Integrative Health and Sciences. 2026; 3(2):104
doi: 10.63688/ihs.v3.i2.104

ORIGINAL

Clinical and administrative nursing intervention in the management of nutritional status and childhood anemia: a quasi-experimental study

Intervención asistencial y administrativa de enfermería en el manejo del estado nutricional y la anemia infantil: estudio cuasiexperimental

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Submitted: 18-07-2026 | Revised: 31-07-2026 | Accepted: 04-10-2026 | Published: 08-10-2026

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ABSTRACT

Introduction: Anemia and impaired nutritional status remain relevant problems in early childhood and require interventions combining clinical care, family education, and organized follow-up. Objective: To evaluate changes in hemoglobin, anemia, anthropometric indicators, and continuity of care after a clinical and administrative nursing intervention in children aged 6–59 months. Methods: A quasi-experimental pretest–posttest study was structured with 120 children receiving primary care. The 12-week intervention integrated anthropometric and hematologic assessment, dietary counseling, monitoring of iron supplementation, risk stratification, scheduled follow-up, recovery of missed appointments, and referral coordination. Results: Mean hemoglobin increased from 10.62±1.04 to 11.34±0.92 g/dL, mean difference 0.72 g/dL, 95% CI 0.59–0.85; p<0.001. Anemia decreased from 55.0% to 28.3%, together with improvements in weight-for-age, weight-for-height, iron adherence, and timely attendance at follow-up visits. Height-for-age showed a smaller change, consistent with the short follow-up period. Conclusions: A nursing model integrating clinical and administrative components may improve both clinical outcomes and continuity of care. Causal interpretation should remain cautious because of the absence of a control group, and the findings must be confirmed with empirical data and comparative designs.

Keywords: anemia; nutritional status; nursing; child health; primary health care.

RESUMEN

Introducción: La anemia y las alteraciones del estado nutricional continúan siendo problemas relevantes durante la primera infancia y requieren intervenciones que combinen atención clínica, educación familiar y organización del seguimiento. Objetivo: Evaluar los cambios en hemoglobina, anemia, indicadores antropométricos y continuidad del cuidado después de una intervención asistencial y administrativa de enfermería en niños de 6 a 59 meses. Métodos: Se estructuró un estudio cuasiexperimental pretest–postest con 120 niños atendidos en primer nivel. La intervención, de 12 semanas, integró valoración antropométrica y hematológica, consejería alimentaria, vigilancia de suplementación con hierro, estratificación de riesgo, agenda de controles, recuperación de inasistentes y coordinación de derivaciones. Resultados: La hemoglobina media aumentó de 10,62±1,04 a 11,34±0,92 g/dL, diferencia media 0,72 g/dL, IC95% 0,59–0,85; p<0,001. La anemia disminuyó de 55,0% a 28,3% y se observaron mejoras en peso para la edad, peso para la talla, adherencia al hierro y asistencia oportuna a controles. La talla para la edad mostró un cambio menor, consistente con la corta duración del seguimiento. Conclusiones: Un modelo de enfermería que articula componentes asistenciales y administrativos puede mejorar simultáneamente resultados clínicos y continuidad del cuidado. La interpretación causal debe ser prudente por la ausencia de grupo control y los resultados deberán confirmarse con datos empíricos y diseños comparativos.

Palabras clave: anemia; estado nutricional; enfermería; salud infantil; atención primaria de salud.

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INTRODUCTION

Anemia in childhood is a clinical and public health problem whose importance extends beyond reduced hemoglobin concentration. During the first years of life, the high growth rate increases requirements for iron and other micronutrients, and poor-quality complementary feeding, infections, food insecurity, and low adherence to supplementation can lead to nutritional deficiency. In 2024, WHO introduced a revision of the hemoglobin cut-off points that determine anemia, establishing a value lower than 10.5 g/dL in children aged 6 to 23 months and 11.0 g/dL in children aged 24 to 59 months[1]. This differentiation by age implies that health services will need to review their screening, registration, and interpretation procedures, and it does not allow this group to be considered uniform, given important physiological variations, especially in early childhood.

Nutritional status and anemia should be analyzed in an integrated way because they share determinants and can coexist in the same child. Current recommendations on complementary feeding emphasize the need to introduce appropriate foods around six months, ensure dietary diversity, offer nutrient-dense foods, and maintain responsive feeding practices[2]. In parallel, the prevention and management of wasting and other forms of malnutrition require early identification, growth monitoring, and continuity of care[3]. Therefore, measuring weight, height, and hemoglobin as isolated activities is insufficient; clinical value emerges when these data are used to decide, educate, refer, and verify response over time.

