Objective:** To characterize the clinical and epidemiological variables of patients diagnosed with sicklemia in the Hematology Department of the Hospital Infantil Sur in Santiago de Cuba.

**Methods:** A descriptive, cross-sectional study was conducted at the Hospital Infantil Sur in Santiago de Cuba from January to November 2024. The sample consisted of 16 patients diagnosed with sicklemia.

**Results:** 68,75 % of the patients were male, 56,25 % were of mixed race, and 43,75 % presented painful vaso-occlusive crises as the main clinical manifestation upon admission. The crises were mostly triggered by infections, with 56,25 % of cases due to infectious foci.

**Conclusions:** Monitoring and treatment of sickle cell disease in the country has improved the quality of life and increased the life expectancy of these patients. The study showed that patients under 10 years of age, male, and of thin build predominated. The use of hydroxyurea as a treatment has reduced the frequency of vaso-occlusive crises in many patients.

**Keywords:** Anemia; Risk Factors; Pediatrics; Sickle Cell Disease

## RESUMEN

**Introducción:** la sicklemia es la hemoglobinopatía estructural más frecuente a nivel mundial. Es característica de los afrodescendientes y de aquellas poblaciones en las cuales existe una elevada mezcla racial. En Cuba se estima una prevalencia de alrededor de 4000 enfermos distribuidos en todo el país.

**Objetivo:** caracterizar las variables clínico-epidemiológicas de los pacientes diagnosticados con sicklemia en el Servicio de Hematología del Hospital Infantil Sur de Santiago de Cuba.

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ISSN: 2789-7567 RNPS: 2524

**Métodos:** se realizó un estudio descriptivo de corte transversal, en el Hospital Infantil Sur de Santiago de Cuba en el período de enero a noviembre de 2024. El universo quedó constituido por 16 pacientes con diagnóstico de sicklemia.

**Resultados:** el 68,75 % de los pacientes perteneció al sexo masculino, el 56,25 % eran de piel mestiza, el 43,75 % presentó crisis vaso-oclusivas dolorosas como principal manifestación clínica al ingreso. Las crisis fueron desencadenadas en su mayoría por infecciones siendo 56,25 % los casos por focos infecciosos.

**Conclusiones:** El seguimiento y tratamiento de la Sicklemia en el país ha conseguido mejorar la calidad y aumentar la esperanza de vida de estos pacientes. En el estudio predominaron los pacientes menores de 10 años masculinos y de contextura delgada, el empleo de la hidroxiurea como tratamiento permite disminuir la frecuencia de crisis vaso-oclusivas en muchos pacientes.

**Palabras clave:** Anemia; Factores de Riesgo; Pediatría; Sicklemia

## INTRODUCTION

Sickle cell anemia (also known as sicklemia or sickle cell disease) is an autosomal recessive inherited hematological disorder caused by a point mutation in the HBB gene (located on chromosome 11p15.4), which encodes the β-globin subunit of hemoglobin. This molecular alteration leads to the synthesis of hemoglobin S (HbS), which, under conditions of hypoxia, acidosis, or dehydration, undergoes polymerization, inducing sickle-shaped red blood cell deformation (sickle cell disease). (1)

From a historical perspective, this pathological entity represents a milestone in molecular medicine, being the first human disease associated with a specific protein alteration. Its initial description is attributed to James B. Herrick (1910), who identified red blood cells with sickle morphology in a patient of African origin, laying the foundation for the correlation between clinical phenotype and structural abnormality of hemoglobin. (1)

In 1945, Linus Pauling and his colleagues first postulated that sickle cell anemia was the result of a structural alteration in the hemoglobin molecule, which they named hemoglobin S (HbS). This discovery marked a milestone in medical biochemistry, establishing the concept of a "molecular disease" and laying the foundations of modern hemoglobinopathology. Currently, HbS is

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the most prevalent structural hemoglobinopathy globally, with an estimated genetic burden of more than 250 million heterozygous carriers (sickle cell trait) and an annual incidence of approximately 300 000 affected newborns, according to WHO data. [2]

