

# Effects of Virtual Health Messages on Maternal Therapeutic Adherence for Childhood Anemia\*

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**Theme :** Health care technologies

**Contribution to the discipline:** It expands the theoretical conception regarding virtual health messages (VHM) to improve supplementation with ferrous sulfate and intervenes in dimensions such as social factors, health personnel, disease, supplementation, and the person who supplements and the patient. The results will be incorporated into health services to reduce anemia in children.

## Abstract

**Introduction:** Therapeutic adherence for childhood anemia is addressed in health services with unsatisfactory results. Therefore, the implementation of this strategy will favor greater adherence to treatment with ferrous sulfate. **Objective:** To evaluate the effect of virtual health messages on maternal therapeutic adherence for childhood anemia. **Materials and Methods:** A pre-experimental and longitudinal study was developed between November and December 2022, in which 24 mothers of children diagnosed with anemia participated. Adherence was determined using a test and inferential analysis through the Wilcoxon test. **Results:** The mothers were between 18 and 29 years old (50.0 %), of rural origin (66.7 %), who completed primary school (33.3 %), housewives (83.3 %), and cohabitants (79.2 %). In the pre-test, high adherence was observed in social factors (50 %), health personnel (75 %), illness (87.5 %), and person supplementing the ferrous sulfate and the patient (75.5 %). The overall adherence was medium in the pre-test (50.0 %) and high in the post-test (100.0 %). Message reception was high for the overall test (62.6 %), reminder (79.2 %), informational (79.2 %), and motivational (75.0 %) messages. **Conclusion:** Virtual health messages have a positive effect on maternal therapeutic adherence for childhood anemia ( $p < 0.05$ ) and their inclusion in primary health services will contribute favorably to obtaining optimal results.

### Keywords (Source: DeCS)

Text messaging; treatment adherence and compliance; anemia; mothers; child.

## 4 Efecto de los mensajes virtuales en salud sobre la adherencia terapéutica materna de anemia infantil\*

\* Artículo derivado de la tesis de doctorado: "Efecto de los mensajes virtuales en salud sobre la adherencia terapéutica de anemia infantil en madres del hospital José Soto Cadenillas, Chota – 2021". Universidad Nacional de Cajamarca, Perú. <https://repositorio.unc.edu.pe/handle/20.500.14074/5539>

### Resumen

**Introducción:** la adherencia terapéutica de anemia infantil es un tópico abordado en los servicios de salud, con resultados poco satisfactorios; por lo tanto, la implementación de esta estrategia favorecerá una mayor adherencia al tratamiento con sulfato ferroso. **Objetivo:** evaluar el efecto de los mensajes virtuales en salud sobre la adherencia terapéutica materna de anemia infantil. **Materiales y Métodos:** se desarrolló un estudio preexperimental y longitudinal entre noviembre y diciembre de 2022, en el cual participaron 24 madres de niños diagnosticados con anemia; la adherencia se determinó mediante un test y el análisis inferencial por medio de la prueba de Wilcoxon. **Resultados:** Las madres tenían entre 18 y 29 años (50,0 %), procedencia rural (66,7 %), primaria completa (33,3 %), amas de casa (83,3 %) y convivientes (79,2 %). En el pretest, se observó alta adherencia en factores sociales (50 %), personal de salud (75 %), enfermedad (87,5 %), persona que suplementa y paciente (75,5 %), y adherencia media en factores relacionados a la suplementación (54,2 %); en el posttest, la adherencia alta se presentó en factores sociales (100,0 %), personal de salud (100,0 %), enfermedad (87,5 %), suplementación (95,8 %), persona que suministra el sulfato ferroso y paciente (100,0 %). La adherencia global fue media en el pretest (50,0 %) y alta en el posttest (100,0 %). La recepción de mensajes fue alta para el test global (62,6 %), mensajes recordatorios (79,2 %), informativos (79,2 %) y motivacionales (75,0 %). **Conclusión:** los mensajes virtuales en salud tienen un efecto positivo en la adherencia terapéutica materna de anemia infantil ( $p < 0,05$ ) y su inclusión en los servicios primarios de salud contribuirá favorablemente en la obtención de resultados óptimos.

#### Palabras clave (Fuente: DeCS)

Envío de mensajes de texto; cumplimiento y adherencia al tratamiento; anemia; madres; niño.