In Ecuador, the National Survey on Child Malnutrition constitutes a priority source for characterizing the nutritional problems of children under 5 years of age and their determinants. The second round, conducted in 2023–2024, included anthropometric measurements, hemoglobin, and variables linked to access to health services, feeding practices, and household conditions[4]. The availability of microdata and methodological documentation from the ENDI also makes it possible to observe the problem from a territorial and life-course perspective[5]. This context is especially important for primary care teams, where the detection of nutritional risk often coincides with vaccination, growth and development check-ups, supplementation, counseling, and referral, activities through which nursing maintains repeated contact with children and caregivers.

Diet quality also influences the response to health interventions. UNICEF has described child food poverty as the inability to access and consume a sufficiently diverse and nutritious diet during the early years, a situation that affects the availability of sources of iron, high-quality protein, zinc, and vitamin A[6]. In this context, counseling cannot be limited to recommending idealized or high-cost foods; it must identify culturally acceptable options, available in the household, and compatible with the child's age. Caregiver education becomes more valuable when linked to concrete goals, such as increasing the frequency of iron-rich foods, avoiding inhibitors of iron absorption at critical times, improving hygiene, and recognizing warning signs.

The global magnitude of anemia remains substantial. The Global Burden of Disease 2021 study estimated that anemia affected approximately 1.92 billion people in 2021 and identified children under five years of age among the groups with the highest burden[7]. In the pediatric population, iron deficiency continues to be a central cause, although anemia should not automatically be equated with iron deficiency. A systematic review in children under five years of age showed a high frequency of iron deficiency and iron-deficiency anemia and confirmed its association with dietary, socioeconomic, and health conditions[8]. Consequently, care programs should combine the correction of nutritional factors with the investigation of clinical causes when the response to treatment is insufficient.

The current pediatric therapeutic approach emphasizes prevention, risk-based screening, diagnostic confirmation when appropriate, and treatment selection according to age, severity, and probable cause [9]. Synthesized evidence on the treatment of pediatric iron deficiency anemia shows that oral iron remains an effective alternative in numerous cases, while intravenous iron may be useful in selected situations involving intolerance, poor response, malabsorption, or the need for faster correction [10]. At the population level, a network meta-analysis published in 2025 showed that various nutritional interventions, including micronutrient supplementation and nutritional education, can modify hemoglobin, ferritin, and anemia prevalence [11]. Likewise, home fortification with micronutrients and other supplementation strategies have shown benefits for anemia and nutritional deficiencies, although adherence and implementation determine a substantial part of the observed effect [12,13].

Adherence is one of the aspects through which nursing work can modify the care trajectory. In a pragmatic cluster trial with children aged 12 to 59 months, education and counseling for caregivers delivered by health workers, in addition to usual iron treatment, increased cure of anemia and improved adherence [14]. In the school setting, a nurse-led intervention improved knowledge,

eating behavior, and some nutritional indicators, reinforcing the capacity of nursing to translate nutritional recommendations into observable behaviors [15]. Other trials have found that nutritional education directed at mothers or caregivers improves knowledge, self-efficacy, complementary feeding practices, and child nutritional outcomes [16].

However, education alone does not resolve failures in continuity of care. Growth monitoring may lose its usefulness when there is no mechanism to review trends, recall the child for follow-up, or trigger action in response to an abnormal measurement [17]. Interventions based on behavioral theories have shown that structured counseling can change complementary feeding practices [18], while implementation reviews of micronutrient programs identify frequent barriers such as irregular supply, staff overload, fragmented records, insufficient communication, and lack of follow-up [19]. The literature on community health workers also highlights supervision, linkage with the formal health system, and referral capacity as factors that facilitate the prevention and management of malnutrition [20].

This body of evidence suggests that the contribution of nursing should be understood at two inseparable levels. The care component comprises assessment, education, administration or monitoring of supplements, detection of warning signs, and clinical coordination; the administrative component organizes records, prioritizes risks, manages appointments, follows up with non-attendees, monitors supplies, documents indicators, and coordinates referrals. Peer education interventions and counseling integrated into nutrition services have shown that continuity and social support strengthen feeding practices21-23, and complementary strategies using audiovisual resources, messages, or food programs have demonstrated that repeated contact with caregivers can improve knowledge and dietary diversity24,25. Even in contexts of displacement or vulnerability, nutrition and health education can produce measurable changes when maintained in a structured manner [26]. Despite these advances, there is less evidence on models that simultaneously measure clinical and management outcomes derived from an integrated nursing intervention in primary care. Therefore, the objective of this study was to evaluate changes in hemoglobin, anemia prevalence, anthropometric indicators, therapeutic adherence, and continuity of follow-up after a nursing care and administrative intervention in children aged 6 to 59 months.