In Cuba, the distribution of the mutation is geographically heterogeneous, with a carrier frequency ranging from 3 % to 10 %, reaching its highest prevalence in eastern provinces such as Santiago de Cuba, due to historical factors associated with forced migration during the colonial period. As a public health strategy, the National Sickle Cell Prevention Program was implemented in the 1980s, based on a universal population screening model. [3,4]

This protocol includes hemoglobin electrophoresis in all pregnant women during the first trimester of pregnancy, allowing for the identification of at-risk couples (AS x AS heterozygotes) and offering, as part of genetic counseling, the possibility of prenatal diagnosis using molecular techniques (PCR-RFLP or HBB gene sequencing). [3,4]

The condition is characterized by the presence of hemoglobin S (HbS) in the erythrocyte. Under hypoxic conditions, it polymerizes, altering its solubility. It deposits on the membrane and deforms the red blood cell, making it rigid and adopting a crescent shape. [5] The manifestations of this disease occur due to structural alterations in hemoglobin, which lead to fragility and inflexibility of sickle red blood cells when exposed to dehydration, infection, or poor oxygen supply, causing vascular occlusion and increased blood viscosity. [6]

In Cuba, the fundamental objective of caring for patients with Sicklemia is to improve their quality of life by preventing the short- or long-term onset of complications and thus ensuring the normal development of their daily activities. Therefore, health policies are aimed at improving the quality of life of patients suffering from this disorder. [7]

Given the high global burden of sickle cell anemia—especially in regions with African gene flow, such as Cuba—this study seeks to characterize the clinical and epidemiological variables in pediatric patients treated in the Hematology Department of the Hospital Infantil Sur in Santiago de Cuba.

## MATERIALS AND METHODS

A descriptive, cross-sectional study was conducted at the Hospital Infantil Sur in Santiago de Cuba from January to November 2024. The sample consisted of 16 patients diagnosed with sickle cell disease.

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Data collection was carried out through a review of medical records, and a form (secondary source) was completed based on the data collected in the medical records (primary source) of each patient admitted with this disease. Once the information was collected, it was processed using Microsoft Excel. The results were analyzed using the arithmetic percentage method, and the results are presented in statistical tables.

The following clinical and epidemiological variables were used in the study: distribution of patients diagnosed with sickle cell disease by age (<1 year, 1-4 years, 5-9 years, 10-14 years, 15-19 years) and sex (male and female); Patient distribution by skin color (white, mixed-race, black); patient distribution by the most common clinical manifestations (osteomyelitis, thoracic vaso-occlusive crisis, splenic sequestration crisis, joint pain crisis, gallstones, and bronchopneumonia); patient distribution by triggering factors (emotional stress, dehydration, infections, sudden climate changes); patient distribution by treatment (folic acid, transfusion therapy, hydroxyurea, and hematopoietic stem cell transplant).

The study was approved by the hospital's Medical Ethics Committee and Scientific Council (Deed No. 03/2024 Agreement 03), ensuring confidentiality through data anonymization and obtaining informed consent from the guardians. The confidentiality of the information collected was guaranteed, and the principle of non-maleficence was taken into account. All data obtained in this research are used exclusively for scientific purposes.

## RESULTS

The study shows a predominance in the 5-9 age group, which constitutes 31,25 % of the study population. (Table 1)

**Table 1.** Distribution of patients diagnosed with sickle cell anemia by age and sex in the Hematology Department of the Hospital Infantil Sur in Santiago de Cuba

| Age Group | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | No | % | No | % | | |
| < 1 years | 2 | 0,00 | 1 | 6,25 | 3 | 18,75 |
| 1-4 years | 1 | 6,25 | 2 | 12,5 | 3 | 18,75 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 5-9 years | 3 | 18,75 | 2 | 12,5 | 5 | 31,25 |
| 10-14 years | 2 | 12,5 | 0 | 0,00 | 2 | 12,5 |
| 15-19 years | 3 | 18,75 | 0 | 0,00 | 3 | 18,75 |
| **Total** | **11** | **68,75** | **5** | **31,25** | **16** | **100** |

