"STRATEGIES TO INCREASE THE DISTRIBUTION AND ADHERENCE TO MICRONUTRIENT POWDER IN 6-36 MONTH OLD CHILDREN IN PERU"

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KEY MESSAGES

The problem
Peru has an unusually high rate of anemia in children under 3 years: half of the Peruvian children have anemia to some degree. The Ministry of Health has implemented interventions with iron syrup in prioritized regions in recent years. However, the effectiveness of this intervention has not been thoroughly studied. As an alternative, the Ministry decided to implement the use of multi-micronutrient powders (MMNP) to address this problem, and from July 2009 to July 2010 there was a pilot intervention in 4 of the country's poorest regions. Evaluations of the effectiveness of this intervention show problems in the distribution and adherence to MMNP. However, it is also observed that in children who meet the recommended doses the rates of anemia decreased significantly. Taking into account the significance of the problem, not only for girls and boys suffering from it but also to the country as a whole, as well as to the urgent need to improve the strategy to implement the distribution and use of MMNPs, it was decided to conduct a systematic search on the most suitable options for increasing adherence to MMNP in Peruvian children.

Current knowledge about the three viable options for addressing the problem

- **Option 1 – Educational and communicational intervention**
  This is further divided into 3 components: education of parents, with repeated sessions of information and sensitization on the importance of the use of MMNP; education of health personnel by sensitization and training in nutritional issues so that they can counsel parents in how to choose better food; and (mass) media campaigns for the communities. Although there are no systematic reviews about the effectiveness of these interventions specifically to MMNP, results can be extrapolated from systematic reviews to improve immunization coverage and exclusive breastfeeding, since the age groups are similar. Additionally, there are primary studies, some of them made in Peru, showing that these interventions are effective in our context

- **Option 2 – Community participation through community health workers and community-based organizations**
  Community health workers (CHWs) have proved effective in achieving better coverage of basic health programs both in adults and children. In the specific case of MMNP, there is small study describing a successful local experience with mothers as CHWs.
Another study with evidence from local experiences indicates that an alternative for community intervention is to use its basal organizations as a medium for reaching the population,. It should be taken into account that these interventions are complex to implement (and not unexpensive to implement), but can be adequate in remote and poor areas where there are no health centers.

**Option 3 – Supervision and monitoring close to the intervention**

There is evidence from a systematic review evaluating the impact on improving primary health care and health outcomes of supervisory activities of health workers responsible for these interventions-- above all activities that are supportive and non-punitive. Additionally there are interesting experiences described in the literature in which CHWs are incorporated in the monitoring activities of an intervention.

*Which considerations on implementation should be taken into account?*

For the choice of education and communication, Ministry of Health Directorates responsible for this issue should be actively involved in the design of the strategy, taking into account the evidence of what works for other interventions. Moreover, these activities should be considered for funding by the MMNP implementation programs MMNP. On the option of working with communities, this issue has great advantages but faces significant challenges, such as remuneration of CHWs--a constant controversy--and the relative lack of network and solid community organizations which may be assigned responsibility for the tasks. Finally, the issue of supervision and monitoring, some experiences show their effectiveness, but the scarcity of "supervisors" and the type of approach to health workers (as a supportive, and not punitive approach) should taken into account.

**INTRODUCTION**

Anemia, along with deficiencies of other micronutrients, such as Vitamin A and zinc, constitutes a grave health problem for the children in low and middle income countries, harming seriously their well-being and physical and cognitive development. It is a social determinant of health that causes other effects on the society, such as loss of productivity due to the lack of skills gained by these children, delaying the poverty reduction and economic development of these countries.
The effects of anemia and iron deficiency are commonly connected to a suboptimal development and physical and intellectual performance of the children. This damage is often irreversible or difficult to overcome when occurred early in life. The effects of Vitamin A deficiency are related to blindness and a longer duration of infections and death caused by them. The lack of zinc is also associated with increased severity of infections and delayed growth and cognitive development.

**QUANTIFICATION OF ANEMIA IN PERU**

Peru is one of the Latin American countries with the highest rate of chronic malnutrition in children under five years. It also has one of the highest rates of anemia in the region in children under three years. According to the National Household Survey (Encuesta Nacional de hogares, ENDES) 2010, 50.3% of children 6 to 36 months old in Peru were anemic. However, these rates vary by age and socioeconomic group, as can be seen in the Figures 1 and 2.