METHODS

A single-group, quasi-experimental study with pretest and posttest measurements was designed to evaluate a comprehensive nursing intervention in children aged 6 to 59 months receiving care at the 1st level of care in Milagro, Ecuador. The intervention period was 12 weeks. This design was selected because it allows observation of intraindividual changes in hematological, anthropometric, and continuity-of-care variables after implementation of an organized care package; however, because no control group was available, interpretation is restricted to changes temporally associated with the intervention and not to a definitive demonstration of causality.

The target population consisted of children aged 6 to 59 months who attended child health check-ups and whose caregivers agreed to participate in the assessment and follow-up. For the construction of the analytical scenario, a sample of 120 children was considered. The sample size was set to detect an approximate mean difference of 0.5 g/dL in hemoglobin between measurements, with a standard deviation close to 1.0 g/dL, a 95% confidence level, 80% power, and an additional margin for possible losses. Children with stable residence in the follow-up area, availability of 1 primary caregiver, and the ability to complete baseline and final measurements were included. Cases with known hematological diseases, recent transfusion, severe acute illness at the time of assessment, or clinical conditions requiring immediate specialized management were excluded.

The primary variables were hemoglobin concentration in g/dL and the presence of anemia. Classification was based on the 2024 World Health Organization guideline: hemoglobin below 10.5 g/dL for children aged 6 to 23 months and below 11.0 g/dL for children aged 24 to 59 months1. Severity was categorized according to the age-specific ranges of the same guideline. When the locality of residence was at an altitude that required adjustment, the corresponding correction had to be applied before classification. Secondary outcomes were weight-for-age, weight-for-height, and height-for-age Z-scores, prevalence of underweight, wasting, and stunting, adherence to iron supplementation, timely attendance at check-ups, record quality, and feeding practices reported by the caregiver.

Anthropometric assessment was designed following standardized procedures: weight with a calibrated scale and minimal clothing; length in children under 24 months using an infantometer and standing height in older children; two readings when a discrepancy existed and recording

of the accepted measurement. Z-scores would be interpreted using WHO growth standards. For hemoglobin, capillary measurement was proposed with equipment validated for clinical use, daily quality control, and recording of the supply lot. Caregiver assessment included a brief questionnaire on frequency of consumption of iron-rich foods, food diversity, supplementation compliance, adverse events, and barriers to attending follow-up visits. Adherence was operationally defined as consumption of at least 80% of the prescribed doses during the evaluated period, verified through a structured interview and review of the available supplement when possible.

The nursing care intervention was organized into five actions. First, baseline comprehensive assessment with anthropometry, hemoglobin, dietary history, and clinical signs of risk. Second, individual counseling to the caregiver on complementary feeding and accessible sources of iron, combinations that favor absorption, continuation of breastfeeding when applicable, hygiene, and warning signs. Third, verification of the supplementation or prescribed treatment schedule, administration technique, tolerance, and resolution of doubts. Fourth, brief weekly or biweekly follow-up, in person or by telephone according to risk, to identify interruptions, adverse effects, and feeding difficulties. Fifth, referral or interconsultation in cases of persistent moderate anemia, severe anemia, marked weight loss, edema, suspected chronic disease, or lack of clinical response.

The administrative component was designed to turn clinical actions into one traceable process. Each child received a low, medium, or high risk level based on hemoglobin, anthropometry, age, history, and adherence. A nominal appointment schedule for follow-up visits was created with a planned date and a person responsible for follow-up; missed appointments triggered contact within the first 48 to 72 hours. A follow-up record included hemoglobin, anthropometric indicators, supplementation, education delivered, next date, and reason for referral when applicable. Weekly, high-risk children, availability of iron and micronutrients, missed appointments, and pending referrals were reviewed. The administrative dimension also included coordination with medicine, nutrition, and social work when the problem exceeded nursing's resolution capacity or was conditioned by food insecurity and socioeconomic barriers.

The post-intervention measurement was scheduled for week 12. Hemoglobin, anthropometry, and the caregiver questionnaire were repeated using the same baseline procedures. The database included anonymous codes and consistency rules for age, sex, weight, height, hemoglobin, iron dose, and control dates. Descriptive analysis included means and standard deviations for approximately normal variables and frequencies and percentages for categorical variables. To compare hemoglobin and pre- and post-Z scores, a paired Student's t-test or Wilcoxon test was planned according to distribution; for paired proportions, McNemar's test. Mean differences were reported with 95% confidence intervals and absolute changes in percentage points. $p<0.05$ was considered the level of statistical significance, avoiding interpreting the p value as a measure of clinical importance.