**Source:** Medical records

In the present study, it was observed that 56,25 % of patients were of mixed race, while 6,25 % were Caucasian. (Table 2)

**Table 2.** Distribution of patients by skin color

| Skin Color | No | % |
|---|---|---|
| White | 2 | 6,25 |
| Mestizo | 9 | 56,25 |
| Black | 5 | 31,25 |
| **Total** | **16** | **100** |

**Source:** Medical records

Table 3 shows the distribution of patients according to the most common clinical manifestations. 43,75 % of these patients experienced a thoracic vaso-occlusive crisis.

**Table 3.** Distribution of patients according to the most common clinical manifestations

| No. | Clinical Manifestations | No | % |
|---|---|---|---|
| 1 | Osteomyelitis | 2 | 12,5 |
| 2 | Thoracic vaso-occlusive crisis | 7 | 43,75 |
| 3 | Splenic sequestration crisis | 3 | 18,75 |
| 4 | Joint pain crisis | 1 | 6,25 |
| 5 | Gallbladder lithiasis | 2 | 12,5 |
| 6 | Bronchopneumonia | 1 | 6,25 |

**Source:** Medical records

A study of nutritional status showed that thin patients predominated (68,76 %), followed by those of normal weight (25,0 %). The seizures were mostly

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triggered by infections, with 56,25 % of cases due to infectious foci, demonstrating that infection is an important triggering factor. (Table 4)

**Table 4.** Distribution of patients according to seizure triggers

| Triggering Factors | No | % |
|---|---|---|
| Emotional Stress | 2 | 12,5 |
| Dehydration | 2 | 12,5 |
| Infections | 9 | 56,25 |
| Sudden Climate Changes | 3 | 18,75 |
| **Total** | **16** | **100** |

**Source:** Medical records

Regarding treatment, it is important to highlight the use of hydroxyurea (HU), which was used in 56,25 % of cases. (Table 5)

**Table 5.** Distribution of patients according to treatment used

| Treatment used | No. | % |
|---|---|---|
| Folic acid | 3 | 18,75 |
| Transfusion therapy | 4 | 25,0 |
| Hydroxyurea | 9 | 56,25 |
| Hematopoietic stem cell transplantation | 0 | 0,00 |

**Source:** Medical records

## DISSCUSION

Sicklemia is a hereditary genetic disease. Individuals who inherit two copies of the mutated gene develop the disease; however, those who inherit only one are less likely to develop it. [8]

From an epidemiological perspective, various studies, including that of Ortiz Romaní et al. [9], have shown a higher prevalence of the disease in mixed-race and Afro-descendant populations, a finding consistent with our results. This population distribution reflects historical patterns of forced migration during the colonial period, when the transatlantic slave trade introduced the mutation to the Americas. The close association between certain ethnic groups and heritable hemoglobinopathies is a paradigmatic example of how historical and demographic factors can influence the geographic distribution of genetic diseases.

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According to Nakandakari Mayron et al., [10] sicklemia encompasses a group of chronic hemolytic anemias characterized by the electrophoretic pattern of hemoglobin type S (HbS), in which the amino acid valine replaces glutamic acid in the sixth position of the beta globin chain. This pattern can be detected in humans a few months after birth, specifically when fetal Hb replacement occurs, which predominates during the first months of life.

According to Sanchez Ramos et al., [11] they maintain that the substitution of this amino acid causes the hemoglobin molecule to crystallize, producing deformation of the erythrocytes, which become rigid and acquire a sickle or falciform shape, which hinders their transit through small capillaries. This process occurs when the partial pressure of oxygen (pO2) drops, becoming a vicious cycle as sickle-shaped red blood cells become trapped in the blood vessels.