# O efeito das mensagens virtuais de saúde na adesão materna ao tratamento da anemia infantil\*

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## Resumo

**Introdução:** a adesão ao tratamento da anemia infantil é um tema abordado nos serviços de saúde, com resultados insatisfatórios; portanto, a implementação dessa estratégia favorecerá uma maior adesão ao tratamento com sulfato ferroso. **Objetivo:** avaliar o efeito das mensagens virtuais de saúde na adesão materna ao tratamento da anemia infantil. **Materiais e método:** foi realizado um estudo pré-experimental e longitudinal entre novembro e dezembro de 2022, do qual participaram 24 mães de crianças diagnosticadas com anemia; a adesão foi determinada por meio de um teste e a análise inferencial, por meio do teste de Wilcoxon. **Resultados:** as mães tinham entre 18 e 29 anos de idade (50 %), eram de áreas rurais (66,7 %), concluíram o ensino fundamental (33,3 %), eram donas de casa (83,3 %) e viviam juntas (79,2 %). No pré-teste, foi observada alta adesão em fatores sociais (50 %), equipe de saúde (75 %), doença (87,5 %), pessoa que suplementa e paciente (75,5 %), e adesão média em fatores relacionados à suplementação (54,2 %); no pós-teste, foi observada alta adesão em fatores sociais (100 %), equipe de saúde (100 %), doença (87,5 %), suplementação (95,8 %), pessoa que fornece sulfato ferroso e paciente (100 %). A adesão geral foi média no pré-teste (50 %) e alta no pós-teste (100 %). A recepção das mensagens foi alta para o teste geral (62,6 %), lembretes (79,2 %), mensagens informativas (79,2 %) e motivacionais (75 %). **Conclusões:** as mensagens virtuais de saúde têm um efeito positivo na adesão materna ao tratamento da anemia infantil ( $p < 0,05$ ) e sua inclusão nos serviços de saúde primários contribuirá favoravelmente para a otimização dos resultados.

### Palavras-chave (Fonte DeCS)

Envio de mensagens de texto; cooperação e adesão ao tratamento; anemia; mães; criança.

## Introduction

Anemia is a severe public health problem associated with several factors, including iron deficiency. This condition predominates in areas where poverty is more prevalent, iron consumption is limited, housing is precarious, access to basic services is restricted, and family information about adequate nutrition or low therapeutic adherence is insufficient, aspects that directly affect the health of the child (1).

Globally, heme iron deficiency is the main cause of iron-deficiency anemia, thus, the prevalence of childhood anemia is close to 42% (2). In Latin America, iron-deficiency anemia in infants negatively affects short-term hematological indices, impacting their learning neurocognitive functions and long-term memory (3). Perú is not immune to this reality, given that 46.6 % of children suffer from anemia (4, 5); for example, in Cajamarca, 26.6 % of children suffer from it, as do 29.3 % in the province of Chota (6).

Faced with this scenario, several countries have implemented various strategies: in Argentina, foods have been fortified with iron to prevent anemia during pregnancy, late clamping of the umbilical cord, promotion and protection of maternal lactation, diversification and improvement of food quality, and supplementation with ferrous sulfate (7). In Ecuador, the State has implemented feeding programs fortified with iron and micronutrients. However, the expected results have not been obtained due to the absence of qualified personnel to verify and supervise its continuity (8). In Perú, the government has promoted various nutritional programs for several decades, nevertheless, there are still high rates of anemia in several regions of the country (9).

Therefore, it is necessary to take measures and join efforts to improve therapeutic adherence to ferrous sulfate, as well as having trained and qualified personnel for their adequate management in the continuous assessment of the effectiveness of these interventions (10, 11).

Currently, there are high rates of childhood anemia, despite the Peruvian government's efforts to reduce it, a situation mainly linked to factors such as low therapeutic adherence. For this reason, the Ministry of Health (*MINSA*) (12) has been executing several multisectoral strategies and actions to address it. In this sense, for adequate adherence, not only therapeutic supplementation is sufficient, but it is also necessary to send VHM to the mothers' mobile phone, to reinforce nutritional counseling and guarantee therapeutic supplementation with ferrous sulfate.

Faced with this context, the Peruvian State has implemented a "Plan to bridge anemia gaps during COVID-19" to reduce anemia through iron supplementation, avoiding the risk of illness, disability, or death (13). To achieve this, multisectoral action is needed, in addition to the active participation of mothers in the selection of foods with sources of iron and vitamin C for children, using methodologies that use

information and communication technologies (ICT), to obtain better indicators of therapeutic adherence to ferrous sulfate. In this scenario, the study's objective was to evaluate the effect of VHM on maternal therapeutic adherence for childhood anemia.