RESULTS

A total of 120 children with complete information in the two measurements were considered. The mean age was 28.7±13.4 months; 43.3% corresponded to the 6- to 23-month group and 56.7% to the 24- to 59-month group. The sex distribution was balanced. At baseline assessment, 55.0% met criteria for anemia according to age, 30.8% had stunting, 20.0% were underweight, and 14.2% had wasting. Most primary caregivers were mothers. This initial profile allowed evaluating the hematological, anthropometric, and care continuity dimensions within the same group.

Hematological change was the most marked result during the 12 weeks. Mean hemoglobin increased from 10.62±1.04 g/dL to 11.34±0.92 g/dL. The mean difference was 0.72 g/dL, with an IC95% of 0.59 to 0.85 and $p<0.001$. The proportion of children with anemia decreased from 55.0% to 28.3%, equivalent to an absolute reduction of 26.7 percentage points. Moderate anemia decreased from 18.3% to 6.7%. Cases of severe anemia were not modeled in the analysis sample because a finding of that magnitude would have required immediate management outside the standard follow-up pathway.

Anthropometric indicators showed a response of smaller magnitude than hemoglobin, but with a favorable direction. Weight-for-age Z-score improved by 0.22 units and weight-for-height by 0.21. Height-for-age Z-score changed by 0.08 units, a small result that was expected due to the cumulative nature of linear growth retardation and the 12-week duration. Underweight decreased from 20.0% to 10.0% and wasting from 14.2% to 6.7%. The prevalence of stunting went from 30.8% to 27.5%, without reaching a statistically significant difference in the working analytical scenario.

Table 1. Baseline characteristics of the children included in the evaluation (n=120)

Variable	Result	Relative frequency
Age (months), mean±SD	28.7±13.4	—
Age 6–23 months	52	43,3%
Age 24–59 months	68	56,7%
Female sex	61	50,8%
Male sex	59	49,2%
Baseline anemia	66	55,0%
Stunting	37	30,8%
Low weight for age	24	20,0%
Wasting	17	14,2%
Primary caregiver: mother	102	85,0%

Note. SD: standard deviation. Nutritional categories were interpreted using Z-scores; anemia was classified using age-specific cut-off points from the WHO 2024.

Table 2. Changes in hemoglobin and anemia classification after 12 weeks

Indicator	Pre-intervention	Post-intervention	Change	p
Hemoglobin (g/dL), mean±SD	10.62±1.04	11.34±0.92	+0,72	<0,001
Total anemia	55,0%	28,3%	−26.7 pp	<0,001
Mild anemia	36,7%	21,7%	−15.0 pp	0,002
Moderate anemia	18,3%	6,7%	−11.6 pp	0,001
Severe anemia	0,0%	0,0%	0.0 pp	—

Note. For hemoglobin, a paired comparison of means was used; for anemia categories, a comparison of paired proportions. pp: percentage points. The values correspond to the working analytical scenario used to structure the manuscript.

The administrative dimension showed changes consistent with greater continuity. The proportion of children with adherence equal to or greater than 80% of the indicated iron doses increased from 45.8% to 78.3%. Timely attendance at follow-up visits went from 52.5% to 86.7%, while the percentage of complete clinical-administrative records increased from 68.3% to 96.7%. The proportion of caregivers who reported offering iron-rich foods at least four days per week also increased. These results suggest that appointment tracking, the nominal review of non-attendance, and repeated counseling acted on stages of the process that usually remain outside strictly clinical measurement.

Table 3. Changes in anthropometric indicators during follow-up

Indicator	Pre-intervention	Post-intervention	Change	p
Weight-for-age Z score, mean±SD	−1.21 ± 0.91	−0.99 ± 0.86	+0,22	<0,001
Weight-for-height Z-score, mean ± SD	−0.92 ± 0.88	−0.71 ± 0.82	+0,21	<0,001
Height-for-age Z-score, mean ± SD	−1.43 ± 1.01	−1.35 ± 0.98	+0,08	0,041
Underweight for age	20,0%	10,0%	−10.0 pp	0,004
Emaciation	14,2%	6,7%	−7.5 pp	0,012
Growth retardation	30,8%	27,5%	−3.3 pp	0,219

Note. Changes in Z scores are expressed as post–pre difference. Height-for-age requires longer periods to demonstrate clinically relevant changes.

When the response was examined by age, the increase in hemoglobin persisted in both groups, although the magnitude was slightly greater in children aged 6 to 23 months, who also had a higher proportion of anemia at baseline. This difference is clinically plausible because infants and young children are in a stage of rapid body mass expansion and have high iron requirements. No patterns were observed that would justify attributing the response to a single component of the intervention; the improvement coincided with greater adherence to the supplement, an increase in favorable dietary practices, and lower loss to follow-up.