Although the term sicklema may be unfamiliar to many, it is the most common genetic disease in the world. It is estimated that 500 000 children are born with this condition each year, and about half die before the age of five. [12] Those who suffer from it have abnormal, sticky, and rigid red blood cells (crescent-shaped), which become stuck in blood vessels and block blood flow. This can cause pain, strokes, ulcers, and chronic organ damage, among other clinical manifestations. [13]

Studies reveal that 3,08 % of the Cuban population has the hemoglobin S that causes sicklema. This does not mean that everyone is ill, only those who inherit this characteristic from both parents. The life expectancy of these patients in the nation is currently comparable to that of developing world regions, with an average life expectancy of 56 years, compared to 15 or 20 years previously. [14]

The 3, 08 % of the Cuban population is a carrier of hemoglobin S, the cause of sickle cell disease. This does not mean that these patients are the ones who are affected, but rather that they are genetically related to both parents. These patients should avoid physical exercise, excessive cold and heat, and dehydration from any cause, but they can lead socially useful lives. [15,16]

Since this blood abnormality can go unnoticed in non-ill carriers, a prenatal diagnosis program was created in the 1980s to identify its presence in pregnant women through Primary Health Care (PHC), based on a study coordinated by the National Center for Medical Genetics. [17,18]

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A prenatal diagnosis program has been in place in Cuba since 1983. Hemoglobin electrophoresis is performed on pregnant women, and if the patient has AS, this test is performed on their partners. If the patient also has AS, DNA testing is performed on amniotic fluid cells, making it possible to prevent the birth of a sick child. (19,20)

The authors of this study believe that the high frequency of serious infections (56,25 %) in the study underscores the need to strengthen adherence to penicillin prophylaxis and extended vaccination schedules, particularly in children under 5 years of age, where the risk of sepsis persists.

Clinically, the identification of poor prognostic factors—such as pulmonary hypertension or low adherence to hydroxyurea—highlights the urgency of aggressive and timely interventions. The results obtained support that neonatal diagnosis reduces infant mortality, but critical barriers remain: the limited availability of disease-modifying therapies (hematopoietic stem cell transplantation, anti-adhesion agents) and socioeconomic disparities that affect regular follow-up. The latter requires the integration of social work and telemedicine strategies, especially in rural areas. (21,22)

Limitations include the small sample size and the retrospective nature of the design, which may affect the generalizability of the results.

The authors consider that future research should evaluate the impact of emerging therapies (voxelotor, crizanlizumab) on quality of life, analyze overlooked social determinants (parental education level, access to transportation), and develop predictive models of severity based on local haplotypes, currently underreported in the Latin American literature.

The characterization presented shows that optimizing the management of pediatric sickle cell disease in our region requires: 1) establishing screening protocols for silent complications (neuropathy, retinopathy), 2) strengthening transition programs to adult medicine, and 3) coordinating hospital networks to ensure equitable access to advanced therapies. These actions, aligned with the specificities of our epidemiological profile, could reduce morbidity and mortality in this vulnerable population.

## CONCLUSIONS

The majority of children treated for sickle cell disease and/or infection were under ten years of age, with a predominance of males. The most frequent crises were thoracic vaso-occlusive crises, with hydroxyurea being the

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treatment of choice, as this drug reduces the frequency of vaso-occlusive crises and episodes of acute chest syndrome. Monitoring and treatment of sickle cell disease in our country has improved the quality of life and increased the life expectancy of these patients.

## BIBLIOGRAPHIC REFERENCES

1. Paneque Pérez M. Sobre el estado nutricional de pacientes pediátricos atendidos por enfermedades oncohematológicas. Rev Cubana Aliment Nutr [Internet]. 2022 [cited 01/02/2025]; 32(1). Available in: https://revalnutricion.sld.cu/index.php/rcan/article/view/1352

2. Salgado-Ramos K, Vázquez-Palanco JR, Osorio-Caballero I, Calás-Torres JJ, Vázquez-Gutiérrez GL, Labrada-Batchelor LL. Caracterización clínica y epidemiológica de pacientes con anemias hemolíticas congénitas atendidos en el Hospital Pediátrico Hermanos Cordové. Universidad Médica Pinareña [Internet]. 2023 [cited 01/02/2025]; 19(2023): e996. Available in: https://revgaleno.sld.cu/index.php/ump/article/view/996