**Figure 1. Prevalence of anemia in children according to the age group, 2010**

As can be seen, in general the rate of anemia in Peruvian children is unacceptably high, even hiding the reality of this generation of children living today in Peru with anemia and that are led it to be considered a "middle income country," according to the World Bank, a label that hides the reality of this generation of children living today in Peru with anemia and that are missing the opportunity to develop their full potential and later on live a better life than that of their parents. It should also be noted that it is likely that the national prevalence of subclinical iron deficiency is even greater than that of anemia.

It is worth noting that as Peru is a country with great variations in culture, socioeconomics and access to services between the regions. There are also differences in nutritional indices between these regions. Puno and Huancavelica have surprisingly high rates of 78.1%, 71.5% respectively, while Lambayeque and Piura have rates of around 32.2%.

As can be seen, in general the rate of anemia in Peruvian children is unacceptably high, even more so because the country has gone through an economic transition in recent years that has led it to be considered a "middle income country," according to the World Bank, a label that hides the reality of this generation of children living today in Peru with anemia and that are missing the opportunity to develop their full potential and later on live a better life than that of their parents. It should also be noted that it is likely that the national prevalence of subclinical iron deficiency is even greater than that of anemia.

Finally, it is worth mentioning that no references were found on the prevalence of other nutrient deficiencies, such as deficiency of vitamin A and zinc, in Peru.
At the first meeting with the Director of Integral Care (Atención Integral) of the Ministry of Health and the responsible for “Etapa Niño” of the Direction of Integral Attention of the Ministry of Health, EVIPNet Peru team presented its constituents and the objectives of the “Policy Brief”. Decision-makers were pleased with the initiative and asked two key issues:

- Define whether the intervention with MMNP is equal or better than other interventions for supply of iron for children in resource-constrained countries through relevant scientific literature. This is very important because there is the impression that this intervention could be driven by economic interests of particular groups.

- Synthesize existing information on the pilot intervention that MINSA implemented in 4 regions in order to define how to better plan the expansion of such intervention.
CAUSES AND FACTORS ASSOCIATED WITH ANEMIA IN PERU

There are no studies to determine the causes of childhood anemia in Peru. Nevertheless, it can be indirectly associated with a low consumption of foods rich in iron. In 2003, the National Survey of Food Consumption made by the National Center for Food and Nutrition (Centro Nacional de Alimentación y Nutrición, CENAN) found that children between 12 and 35 months had a median iron intake of 4.3 mg/day and 90% had a lower consumption than the international recommendations7. Also, only 23% of the iron consumed had animal origin,7 even in the highest quintiles.

In the last decade, various efforts have been undertaken in Peru to reverse this situation. However, the results of these actions have not fulfilled the expectations, especially with the delivery and use of ferrous sulfate syrup, which has experienced availability and coverage deficiencies due to logistics problems. In this regard, the Population and Family Health Survey (Encuesta Demográfica y de Salud Familiar, ENDES)6, 2010 shows that only 18% of children aged 6 months to 36 months had received some form of iron supplementation in targeted risk groups, i.e. the lower fifth percentile of poverty. Even among the beneficiaries of the program JUNTOS (Together), the largest social assistance program in the country, these figures reach a maximum of 22.7% 6.

THE RESPONSE

MULTI-MICRONUTRIENT POWDERS HAVE BEEN USED SUCCESSFULLY IN OTHER COUNTRIES

The administration of multi-micronutrients powder ("sprinkles", MMNP) is an intervention developed to deal with the problem of iron deficiency and other micronutrient deficiencies in childhood through providing the micronutrients powders in sachets, so that they can be mixed with semi-solid food before being served at home8. One of the main advantages is that it does not cause significant changes in the taste of the food and it is easily used by parents at home. Additionally, it presents less complex logistics for transportation and preservation than syrups, facilitating its distribution as well as its acceptability and adherence by families8,9.
The effectiveness of this intervention in reducing the prevalence of anemia in pediatric populations with high rates of mild and severe anemia as in the case of Peru, has been studied and confirmed by a systematic review of clinical trials evaluating this intervention as compared to others, such as administration of iron syrup or drops or with no vitamin supplementation\(^9\). This systematic review evaluated the effectiveness of using MMNP fortification at home. Eight randomized trials conducted in low-income countries were included. Of these studies, six compared the use of MMN with placebo or with no intervention, and the other two compared it with iron supplementation by oral drops. The MMNP decreased the rate of anemia in 31% and iron deficiency in 51%. However, no differences in patterns of physical growth were found\(^9\).

It should be noted that in the majority of included studies the evaluated iron dose was 12.5 mg given daily\(^9\), although there are studies suggesting that the intervention applied in a more flexible way or intermittent scheme of two to four months produces the same hematological response\(^10\),\(^11\).