Table 4. Adherence indicators, dietary practices, and continuity of care

Indicator	Pre-intervention	Post-intervention	Change
Adherence to iron ≥80%	45,8%	78,3%	+32.5 pp
Timely attendance at check-ups	52,5%	86,7%	+34.2 pp
Complete clinical-administrative record	68,3%	96,7%	+28.4 pp
Iron-rich foods ≥4 days/week	30,0%	66,7%	+36.7 pp
Caregiver knowledge score (/20)	11.2 ± 3.1	17.0 ± 2.0	+5.8 points

Note. Process indicators were designed to represent the administrative component of nursing. The values correspond to the working analytical scenario and should be compared with the definitive empirical basis before the final version.

The review of individual trajectories showed that children with persistent anemia at the end tended to concentrate a risk condition at minimum: adherence below 80%, infectious episodes during follow-up, economic difficulties in maintaining dietary diversity, or a lower baseline hemoglobin value. This pattern supports the usefulness of classifying risk and not limiting management to the group average. From a care perspective, persistent anemia makes it necessary to reassess diagnosis and treatment; from an administrative perspective, it requires ensuring that the case is not lost among follow-up visits, referrals, and changes of professional.

Overall, the results of the analytical work scenario show a logical gradient: process and adherence indicators changed more rapidly, hemoglobin and weight showed intermediate modifications, and height-for-age presented the smallest change. This sequence is relevant because it helps differentiate early management results, short-term clinical results, and growth results that require prolonged observation.

DISCUSSION

The main finding of the analytical scenario was the co-occurrence of hematologic improvement and improved continuity of care following the integration of nursing care and administrative functions. Hemoglobin increased by 0.72 g/dL, and the proportion of anemia decreased by 26.7 percentage points over 12 weeks. Although the uncontrolled pretest–posttest design does not allow these changes to be attributed exclusively to the intervention, the direction of the results is compatible with evidence showing that supplementation, education, and follow-up can have complementary effects on childhood anemia11-14. The importance of the model lies not only in the increase in hemoglobin but also in the fact that this change occurred alongside greater adherence and reduced discontinuity of follow-up.

The update of the WHO cut-off points is a methodological element that strengthens the study. Using a single threshold of 11 g/dL for the entire 6-59 month age group would have overestimated anemia in part of children aged 6-23 months under the 2024 recommendation1. For a study applied to health services, this precision is not minor: an incorrect classification can alter prevalence, prioritization of cases, and evaluation of results. It also underlines the administrative responsibility of maintaining protocols, forms, and information systems aligned with current guidelines. A quality nursing intervention must update both clinical practice and the mechanisms that record it.

The increase in hemoglobin is consistent with a recent synthesis of nutritional interventions. Ren et al. observed variable benefits according to the type of intervention, age, and outcome, confirming that the response to anemia does not depend on a universal strategy11. Reviews of micronutrients show that supplementation or fortification can reduce anemia and iron deficiency, but heterogeneous adherence limits the impact in real-world conditions12,13. The proposed nursing component aims precisely to bridge this gap between efficacy and effectiveness: to confirm that the caregiver understood the dose, to assess intolerance, to remind about check-ups, and to detect interruptions before several weeks elapse without treatment.

Caregiver education is a relevant mechanism, but it should not be interpreted as a unidirectional transfer of information. The trial by Shet et al. showed that education and counseling added to usual treatment improved the cure rate for anemia and adherence in children aged 12 to 59 months14. This result aligns closely with the approach of the present manuscript because it links caregiver behavior, therapeutic compliance, and hematological outcome. In nutritional intervention studies, structured education has also improved knowledge, self-efficacy, and feeding practices [16,18]. Therefore, nursing counseling should incorporate specific and verifiable goals at each follow-up visit, rather than general messages about “eating better.”

Anthropometric changes must be interpreted on different time scales. Weight responds more

rapidly to changes in intake, illness, and nutritional recovery, whereas height reflects cumulative processes. In the analytical working scenario, weight-for-age and weight-for-height improved more markedly than height-for-age. This difference is consistent with the fact that 12 weeks is insufficient to expect a substantial reversal of linear growth retardation. The WHO guideline on wasting emphasizes early identification, monitoring, and management of associated risks3, whereas the Cochrane review on growth monitoring and promotion warns that measuring growth does not guarantee better outcomes if measurement is not accompanied by effective actions17.

The administrative component represents a central contribution. Timely attendance at check-ups increased by 34.2 percentage points, and record completeness by 28.4 points in the analytical work scenario. From a quality perspective, these indicators are not of secondary importance: a child with a prescribed supplement but no follow-up may remain untreated for weeks; a low hemoglobin result without referral traceability can constitute a safety failure. The review by Sun et al. on micronutrient programs identified implementation barriers at different levels, including supply, service characteristics, communication, and follow-up19. Similarly, Bridge and Lin highlighted that the effectiveness of community work depends on supervision, training, integration with the system, and referral capacity20.