## Materials and Methods

Quantitative, explanatory level, pre-experimental, and longitudinal design study, conducted with 24 mothers with children aged 6 to 35 months diagnosed with anemia, which formed a universal sample ( $N = n$ ). The data collection technique was a directed survey, and the therapeutic adherence test for childhood anemia was used as a measurement instrument, which was self-administered and applied at each participant's home.

The mothers were contacted after they participated in a meeting scheduled by the health facility's growth and development service. The exclusion criteria were mothers of preterm children and babies with low birth weight, failure in supplementation, and diagnosis of severe anemia. The inclusion criteria were children who started treatment immediately after the anemia diagnosis, with a maximum of 15 days after starting treatment, and who only used ferrous sulfate provided by the health facility.

The test contains 23 questions developed by the World Health Organization (WHO) distributed in five dimensions: 1) social factors (5 questions); 2) health personnel (4 questions); 3) illness (2 questions); 4) supplementation (5 questions), and 5) the person who supplements and patient (7 questions). Each question had three possible answers (1 = low adherence, 2 = medium adherence, and 3 = high adherence). A scale was built and a score was obtained for each dimension with the global score to achieve adherence in each dimension. Prior to its administration, the test was validated by seven nursing professionals with experience in growth and development or public health, who gave indications to improve the content of the VHM. Content validity was performed through Aiken's V coefficient, reaching agreement between judges of 0.99 (adequate=0.99; sufficient=1.00; relevant=1.00; relevant=1.00; and clear=0.99). Reliability reached KR-20 = 0.76, through a pilot test done with 15 mothers. The Wilcoxon statistical test was performed to contrast adherence before and after the intervention by the sending of VHM, being statistically significant ( $p < 0.05$ ). The collected information was entered into the SPSS v. 26. statistical software.

The study consisted of an intervention carried out with mothers of children with anemia aged 6 to 35 months, who belonged to the Growth and Development Control Service (CRED) of the Jose Soto Cadenillas Hospital in Chota; they were made aware of the problem of anemia and the importance of complying with the children's treatment, using for this purpose the sending of VHM through the instant messaging application WhatsApp, dis-

tributed in reminder messages (RMs), informative messages (IMs), and motivational messages (MMs), to improve therapeutic adherence to the consumption of ferrous sulfate.

The study was executed between November and December 2022, a period in which three messages were sent daily for 19 days (Monday to Friday, one for each type of message), and which were repeated the following month. The RMs were elaborated as a two to three lines long text; the IMs (audios) were recorded by the authors of this article, they had a duration of 0.5 to 15 seconds, and were sent at 11:00 hours; the MMs (videos) recorded by the researchers had a duration of 0.8 to 20 seconds, and were sent at 17:00 hours. To guarantee the reception of the VHM, a checklist for each participant was made, where the reception status of the messages was recorded daily.

Before signing the informed consent, the participants received details about the objective, purpose, and benefits of the study. The project was authorized by the Research Ethics Committee of the Graduate School of the Universidad Nacional de Cajamarca through the Official Letter N°16-2021-CE-UNC, which assumed the relevant ethical principles throughout the study. A critical evaluation of the study was fulfilled following the recommendations of the STROBE Guide (Strengthening the Reporting of Observational Studies in Epidemiology).

## Results

The majority of mothers were between 18 and 29 years old (50.0%), lived in a rural area (66.7%), had completed primary school (33.3%), worked as housewives (83.3%), and had a permanent partner (79.2%) (Table 1).

**Table 1.** Sociodemographic Characteristics of the Children's Mothers (14)<sup>1</sup>

Mother's sociodemographic characteristics		N (24)	% (100.0)
Age	< 18 years	3	12.5
	18 - 29 years	12	50.0
	30 - 39 years	6	25.0
	40 or more years	3	12.5
Origin	Urban	8	33.3
	Rural	16	66.7
Education level	No instruction	1	4.2
	Incomplete primary	2	8.3
	Complete primary	8	33.3
	Incomplete secondary	6	25.0
	Completed secondary	3	12.5
	Advanced technician	4	16.7



Mother's sociodemographic characteristics		N (24)	% (100.0)
Occupation	Housewife	twenty	83.3
	Student	4	16.7
Civil status	Single woman	1	4.2
	Married	2	8.3
	Cohabitant	19	79.2
	Widow	2	8.3

Source: (14).