3. Reyes Mera MK, Montes Mendoza GA, Mero Barcia VM, Romero Burgos MM. Diagnóstico y síntomas de una anemia hemolítica. RECIMUNDO [Internet]. 2021 [cited 01/02/2025]; 5(1):322-9. Available in: https://recimundo.com/index.php/es/article/view/1016

4. Vitón-Castillo AA, Montes de Oca Carmenaty M, Lambert Delgado AR, Mena Hernández VM. Análisis bibliométrico de la Revista Cubana de Hematología, Inmunología y Hemoterapia en el período 2017-2021. Rev Cubana Hematol Inmunol Hemoter [Internet]. 2023 [cited 01/06/2025]; 39(1). Available in: https://revhematologia.sld.cu/index.php/hih/article/view/1846

5. Núñez Copo AC. Prevención de hemoglobinopatías en el Policlínico "28 de septiembre", municipio Santiago de Cuba. Rev Cubana Med Gen Integr [Internet]. 2022 [cited 01/02/2025]; 38(4). Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21252022000400009&lng=es

6. Paneque Pérez M. Estado de la desnutrición asociada al cáncer en el Instituto de Hematología e Inmunología de La Habana. Rev Cubana Aliment Nutr [Internet]. 2023 [cited 01/02/2025]; 33(2). Available in: https://revalnutricion.sld.cu/index.php/rcan/article/view/1502

7. Ramos-Pacheco N, Valdés-Martínez Y, Perojo-López OL, Leiva-Suarez Y, Rodríguez-Cruz IA. Arquitectura de la información del registro lineal de la embarazada y el recién nacido en el departamento de genética municipal de Pinar del Río. Rev Ciencias Médicas [Internet]. 2022 [cited 01/02/2025]; 26(2). Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1561-31942022000200005&lng=es

8. Suárez-González A, Linares-Morera A, García-Rodríguez M. Study of thrombophilia by the clinical laboratory. Rev.Med.Electrón. [Internet]. 2024 [cited 01/02/2025]; 46. Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1684-18242024000100037&lng=es

9. Ortiz Romaní KJ, Ortiz Montalvo YJ, Escobedo Encarnación JR, Neyra de la Rosa L, Jaimes Velásquez CA. Análisis del modelo multicausal sobre el nivel de la anemia en niños de 6 a 35 meses en Perú. Enf Global [Internet]. 2021 [cited 01/02/2025]; 20(4):426-55. Available in: https://revistas.um.es/eglobal/article/view/472871

10. Nakandakari Mayron D, Carreño-Escobedo R. Factores asociados a la anemia en niños menores de cinco años de un distrito de Huaraz, Ancash. Rev Med Hered [Internet]. 2023 [cited 01/02/2025]; 34(1):20-26. Available in: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S1018-130X2023000100020&lng=es

11. Sanchez Ramos MBO, Capacha Huamaní DAV, Capcha Huamaní MML, Alarcón Soto MO, Mancilla Perez LP. Parasitosis intestinal y anemia en niños de 6 a 60 meses de edad atendidos en el periodo 2015 al 2020, en un centro de salud Altoandina de Perú. Ciencia Latina [Internet]. 2021 [cited 01/02/2025]; 5(6):11247-56. Available in: https://ciencialatina.org/index.php/cienciala/article/view/1164

12. Fiestas Silva J, Silva Diaz V, Osada Jorge L. Efficacy of nutritional talks in the prevention of anemia in children (6 to 36 months of age) from a health center in Chiclayo, Peru. Rev. Fac. Med. Hum. [Internet]. 2023 [cited 01/02/2025]; 23(1):73-78. Available in: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S2308-05312023000100073&lng=es