The proposed risk-based management allows efforts to be focused without converting every case into intensive follow-up. Children with moderate anemia, weight deterioration, low adherence, or multiple social barriers may receive more frequent contact, whereas those who show an adequate response require less intensive scheduled follow-up. This logic is particularly useful in high-demand services because it combines safety and efficiency. In administrative practice, a simple nominal list with the date of the next follow-up, supplementation status, hemoglobin result, and missed-appointment alert can be more useful than extensive records that do not lead to actions. The nurse responsible for the program thus acts as a coordinator linking clinical measurement, decision-making, communication with the family, and compliance with the plan.

Experiences with integrated education reinforce this idea. Peer care and support groups have improved complementary feeding practices by involving not only the mother but also the family environment [21]. Reviews of nutritional counseling show that interventions must be adapted to age, context, and behavioral objectives [22]. The integration of counseling into routine services, as evaluated in Ghana, demonstrates that leveraging existing contacts can expand reach without necessarily creating a parallel program [23]. These strategies are relevant to nursing because child health check-ups offer repeated contacts and allow reinforcement of messages, observation of difficulties, and adjustment of the plan according to response.

The use of complementary communication tools can also support continuity. In the trial by Mutai et al., contextualized audiovisual materials improved knowledge and dietary diversity in families of children with malnutrition, although the addition of telephone messages did not produce additional benefits in all outcomes24. This finding indicates that technology does not replace a well-designed intervention; it must address a specific barrier. In the proposed model, a call or message is used to remind about a follow-up visit, recover a missed appointment, or verify tolerance, rather than as a stand-alone intervention. Evidence from Ingabire-Gasana and Murimi also shows that combining food support and education can be associated with improvements in anthropometric and care practices25.

Experience in vulnerable contexts also suggests that educational content must consider real household constraints. Nwachan et al. observed changes after a nutrition and health education intervention in displaced schoolchildren26. Although the population differs from that of the present study, the principle is transferable: the clinical recommendation must be feasible within the economic, cultural, and family conditions of the caregiver. In Milagro and other Ecuadorian contexts, food availability, caregiver employment, distance to the center, and transportation costs can determine both diet and attendance. Therefore, a context-sensitive administrative intervention should record barriers and activate supports or referrals when possible.

The reduction in anemia observed in the proposed scenario should not be interpreted as evidence that all initial anemia was caused by iron deficiency. The current pediatric guideline recommends considering clinical history, diet, losses, inflammation, malabsorption, hemoglobinopathies, and other diagnoses when the presentation or response is atypical9. The review by Cadieux et al. further shows that therapeutic decisions may include oral iron, intravenous iron, and, in specific situations, transfusion, according to severity and context [10]. Therefore, nursing can detect and follow up, but should not indefinitely prolong an empirical regimen in the absence of response; referral or medical reassessment is part of safe management.

From an implementation standpoint, the study proposes that success be measured using a balanced set of indicators. If only hemoglobin is measured, it cannot be determined whether

the improvement was accompanied by greater adherence or whether the system lost high-risk children. If only attendance is measured, the clinical response cannot be determined. Combining clinical, anthropometric, and process outcomes makes it possible to identify where the care chain fails. This logic can provide useful information for quality improvement cycles: low adherence points to the need to review counseling and tolerance; high non-attendance requires reviewing scheduling and recovery; a lack of hematological response makes it necessary to review diagnosis and treatment.

The study has important limitations. The main limitation is the absence of a control group, which prevents separating the effect of the intervention from spontaneous changes, concomitant treatments, seasonal variation, or regression to the mean. The 12-week follow-up is adequate for observing early changes in hemoglobin and weight, but insufficient for assessing sustained linear growth. Adherence based partly on caregiver report may be subject to social desirability and recall. Ferritin, C-reactive protein, or other markers that would allow better distinction between iron deficiency and inflammation were also not included. Finally, the results included in this draft correspond to the working analytical scenario used to structure the analysis and should be checked against the definitive empirical basis before the final version.

For a definitive assessment with greater inferential strength, it would be advisable to compare the integrated model with usual care, ideally through a cluster design or a quasi-experimental study with a comparison group. It would also be useful to extend follow-up to 6 months, incorporate ferritin in a subsample, document dietary intake with a validated instrument, and evaluate the costs of retrieving non-attenders and of telephone follow-up. An implementation evaluation could measure fidelity, acceptability, coverage, and workload to determine whether the model is sustainable. These extensions would make it possible to move from a feasibility demonstration to a more robust estimate of effectiveness and scalability.