Regarding the children, 66.7 % of them came from rural areas, 50% were between 12 and 23 months of age, and 75% were women (Table 2) (14).

**Table 2.** Children's Sociodemographic Characteristics (14)

Children's sociodemographic characteristics		N (24)	% (100.0)
Origin	Urban	8	33.3
	Rural	16	66.7
Age	6-11 months	9	37.5
	12-17 months	6	25.0
	18-23 months	6	25.0
	24 or more months	3	12.5
Sex	Male	6	25.0
	Female	18	75.0

Source: (14).

In the pre-test and post-test high adherence predominated in social factors, health personnel, illness, and the person who supplements and the patient. However, in the supplementation factor, medium adherence predominated in the pre-test and high adherence in the post-test (Table 3) (14).

**Table 3.** Level of Anemia Therapeutic Adherence according to Factors (14)

Therapeutic adherence factors	Pre-test		Post-test	
	N (24)	% (100.0)	N (24)	% (100.00)
Social				
High adhesion	12	50.0	24	100.0
Regular adhesion	eleven	45.8	0	0.0
Low adhesion	1	4.2	0	0.0
Related to health personnel				
High adhesion	18	75.0	24	100.0
Regular adhesion	6	25.0	00	0.0

Therapeutic adherence factors	Pre-test		Post-test	
	N (24)	% (100.0)	N (24)	% (100.00)
Related to the disease				
High adherence	twenty-one	87.5	twenty-one	87.5
Regular adherence	3	12.5	0	0.0
Low adherence	0	0.0	03	12.5
Related to supplement with ferrous sulfate				
High adherence	8	33.3	23	95.8
Regular adherence	13	54.2	01	4.8
Low adherence	3	12.5	0	0.0
Related to the person supplying the ferrous sulfate and the patient				
High adherence	18	75.0	24	100.0
Regular adherence	6	25.0	0	0.0

Source: (14).

Regarding the reception of VHM, high reception (62.6%) was the globally predominant category, as well as in its dimensions: reminder messages (79.2%), informative messages (79.2%) and motivational messages (75%) (Table 4) (14).

**Table 4.** VHM Reception Frequency in Mothers of Children (14)

Reception frequency	N (24)	% (100.0)	Total
RMs			
Low reception	1	4.2	4.2
Average reception	4	16.7	16.7
High reception	19	79.2	79.2
IMs			
Average reception	5	20.8	20.8
High reception	19	79.2	79.2
MMs			
Average reception	6	25.0	25.0
High reception	18	75.0	75.0
Global message reception			
Low reception	6	25.0	25.0
Average reception	3	12.5	12.5
High reception	fifteen	62.6	62.6

Source: (14).

According to the therapeutic adherence for global anemia in children, the categories of regular adherence (50 %) and high adherence (45.8 %) predominated in the pre-test; while in the post-test, high adherence prevailed (100 %). When testing the hypothesis, a significant relationship was found between VHM and therapeutic adherence for childhood anemia using the Wilcoxon test ( $p < 0.05$ ) (Table 5) (14).

**Table 5.** Therapeutic Adherence of Global Anemia in Children (14)

Therapeutic adherence	Pre-test		Post-test		p-value (Wilcoxon)
	N (24)	% (100.0)	N (24)	% (100.0)	
High adhesion	eleven	45.8	24	100.0	0.000*
Regular adhesion	12	50.0	00	0.0	
Low adhesion	1	4.2	00	0.0	

Source: (14).

## Discussion

The characteristics of the participating mothers are similar to those reported by De la Cruz (15), the majority were between 19 and 30 years old (64.7 %), with secondary education (55.1 %), and housewives (63.9 %), as evidenced by Sotomayor (16), who identified most mothers were between 27 and 34 years old (35 %), had secondary education (33.3 %), dedicated to household chores (84 %), and cohabitants (67 %). However, these results differ from the findings of Mamani and Palomino (17), who point out that 72.4 % of mothers were between 18 and 29 years old and 62.1 % had completed secondary education, and those of Caballero et al (18), in which 45.1 % were adult mothers and 46% had higher technical education.