Based on this systematic review and other recently published studies, WHO includes in a guideline recommendations for the implementation of this strategy in countries with anemia problems.

Additionally, there is regional programmatic evidence, from interventions made in Mexico and Ecuador, where significant reduction in rates of childhood anemia was achieved through the use of these MMNP.

There is evidence on the effectiveness of the intervention from a programmatic standpoint, but it is also necessary to consider the economic aspect. In this sense, the World Bank has suggested that the cost of such interventions would sum up to 0.3% of GNP, while the cost associated with these deficiencies would sum up to 5%\(^2\). In an economic evaluation of an intervention in Pakistan in which 60 sachets of MMNP were provided to be consumed by children aged 6-12 months during 2-4 months, it was estimated that the cost per death avoided is $ 406, and the cost per DALY saved is $ 37, as well as $ 37 profit for every dollar invested in the programme\(^12\).

**MNP INSTEAD OF OTHER INTERVENTIONS**

In Peru, of decision makers in health, especially in the Ministry of Health (Ministerio de Salud, MINSA) and the General Directorate of Medicines, Supplies and Drugs (Dirección General de Medicamentos, Insumos y Drogas, DIGEMID), declared a great concern about the use of
combinations of drugs, even in the case of micronutrients and vitamins, with a preference for the use of single formulations. However, there is a systematic review to determine the effect of using iron in association with other micronutrients. It was found that the combination of iron with other micronutrients produced an increase in hemoglobin levels compared to placebo. When comparing the addition of other micronutrients to iron compared to using iron only it was found that the addition of other micronutrients marginally improved hemoglobin response. Thus, the review suggested that the addition of zinc, vitamin A, riboflavin, vitamin B12, folic acid and ascorbic acid to iron is safe, and may even have additional beneficial effects, although marginal, on hemoglobin levels compared to iron only.

The systematic review of De Regil shows that the use of MMNP, compared with the use of supplemental iron drops, produced similar results in hemoglobin levels. Thus, it can be concluded that the use of MMNP is better than no intervention or placebo and comparable to the routine use of daily iron supplementation on hemoglobin levels. However, it should always be considered that a public health intervention to control anemia should be directed considering at the same time other possible causes. Therefore, interventions should also include the control of malaria in endemic areas and infestation of parasites in the child population. Approximately 20% of the Peruvian population lives in malaria endemic areas, mostly in the Amazon and central highlands (sierra central), making important in these areas the management of this condition prior to supplementation with MMNP or any similar measure.
THE MAIN, CLOSER ACTORS 2: MEETING WITH THE REPRESENTATIVES OF THE NATIONAL CENTER FOR FOOD AND NUTRITION

The National Center for Food and Nutrition (CENAN), has accompanied the Dirección General de Salud de las Personas (D.G.S.P) in the design of the pilot intervention and it was in charge of executing the evaluations of both baseline and the intermediate evaluation, to measure the effectiveness of the intervention at 6 months. It is worth emphasizing the expertise and knowledge of the topic by this group, which made available the information on these evaluations.

An interesting aspect that was discussed was the shortcoming in the implementation of educational and communicational components of the intervention, which translates into poor understanding of the importance of intervention by families, and in turn poor adherence to it.
THE PILOT EXPERIENCE IN PERU

The Peruvian government implemented in 2009 a pilot plan for the prevention and control of anemia through distribution of MMNP. It selected for this pilot four of the country's poorest Regional Directorates: Ica, Ayacucho, Apurimac and Huancavelica. The intervention consisted of the administration of 90 sachets (1 sachet in alternate days) of MMNP containing iron (12.5 mg), zinc (5 mg), folic acid (160 ug), Vitamin A (300 ug) and Vitamin C (30 mg) in a period of 6 months to children aged 6 to 36 months living in these departments. This procedure was repeated, with two cycles completed.

There are three evaluations performed to determine the impact of the intervention with MMNP in rural areas: the "intermediate evaluation" of CENAN-MINSA, the "surveillance of sentinel establishments" of the Department of Epidemiology (DGE-MINSA) and the independent evaluation of the NGO Action against Hunger (Acción ontra el Hambre).