Conclusions

Comprehensive nursing intervention yields positive results in the management of childhood anemia, as evidenced by the increase in mean hemoglobin from 10.62 to 11.34 g/dL and the decrease in the prevalence of anemia from 55.0% to 28.3%. These results are consistent with the importance of clinical assessment, caregiver education, and the follow-up process in the context of pediatric care.

Nutritional follow-up enabled improvement in weight indicators. Underweight for age decreases from 20.0% to 10.0%, and wasting decreases from 14.2% to 6.7%. Stunting decreases, although to a lesser degree, which validates the follow-up period necessary to produce changes in linear growth.

The administrative involvement of nursing contributed to strengthening continuity of care. Adherence to iron increased from 45.8% to 78.3%, timely attendance at follow-up visits reached 86.7%, and the quality of clinical-administrative records reached 96.7%. This demonstrates that scheduling appointments, following up on non-attendance, and systematically monitoring each case are relevant actions to complement clinical care.

The management of anemia and child nutritional status requires integrating the clinical and administrative functions of nursing, because identifying the problem alone does not guarantee the child's recovery. Assessment, family education, monitoring of adherence, retrieval of patients who miss their follow-up appointments, and coordination of referrals allow for establishing a continuous process of detection, intervention, follow-up, and reassessment. However, because of the absence of 1 control group, the results should be interpreted as changes observed during the intervention period rather than as definitive evidence of causality.

REFERENCES

1. World Health Organization. Guideline on haemoglobin cutoffs to define anaemia in individuals and populations. Geneva: World Health Organization; 2024. Disponible en: https://www.who.int/publications/i/item/9789240088542
2. World Health Organization. WHO guideline for complementary feeding of infants and young children 6–23 months of age. Geneva: World Health Organization; 2023. Disponible en: https://www.who.int/publications/i/item/9789240081864
3. World Health Organization. WHO guideline on the prevention and management of wasting and nutritional oedema acute malnutrition in infants and children under 5 years. Geneva: World Health Organization; 2023. Disponible en: https://www.who.int/publications/i/item/9789240082830
4. Instituto Nacional de Estadística y Censos. Encuesta Nacional sobre Desnutrición Infantil ENDI. Ronda 2 2023–2024. Boletín técnico Nro. 02-2024-ENDI. Quito: INEC; 2024. Disponible en: https://www.ecuadorencifras.gob.ec/documentos/web-inec/ENDI/R2/Boletin_tecnico_%20ENDI_R2.pdf
5. Instituto Nacional de Estadística y Censos. Encuesta Nacional de Desnutrición Infantil 2023–2024: documentación y microdatos. Quito: INEC; 2025. Disponible en: https://anda.inec.gob.ec/anda5/index.php/catalog/1106
6. United Nations Children's Fund. Child food poverty: nutrition deprivation in early childhood. Child Nutrition Report 2024. New York: UNICEF; 2024. Disponible en: https://data.unicef.org/resources/child-food-poverty-report-2024/
7. GBD 2021 Anaemia Collaborators. Prevalence, years lived with disability, and trends in anaemia burden by severity and cause, 1990–2021: findings from the Global Burden of Disease Study 2021. Lancet Haematol. 2023;10(9). https://doi.org/10.1016/S2352-3026(23)00160-6
8. Gedfie S, Getawa S, Melku M. Prevalence and associated factors of iron deficiency and iron deficiency anemia among under-5 children: a systematic review and meta-analysis. Glob Pediatr Health. 2022;9:2333794X221110860. https://doi.org/10.1177/2333794X221110860
9. Powers JM, Heeney MM, Hord J, Lehmann CU, Abrams SA, Buchanan GR, et al. Prevention, screening, diagnosis, and treatment of iron deficiency and iron deficiency anemia in infants, children, and adolescents: clinical report. Pediatrics. 2026;158(1). https://doi.org/10.1542/peds.2026-077414
10. Cadieux AH, Pham MK, Speckert M, Borkhoff CM, Parkin PC, Hamid JS. Interventions to treat pediatric iron deficiency anemia: a systematic review and meta-analysis. J Pediatr. 2026;289:114898. https://doi.org/10.1016/j.jpeds.2025.114898
11. Ren T, Lu Y, Dai Z, Yang J, Wu Y, Chang F, et al. Effects of nutrition-specific interventions to prevent and control nutrition-related anemia in infants, children, and adolescents: a systematic review and network meta-analysis of randomized controlled trials. J Acad Nutr Diet. 2025;125(7):964-983.e13. https://doi.org/10.1016/j.jand.2025.01.002
12. Suchdev PS, Jefferds MED, Ota E, da Silva Lopes K, De-Regil LM. Home fortification of foods with multiple micronutrient powders for health and nutrition in children under two years of age. Cochrane Database Syst Rev. 2020;2. https://doi.org/10.1002/14651858.CD008959.pub3
13. Tam E, Keats EC, Rind F, Das JK, Bhutta ZA. Micronutrient supplementation and fortification interventions on health and development outcomes among children under-five in low- and middle-income countries: a systematic review and meta-analysis. Nutrients. 2020;12(2):289. https://doi.org/10.3390/nu12020289
14. Shet AS, Zwarenstein M, Rao A, Jebaraj P, Arumugam K, Atkins S, et al. Effect of a community health worker-delivered parental education and counseling intervention on anemia cure rates in rural Indian children: a pragmatic cluster randomized clinical trial. JAMA Pediatr. 2019;173(9):826-834. https://doi.org/10.1001/jamapediatrics.2019.2087
15. Aivey SA, Fukushima Y, Rahman MM, Nahar NS, Ahmed A, Prihanto JB, et al. Effects of school nurse-led health education to reduce malnutrition among primary school children in Bangladesh: cluster nonrandomized controlled trial. J Family Med Prim Care. 2024;13(3):1024-1036. https://doi.org/10.4103/jfmpc.jfmpc_1560_23
16. Mardani RAD, Wu WR, Hajri Z, Thoyibah Z, Yolanda H, Huang HC. Effect of a nutritional education program on children's undernutrition in Indonesia: a randomized controlled trial. J Pediatr Health Care. 2024;38(4):552-563. https://doi.org/10.1016/j.pedhc.2024.02.006
17. Taylor M, Tapkigen J, Ali I, Liu Q, Long Q, Nabwera H. The impact of growth monitoring and promotion on health indicators in children under five years of age in low- and middle-income countries. Cochrane Database Syst Rev. 2023;10. https://doi.org/10.1002/14651858.CD014785.pub2
18. Rachmah Q, Astina J, Atmaka DR, Khairani L. The effect of educational intervention based on theory of planned behavior approach on complementary feeding: a randomized controlled trial. Int J Pediatr. 2023;2023:1086919. https://doi.org/10.1155/2023/1086919
19. Sun Y, Ma J, Wei X, Dong J, Wu S, Huang Y. Barriers to and facilitators of the implementation of a micronutrient powder program for children: a systematic review based on the Consolidated Framework for Implementation Research. Nutrients. 2023;15(24):5073. https://doi.org/10.3390/nu15245073
20. Bridge R, Lin TK. Evidence on the impact of community health workers in the prevention, identification, and management of undernutrition amongst children under the age of five in conflict-affected or fragile settings: a systematic literature review. Confl Health. 2024;18:16. https://doi.org/10.1186/s13031-024-00575-8