The mothers were relatively young, allowing them to take care of their children, contributing to their healthy growth and development. This could have positive effects on the therapeutic adherence observed after the intervention, given that younger mothers have a greater receptivity to ICT, greater willingness to receive—and follow—the VHM and, most likely, less of a burden of additional family responsibilities, which facilitates attention to treatment recommendations. For this reason, the adaptation of specific strategies according to maternal age would help promote better therapeutic adherence.

In terms of origins, almost 3/4 of the mothers lived in rural areas, which constitutes a disadvantage given that the highest prevalence of anemia has been reported in these areas (6). Neverthe-

less, concerning access to mobile coverage and connectivity they do not represent a limitation, since the area where the mothers come from has these services, evident in the observed VHM reception percentages—41.7 % of the mothers in rural areas had high reception compared to 20.8% of residents in urban areas. This indicates that the use of ICT, to promote better therapeutic adherence, can be implemented in any geographic space.

The predominance of completing primary school would be related to a greater family burden for the women, as established by Mehta et al. (19), confirming that mothers who dedicate more time to family activities and raising children prefer to postpone their studies. The same happens with the mothers' marital status, which coincides with the reports of Matias de Lima et al. (20) since in recent decades there has been an increase in the cohabiting or separated category.

As for the children's characteristics, the majority were from rural areas (66.7 %), aged between 12 and 23 months (50 %), and female (75 %). Different results than those of Sotomayor (15), where the most frequent age was 16 to 24 months (47 %) and the male sex (51 %). According to Ribeiro et al, the preschool population is older compared to schoolchildren and adolescents (21). Yet, it is necessary to clarify that the intervention population for this research was children from 6 to 35 months (14).

Regarding the frequency of anemia in children between 6 and 11 months, this is associated with the inadequate transition between breastfeeding exclusively, and complementary feeding, in which the incorporation of foods rich in iron in the daily diet is not sufficient; yet, in general terms, anemia is more incident in the first 24 months (22, 23). Furthermore, cultural aspects and the degree of maternal knowledge about anemia reduce the level of therapeutic adherence and success in its management (2, 5).

According to the social factor, high therapeutic adherence predominated (100 %) in the post-test, a result that is contrasted with those of Dolores (24), where 41.4 % of the children had medium adherence. About the aforementioned, the motivation of the family and/or neighbors has been essential in obtaining high adherence after the intervention by sending RM, IM and MMs to the mothers' cell phone (14).

From this perspective, to achieve adequate therapeutic adherence, it is not only enough to have ferrous sulfate, but also for the mother to be motivated and have the support of the family (14). In addition, it is imperative to promote the counseling provided by nursing staff in primary health facilities, considering interculturality and the participation of various social actors in the health of the individual, family, and community. Likewise, the use of information and communication technologies should be established, such as virtual messages as alternative methods to the customary (radio, TV, etc.) (14).

High adherence in both the pre-test (75 %) and the post-test (100 %), in terms of health personnel, differs from the results of Dolores (24), who determined that 66.9 % of infants had medium adherence. According to Liu R et al (23), nursing staff interventions contribute to improving adherence to ferrous sulfate.

As for factors related to the disease, albeit the level of therapeutic adherence is indeed high, both in the pre-test (87.5 %) and in the post-test (87.5 %) it is observed that the intervention of the VHM was not effective because there was no significant increase in the percentage (14). These results are contrasted with those of Dolores (24), who found that 89.9 % of infants had average adherence. The VHM low effectiveness is probably related to the suspension of supplementation, either due to the absence of clinical symptoms in the case of mild anemia, or because the child is receiving antibiotics for an infectious treatment (bronchitis, pharyngotonsillitis, pneumonia, and diarrhea, among others) (14).

The most predominant category in supplementation after the intervention was the high level of adherence (95.8 %), thanks to the tactic of sending VHM to the mothers' cell phones (14). Findings differ from those of Dolores (24), who identified that 40.8 % of the children showed high adherence, and those of Uceda and Arriola (25), in which 65 % of the children showed regular adherence. These aspects show that the guidance and recommendations provided to mothers through the strategies used were adequate, effective, and relevant to assume therapeutic adherence linked to supplementation (14).

Therefore, it is essential to provide counseling on therapeutic adherence to ensure supplementation and controls after starting it, since treatment is often suspended due to the side effects generated by iron. In addition, it is needed to accompany the supplementation with citrus to help its absorption or to segment the dose to reduce side effects. On this matter, it has been identified that approximately between 20 % and 30 % of the therapeutic management of childhood anemia is suspended due to the side effects generated by the administration of supplements containing iron, especially in its elemental form (26, 27).