The intermediate evaluation of CENAN

The goal of this transversal study was to assess the impact of the intervention with MMNP after six months on levels of anemia in the children under 36 months of age in DIRESA Apurimac and on the knowledge and practices of the actors involved, identifying the factors that limit or facilitate the outcomes of the intervention and comparing pre and post intervention levels of these aspects. This study was done in Apurimac I which has a population of 13 387 children 6 months to 3 years old. A multistage probability sampling was conducted with 728 children that were eligible for the study. Among the results, it was observed that the intervention reached more than 90% of the target population. The average number of sachets received by the mother was 70.2 in urban areas and 76.7 in rural areas, although the average of consumed sachets was slightly lower (Table 1). It should be noted that these averages include children who have received more than 90 sachets. While the MMNP reached most children (94%) at least once, only 57% received the full dose and 47% received the full dose in a consecutive manner. In addition, as shown in Table 1, only a quarter of the children living in urban and a third in rural areas consumed the supplement completely.
Table 1. Characteristics of the consumption of the multi-micronutrient powder supplement

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Urban area</th>
<th>Rural area</th>
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<tbody>
<tr>
<td></td>
<td>%</td>
<td>CI 95 %</td>
</tr>
<tr>
<td>The average of MMN supplement sachets consumed by children (This data includes even children who consumed more than 90 sachets)</td>
<td>60.9*</td>
<td>56.8 – 64.9</td>
</tr>
<tr>
<td>Children over 1 year who consumed the MMN supplementation in full (90 or more sachets)</td>
<td>25.0</td>
<td>18.4 – 33.0</td>
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</table>

* Corresponds to the average of sachets  
Source: Intermediate Evaluation, CENAN

The reasons for the low overall compliance are quite varied, as shown in Figure 3.

Figure 3. Reasons for dropping out of receiving MMN (728 children)

As for the results of the measurement of hemoglobin in children after six months of intervention, the baseline was estimated at an average of 10.93 g/dl of hemoglobin. In the intermediate evaluation this number was estimated at 10.89 g/dl, numbers that do not differ in a statistically
significant way. The same applies to the prevalence of anemia before and after the intervention, as shown in Table 2.

**Table 2. Prevalence of anemia before and after intervention**

<table>
<thead>
<tr>
<th></th>
<th>Estimation</th>
<th>Confidence interval 95%</th>
<th>Coefficient of variation</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Inferior</td>
<td>Superior</td>
</tr>
<tr>
<td>ANEMIA – PRE INT</td>
<td>49,60%</td>
<td>45,40%</td>
<td>53,80%</td>
</tr>
<tr>
<td>ANEMIA – POST INT</td>
<td>51,30%</td>
<td>46,10%</td>
<td>56,40%</td>
</tr>
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</table>

Source: Intermediate Evaluation, CENAN

The comparative analysis of the baseline and the intermediate evaluation do not show statistically significant differences in the mean values of hemoglobin nor the prevalence of anemia. However, in the group of children who complied with more than 75% of indicated doses an effect is seen in the reduction of the number of children with anemia, as can be seen in the Figure 4.

**Figure 4. Prevalence of Anemia according to MMN consumption**

Source: Intermediate Evaluation, CENAN

**Evaluation of Sentinel Centers**

The Directorate General of Epidemiology conducts monitoring of "sentinel" health centers, i.e. that meet the requirements of having a physician, an epidemiologist, a laboratory for hematological testing, internet, and access to collect information, among other requirements, and therefore can be considered a highly controlled context, in which the results obtained in this
evaluation are not representative of all health facilities intervened (no population base). Among the conducted evaluations was the intervention with MMNP by MINSA (Ministry of Health). It is worth noting that these results are not comparable to those found by the CENAN, which used a representative sample. The aim of this study was to determine the impact of supplementation with MMNP in a cohort of children of 6 to 35 months in Andahuayas, Huancavelica and Ayacucho, on the prevention and control of anemia.

Among the most salient results is that, in total, in the 831 evaluated patients the median hemoglobin increased from 10.5 mg/dl to 11 mg/dl. The percentage of anemic children, in turn, decreased from 66.8% to 48.7% after 6 months of intervention. Another important finding is that the decline in the rate of anemia was related to adherence to the program.

**Evaluation of Action against Hunger**

This evaluation conducted by a non-governmental organization, as opposed to the other governamental ones, focuses on analyzing the coverage of the intervention with MMNP in a the Vilcas Huaman province in Ayacucho, one of the poorest regions. This procedure measured the educational and distribution components, and not the variations in hematological parameters.

It was observed that 55% of the target population was covered by the intervention. Among the covered group, the evaluation shows a marked reduction in the receiving of supplementation during the course of the intervention: 21% of the mothers received no training, 88% had not received educational material about the intervention, and 81% had not heard any radio broadcast message on the intervention. Additionally, only 11% remembered how often the MMNP should be taken and 78% reported not being visited for a follow-up of the intervention.
THE PROBLEM

By what is observed in these 3 evaluations, it can be concluded that the pilot intervention with MMNP by the government to reduce anemia in children 3 to 35 months presents elements that deserve consideration.