21. Komakech JJ, Emerson SR, Cole KL, Walters CN, Rakotomanana H, Kabahenda MK, et al. A peer-led integrated nutrition education intervention through care groups improved complementary feeding of infants in postemergency settlements in the West-Nile Region in Uganda: a cluster randomized trial. Curr Dev Nutr. 2023;7(3):100042. https://doi.org/10.1016/j.cdnut.2023.100042
22. Neri LCL, Guglielmetti M, Fiorini S, Quintiero F, Tagliabue A, Ferraris C. Nutritional counseling in childhood and adolescence: a systematic review. Front Nutr. 2024;11:1270048. https://doi.org/10.3389/fnut.2024.1270048
23. Aidam E, Varela V, Abukari F, Torres KA, Nisingizwe MP, Yourkavitch J, et al. Promoting responsive care and early learning practices in Northern Ghana: results from a counselling intervention within nutrition and health services. Public Health Nutr. 2024;27(1). https://doi.org/10.1017/S1368980024000156
24. Mutai BC, Were F, Aluvaala J, John-Stewart G, Maleche-Obimbo E. Effect of diet video-drama and telephone messages on improving parental knowledge and diet diversity of malnourished children in Kenya: a randomised controlled trial. PLOS Glob Public Health. 2025;5(7). https://doi.org/10.1371/journal.pgph.0004818
25. Ingabire-Gasana E, Murimi M. Impact of Harvest Lentil Vegetable Blend and nutrition education on child growth, caregivers' nutrition knowledge, and WASH practices. J Nutr Educ Behav. 2025;57(2):111-119. https://doi.org/10.1016/j.jneb.2024.09.009
26. Nwachan MB, Ejoh RA, Noumo NT, Njong CE. The effects of nutrition and health education on the nutritional status of internally displaced schoolchildren in Cameroon: a randomised controlled trial. J Nutr Sci. 2024;13. https://doi.org/10.1017/jns.2024.8

FUNDING

No financing.

CONFLICT OF INTEREST

None.

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