Regarding the person who supplements and the patient, there is a high level of therapeutic adherence after the intervention (14). These results are different from those shown by Dolores (24), where 49.1 % of the children had high adherence. Uceda and Arriola (25) reported 93 % regular adherence and 7 % high adherence. The superiority of high adherence in the post-test would be associated with maternal knowledge about the amount, periodicity and way of supplementing with ferrous sulfate, monitoring supplementation by health personnel, supplementation counseling, and the mother's motivation to comply with the instructions (14).

As for the reception frequency of VHM, a predominance of its high reception (62.6 %) was observed in the global test, as well as in RM (79.2 %), IM (79.2%) and MM (75 %), which would be related to appropriate intervention, intercommunication through VHM and, above all, to the empowerment and responsibility of mothers in supplementation (14). To this end, the VHMs were characterized in three moments: their creation (text, audio, and video messages), application (sending the VHM) and their results (adequate therapeutic adherence) (14).

Regarding therapeutic adherence for global anemia, the intervention had a positive impact since high adherence (100 %) prevailed in the post-test (14). Similar results to those of Dolores L et al (28), where the intervention was effective, since the children remained without anemia and consumed sources of iron, favoring the infant's health.

The study showed that there is a significant relationship between VHM and therapeutic adherence for childhood anemia through the Wilcoxon statistical test ( $p < 0.05$ ) (14). Results similar to the findings of Dolores L et al. (28), who showed the educational program (telenursing) was effective, which was reflected in good knowledge about the intake of foods with iron, and the findings of Echagüe et al (29), where the educational intervention was effective in respect to supplementation with ferrous sulfate ( $p < 0.05$ ).

Granting that it is true that the findings show better adherence to supplementation after the intervention with VHM, it is noteworthy that there is still a gap in this aspect that must be closed, and whose causes could be related to the lack of equitable access to mobile phones and reliable connectivity, especially in rural communities, which limits the effective reception of VHM or the existence of cultural or linguistic barriers which make it difficult for mothers to understand and accept the messages. To address these gaps, it would be crucial to adapt the VHM to the cultural and linguistic particularities of each community, thus ensuring that the messages are understandable and relevant. Nguyen and Tadi (30) suggest on this topic that, in long-term therapies where the caregiver is required to administer iron on an outpatient basis, exhaustive follow-up and monitoring of the case ensures optimal adherence to treatment.

On the other hand, to encourage the effective use of ICT in health outcomes, it is essential to carry out an awareness and training campaign aimed at both health professionals and beneficiary families, which includes the active promotion of ICTs' advantages in health care, as well as the dissemination of success stories, which highlight the benefits of therapeutic adherence. Likewise, it must be ensured that ICTs are accessible to all populations, even those in rural areas or with limited resources. On this matter, the constant training of health personnel in the use of these technologies and their integration into care protocols is essential, since this promotes the understanding, accessibility and effective use of ICTs and strengthens the population's health improvement and well-being (31, 32).

# Conclusions

The intervention by sending virtual health messages to the mothers' cell phones was effective, using the WhatsApp application, since the mothers were trained in knowledge and practices about therapeutic iron supplementation in each of the dimensions of adherence to treatment (social factors, health personnel, illness, supplementation, and person who provides the supplementation and patient), evidenced thanks to the reception of virtual health messages.

The findings suggest specific nursing care that ensures the effective implementation of the VHM to improve therapeutic adherence in cases of childhood anemia, as well as the individualized evaluation of the child and his or her family environment to adapt the VHM to their specific needs, considering factors such as the child's age, access to ICTs, and cultural or linguistic barriers; maternal education and training on how to use and benefit from VHM; continuous monitoring by establishing a system for tracking and monitoring patient response to VHM, identifying doubts and providing timely responses, as well as adaptation and updating the VHM with relevant and current information on the treatment of anemia.

Moreover, the results contribute to achieving the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda, since by improving maternal therapeutic adherence for childhood anemia, the prevalence of anemia and mortality is reduced, which is aligned with SDG 3 (health and well-being). Furthermore, by using ICTs to access rural or remote populations, SDG 10 (reduced inequalities) is addressed, ensuring that excluded communities have access to effective health services.

**Conflicts of interest:** None declared.



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