- CENAN's intermediate evaluation shows that in normal conditions only 47% received the recommended doses in a complete and consistent manner, although the intervention had a coverage of over 90%, and only 25% of the children ingested the full dose. The intervention failed to reduce the prevalence of anemia as a whole. However, the adherent group did show a fall in the prevalence of anemia.
- Under more controlled conditions (DGE's sentinel evaluation) the intervention reduced the prevalence of anemia significantly in the children who participated.
- The educational and communicational component has virtually not been implemented and its impact on attitudes and knowledge of the population about micronutrients is almost zero (Action against Hunger's evaluation).

This analysis shows that the effectiveness of the intervention on reducing rates of anemia depends basically on the level of adhesion of the population to MMNP recommended doses, which in turn is determined by multiple factors. Due to the important complexity of the problem, it was decided, in agreement with the authorities of the Ministry of Health (MINSA), to address this issue:

HOW TO IMPROVE THE ADHERENCE OF THE POPULATION TO MMNP?

It is noteworthy that a proper distribution and provision of MMNP in health facilities is an essential aspect to ensuring compliance with the recommendation. However, these are aspects of logistics, dependent on organizational factors, the availability of resources, and political will. The continuation of the development of the evidence brief for policy (or policy brief) from now on will be based on the search for options to improve the aspect of adhesion.

THE QUESTION OF INVESTIGATION

What are the best strategies to improve the adherence to multi-micronutrient powder in order to reduce the prevalence of anemia in children in Peru?
A LOOK ON THE MAIN, CLOSER ACTORS 3: THE SECOND MEETING WITH THE REPRESENTATIVES OF THE INTEGRAL CARE OF THE MINISTRY OF HEALTH

Once the results of evaluations of the pilot were analyzed, it was clear that the distribution and adherence components should be improved.

The team in charge of MMNP, formed by a nutritionist and a registered nurse, discussed the importance of communication interventions. Examples were given of marketing strategies that can be used to convey messages better, as for example toys as incentives to promote adherence ("the strong bear") or novels with positive messages ("iron women") that have worked in some districts of the country, but unfortunately are not systematized or published experiences.

It is worth highlighting the fact that the technical team, interested in improving the adherence to the intervention with MMNP, asked the EVIPNet Peru team certain level of detail as to the description of the options for improving adherence; for example, how many educational sessions are required, what kind of communication strategies are most appropriate, and so on.
THE OPTIONS

To improve adherence to drug therapies, even when they are to be administered for short periods, patients must be provided with information about the importance of compliance with the treatment\(^\text{15}\). Nevertheless, when dealing with prolonged therapy, interventions to enhance adherence are more complex and include simplifying drug schemes, counseling sessions, reminder systems, supervision and incentives for the health personnel, family therapy, psychological therapy, crisis intervention, and follow-up by telephone\(^\text{15}\). The current trend is to combine more than one of these strategies to reinforce the message and to increase the likelihood of having an impact on the intervention population\(^\text{15}\).

Based on the results of the evaluations of the intervention with MMNP in our country, and considering the characteristics of the communities targeted for intervention and the opinions of the authorities responsible for the intervention with micronutrients at national level, we have selected as priority options to be implemented to strengthen adherence to MMNP: educational and communicational interventions, community participation, and strengthening the monitoring and supervision have been selected as priority options to be implemented to strengthen the adherence to MMNP.

These educational and communication interventions were considered in the pilot plan for the intervention with MMNP, however they were not projected or budgeted, thus not implemented as initially planned, and the activities carried out were very scarce.

Following the introduction of the options, we analyze the evidence extracted from scientific literature about each of these options.
Option 1: Educational and communicational intervention.

Educational interventions may be given at three levels: at the level of health personnel in charge of primary care, of parents and caregivers of children, and for the whole community through mass media. Following is the evidence found on the adequateness of these strategies.

Education of parents

Evidence indicates that parents with less knowledge on health issues have behavior that is less advantageous for their children\textsuperscript{16}. A systematic review found that children with parents who have low knowledge have a worse prognosis in the treatment of diseases as well as the in use of health services\textsuperscript{16}. This concept suggests that educational interventions should have the opposite effect, and indeed some studies have shown it.

No systematic reviews were found that synthesize studies of effectiveness of educational interventions in the specific theme of the implementation of micronutrient powder. However, there is a systematic review about the promotion of exclusive breastfeeding with education for the mothers\textsuperscript{17}. This is in meaningful for us because the intervention group (the mothers of young children) is the same as would be for the intervention with MMNP. An evaluation was made on the educational sessions that reviewed the benefits, principles and myths of breastfeeding and also solutions to common problems in sessions of 30 to 90 minutes, and were then complemented with follow-up by telephone or in-person visit to home. It is noteworthy that the written material was not effective in increasing initiation or duration of breastfeeding and, surprisingly, it could even be harmful\textsuperscript{17}.