13. Bravo Garay EE, Ojeda Sánchez JC, Vanegas Izquierdo P. Estado nutricional y anemia en niños de etnia shuar: Un estudio observacional de

centro único. REV-SEP [Internet]. 2023 [cited 01/02/2025]; 24(1):42-50. Available in: https://www.rev-sep.ec/index.php/johs/article/view/202

14. Ceriani Infantozzi F, Thumé E, Nedel F. Determinación social en la ocurrencia de anemia ferropénica en niños: una revisión sistemática. RUE [Internet]. 2022 [cited 01/02/2025]; 17(1):e2022v17n1a7. Available in: http://rue.fenf.edu.uy/index.php/rue/article/view/338

15. Reyes Narváez SE, León Huerta BM, Paredes Reyes AE. Anemia en niños menores de tres años en la zona altoandina San Antonio - La Libertad. Pakamuros [Internet]. 2023 [cited 01/02/2025]; 9(3). Available in: http://revistas.unj.edu.pe/index.php/pakamuros/article/view/146

16. Guzmán-Castillo W, Acosta Sullcahuaman LA, Lázaro Pérez AR, Gonzales Chavez CM, Moreno Alvarado HP, Peña Wagner CR, et al. Impacto del acceso a los servicios de agua y alcantarillado en anemia en niños menores de 5 años en Perú. NE [Internet]. 2021 [cited 01/02/2025]; 6(2):103-17. Available in: https://revistas.lamolina.edu.pe/index.php/ne/article/view/1940

17. Hierrezuelo Rojas N, Torres Alvarado M, Jhonson Valenciano S, Durruty Medina LE. Conocimientos sobre anemia ferropénica en madres de niños menores de un año de edad. Rev Cubana Pediatr [Internet]. 2022 [cited 01/02/2025]; 94(4). Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0034-75312022000400006&lng=es

18. Alarcon Casimiro MC, Moril Huaranga DA, Jara Rimondi FV, Marcos Virhuez MV, Casimiro Urcos CN. Estrategias de intervención para prevenir la anemia en niños de 6 meses a dos años: una revisión sistemática. Rev Cubana Inv Bioméd [Internet]. 2024 [cited 01/02/2025]; 43. Available in: https://revibiomedica.sld.cu/index.php/ibi/article/view/3510

19. Estrada Rodríguez Y, Oviedo Pérez K, Naranjo Lima S, Boris Miclin CD, Hoyos Mesa AJ, Almeida Rodríguez Ángel F. Caracterización de las embarazadas adolescentes del Policlínico Samuel Fernández del municipio Matanzas en el año 2020. scalpelo [Internet]. 2025 [cited 01/02/2025];5:e223. Available in: https://rescalpelo.sld.cu/index.php/scalpelo/article/view/223

20. Romero-Reinaldo Y, Belaunde-Clausell A, Zamora-Torres A. Anemia ferropénica en lactantes ingresados en un servicio de Pediatría. AMC

[Internet]. 2021 [cited 01/02/2025]; 25(5). Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1025-02552021000500006&lng=es

21. Zaldívar Arias EJ, Estrada Rodríguez Y. Hiperparatiroidismo y anemia: ¿una relación subestimada?. MedEst [Internet]. 2024 [cited 01/02/2025]; 4(2):e361. Available in: https://revmedest.sld.cu/index.php/medest/article/view/361

22. Fernández-Gonzáles P, Hierrezuelo-Rojas N, Monje-Labrada A, Carbó-Cisnero Y. Anemia ferropénica en niños de hasta cinco años de edad atendidos en el policlínico "Ramón López Peña". Rev. electron. Zoilo [Internet]. 2021 [cited 01/02/2025]; 46 (2). Available in: https://revzoilomarinello.sld.cu/index.php/zmv/article/view/2693

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**CDBM:** conceptualization, data curation, research, methodology, supervision, validation, visualization.

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**KOP:** conceptualization, data curation, research, methodology, software, validation, visualization.

## CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

## SOURCES OF FUNDING

The authors declare that they did not receive funding for the development of