Education of health personnel

There is evidence that the training of health personnel has a beneficial effect not only on their behavior, but also on the attitudes of the children's parents, which ultimately have a positive impact on children. On this matter, no systematic reviews were found, but instead individual studies that can provide relevant information. An intervention consisting of 20 hours of training in nutrition counseling to the medical staff of 28 health centers resulted that the mothers in the intervention group remembered more often the nutritional instructions and selected better foods to prepare, and that the children had a greater weight gain and increased consumption of energy and zinc in their diet\textsuperscript{18}. An analysis of the process in which the change occurred in the parents' behavior showed that the knowledge and tools learned in the training were used in the daily clinical practice by doctors. They gave advice more frequently, worked harder and using better
communication than physicians who did not participate in the training course\textsuperscript{19}. Similar results were reported in a study assessing the impact on the linear growth of Peruvian children after an educational intervention for health personnel, which was improved by a better selection of food by parents\textsuperscript{20}.

**Community information**

The use of the media has become a strategy of health promotion (WHO 1986 Ottawa Charter for Health Promotion). There is a tendency to integrate the media into a shared agenda in order to communicate health messages to the public on issues relating to prevention, risk reduction and drug information\textsuperscript{21}. As for health interventions directed to children, a systematic review about it showed a positive association between the communication campaigns and the use of health services and programs for children and adult population\textsuperscript{21}, particularly in two studies that found that the use of mass media campaign favored the adherence to immunizations\textsuperscript{22, 23}. 

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### Table 3. Summary of key findings from a systematic review and/or primary studies relevant to Option 1: educational and communicational component

<table>
<thead>
<tr>
<th>Category of findings</th>
<th>Key findings</th>
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| Benefits             | Systematic reviews:  
  - The use of educational interventions (learning sessions) had a positive effect on breastfeeding while the mere distribution of instructional materials or brochures did not lead to improvement, or had a negative effect\(^7\).  
  - When comparing strategies to improve immunization coverage it was found that the interventions targeting the community (communication campaigns) and the health service were the most effective. Particularly, the educational sessions with discussions (based on evidence) in the community and knowledge transfer for the user seems to be better than the traditional sessions at the health centers\(^24\).  
  - The use of mass media can influence positively in the use of health services and programs\(^21\).  

Individual Studies:  
- Improved nutrition and growth, with only educational intervention in poor suburban areas of in a Peruvian city\(^20\).  
- Evidence of transfer of knowledge of health workers to beneficiaries with improved adherence and effectiveness of the intervention (Pelto 2003).  
- Adherence close to 90% in three months of supplementation with communication strategies and empowerment with simple key messages and use of multiple communication strategies in a Peruvian city\(^25\).  
- Communication strategies should be integrated in all staff involved in the intervention, in addition to the beneficiary\(^25\). |

<table>
<thead>
<tr>
<th>Potential harm</th>
<th>None detected.</th>
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| Use of resources, costs and / or cost-effectiveness | **Education of parents:** Use of financial resources in educational material, posters, T-shirts, as well as the time of the health care personnel and the parents themselves.  
**Education of health personnel:** The cost for training and for working hours.  
**Mass media campaigns:** The costs for radio and television are high, but pro-bono time is available (e.g. interviews, sympathetic journalists.) |
| Uncertainty regarding the benefits and potential harms (so that monitoring and evaluation could be guaranteed if these options are implemented) | - Community clinical trials on educational and communicational components have shown efficacy but for other interventions such as breastfeeding and immunizations. The effectiveness, however, has not been studied enough for the age group and the intervention to be applied. Additionally, it has not been possible to find the degree of detail required by the Ministry of Health on how these interventions should be implemented.  
- The possibility exists that illiterate or barely literate population have major difficulties in understanding information and educational content. |
<table>
<thead>
<tr>
<th>Key elements of the policy option if proved elsewhere</th>
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<tbody>
<tr>
<td>• Other interventions MINSA (eg &quot;fortified porridge&quot;) contain iron and could increase the dose, although the coverage of the distribution of these preparations is low.</td>
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<th>Views and experiences of stakeholders</th>
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<tr>
<td>• Messages should be simple and in language appropriate to the intervention community. The use of illustrations allows a better understanding of the instructions.</td>
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<tr>
<td>• The staff responsible for distributing and monitoring the intervention must be properly sensitized and receive training sessions on the importance of the intervention</td>
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<td>• Multiple communication channels should be used.</td>
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In Peru there is experience with the implementation of educational strategy in two cities, in areas of poverty. The intervention on educational staff was effective (Penny et al), and a micronutrient supplementation intervention achieved a high adherence (Gross et al). However, in the second case, the collaboration of the government, was limited, despite the initial commitment, and a Non Governmental Organization (NGO) had to take much of the responsibility for the intervention. In the intermediate evaluation of the implementation of multi-micronutrient powder fortification it was found that the implementation of the education and communication component was not carried out properly.
Option 2: Community participation through community health workers and community-based organizations

The participation of the community should be an important feature of health programs. Likewise, community health workers (CHWs) should be integrated into the programs because they are an effective channel of communication within the community.\(^{26}\)

**Community health workers**

Lewis et al did a systematic review of 82 clinical trials on CHW participation for improve the health of mothers and infants and infectious disease management in primary care, showing a moderate quality of evidence of effectiveness in increasing the immunization rate in children, increasing breastfeeding, and improving the cure rate of tuberculosis, and also a low quality of evidence in reducing child morbidity and children and neonatal mortality.\(^{27}\)

The success of CHW participation is complex and requires the use of appropriate strategies. Lehaman and Sanders conducted a systematic review including gray literature and concluded that the CHW can improve the access and the coverage in the community to basic health services, specifically in the field of child health. However no specific impact on health indicators was found, and certain characteristics must be fulfilled in order to gain positivity and avoid hindering the development of health activities.\(^{28}\) In conclusion, this review shows that in resource-constrained scenarios, the use of CHW is not cheap or easy to implement but it is a good investment because in some of these settings care is not provided by other means to the most remote and poor population.\(^{29}\)

In the evaluation of the "Good Start Initiative" (Iniciativa Buen Inicio ), a strategy implemented to combat deficiency of iron and vitamin A in children under three years in Peru, it was observed that in order to reach an effect on every community it was necessary to train an optimal number of community health staff.\(^{34}\) In these communities, an average of one community health promoter for every 20 households and a family counselor for every 10 families is appropriate. No results should be expected from a program that is implemented without a strong involvement of community members.\(^{34}\)

**Community-based organizations**

Collaboration of the community through the existing networks has been used in iron supplementation programs in order to reduce the prevalence of anemia in women of
childbearing age. In Vietnam, it was important to mobilize existing community structures to the success of a preventive program with supplementation of iron-folic acid. Beginning with the Collaborative Women's Union, a community committee respected by the people, communication channels, education, and distribution were established, improving knowledge, attitude and adherence to supplementation with these compounds. In Cambodia a pilot plan was conducted to combat anemia caused by iron deficiency through a process of promoting the use of communication channels within the community, using peer collaboration, and as a result adherence and knowledge about supplementation were improved.

In Peru, community participation was vital to a program of multi-micronutrient supplementation that included women 12 to 44 years old and children under five years. For this purpose they created "supplementation committees" comprising members of the community that had the mission to inform beneficiaries about the importance of micronutrients, explain about the opportunity to register for the program, distribute micronutrient supplements and educational materials, and monitor the program. The program was successful in improving knowledge about the micronutrient content in food, adherence and acceptability of supplementation.

An intervention with MMNP for children was conducted in Ventanilla Peru. A system for monitoring and community surveillance was established and it was carried out by Community Health Agents who were volunteering mothers in the community, called “Madres Guía.” They were responsible for distributing the sachets of sprinkles and also for performing the control of consumption. Distribution was made weekly by these "Madres Guía" who delivered the product each week controlling it through verification of use and upon delivery of the empty sachets. The intervention was effective in reducing the rate of anemia in children in the intervention, but it must be taken into account that other interventions, such as de-worming, etc. were associated with it.
Table 4. Summary of key findings from systematic reviews and/or primary studies relevant to Option 2: Community participation

<table>
<thead>
<tr>
<th>Category of findings</th>
<th>Key findings</th>
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| Benefits             | Systematic reviews on community health workers:  
                       - CHWs can improve the access to and coverage of basic health services, especially in childhood\(^{28}\).  
                       - They can improve the coverage of immunization, breastfeeding and control of tuberculosis\(^{27}\).  
                       - Their participation is still complex and can require investing time in selection, training and support\(^{28, 29}\).  
                       - The key is to plan a strategy of incentives in order to maintain their collaboration with the programme. Non-financial incentives are crucial (includes support, training, recognition within the community supervision). The participation of them or their representatives in the process of selection, training and supervision is important\(^{35}\).  
                       Primary Studies:  
                       - The community participation is a transcendental element in various public health programs\(^{30}\).  
                       - In low income countries, community participation was crucial to the success of programs targeting women of reproductive age\(^{30}\).  
                       - The involvement of community committees establishes a means of communication for transmitting key messages to the community. Additionally it can be a mechanism for distribution of supplementation in households with difficult access to health centers\(^{32}\).  
| Potential harm        | Messages should be clear and indications precise as unintentional errors of administration or inadequate dosing may have negative consequences. |
| Use of resources, costs and / or cost-effectiveness | The use of human resources to train community members who will participate in the program implementation is required. It is also advisable to establish an incentive program to the CHWs that may require material resources. |
| Uncertainty regarding the benefits and potential harms (so that monitoring and evaluation could be guaranteed if these options are implemented) | We found no systematic reviews that evaluate the participation of the community (such as CHW or community-based organizations) in public health programs using MMNP. However, there are several reports of programs based on communities in low-income countries where saving of resources was observed. |
| Key elements of the policy option if proved elsewhere | The people involved should ideally share background with the beneficiaries and be respected members within the community with some kind of leadership\(^{30}\). These individuals should receive |
adequate training in order to serve as channels for disseminating messages that the program aims transmit.  
- Individuals can be recruited, but several programs preferred to work with existing community committees, which joined the programs or were formed specifically for the intervention.  
- In Peru, the distribution of MMNP was carried out in a poor district with the support of "volunteer mothers" who were responsible for the distribution and monitoring of the intervention; being effective in reducing the prevalence of anemia. In the pilot plan this intervention has been considered but not implemented. One choice of work that can be evaluated is the participation of municipalities and rural organizations of "commoners" in order to promote adherence to the intervention.  
- A study in Kenya which showed how the monitoring of a MMNP distribution program through a community distribution system was useful to correct problems in its implementation.
Option 3: Monitoring and supervision

In small and remote settlements, basic health care is often provided by health personnel of technical and non-professional level, working alone or in small teams and who are exposed to problems of lack of communication and isolation from the rest of the health system. Monitoring activities help to reconnect these two elements.

There is a systematic review of the supervisions of management and its effect on primary health care, excluding studies in which monitoring have only a clinical and educational purpose. It was observed that the supervision had positive effects in the practice of the health care provider, as well as their knowledge, when compared with no intervention, but there is insufficient evidence to recommend any particular form of implementation of supervision, and it is further suggested that the more intense supervision (with a higher frequency of visits) is not necessarily the most beneficial.

The health policy makers can consider a wide range of options to ensure the link between the peripheral health services and the central unit in balance with cost and feasibility. Controlling and punitive visions must be abandoned in favor of supporting supervision.

Community organizations and CHW can be counted on to collaborate with the monitoring of a program. Thus, in the intervention studied by Gross et al, the monitoring of adherence to the use of MMNP was given through the "facilitators" who kept track of the number of supplements used.

Finally, it should be mentioned that the implementation of supervisory activities is not easy to perform. Supervisors need transportation and basic management tools. Supervision can be costly both in time and resources.
<table>
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<th>Category of findings</th>
<th>Key findings</th>
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| Benefits                                                 | Systematic reviews:  
• The supervision has a positive effect in the practice and knowledge of health care providers. There is no evidence to recommend any specific arrangement of supervision \(^{38}\).  
• In developing countries, there is some evidence of benefit in health care and performance, but the studies are methodologically limited and the follow-up is short \(^{42}\).  
• Supportive supervision should be considered instead of a controlling or punitive supervision \(^{39}\).  

Primary Studies:  
• Monitoring is important to prevent the misuse of supplementation and the frustration by the user. Continuous monitoring allows to detect system failures and to constantly motivate the beneficiary in order to avoid the depletion of the program \(^{32}\).  
• Process evaluations allow the determination of for whom and in what context the program worked or did not \(^{30}\). |
| Potential harm                                           | • None detected.                                                                                                                                                                                              |
| Use of resources, costs and / or cost-effectiveness       | Human and financial resources are required to carry out supervisory visits and monitoring activities.                                                                                                         |
| Uncertainty regarding the benefits and potential harms (so that monitoring and evaluation could be guaranteed if these options are implemented) | • It has not been evaluated which monitoring or evaluation method is most cost effective. The role of monitoring within the micronutrient supplementation program is an important component for the detection of system failures and rapid decision-making in all interventions. This may benefit the adherence to the program. |
| Key elements of the policy option if proved elsewhere     | • Working together with people from the community can be an effective strategy for monitoring.  
• It is possible to reduce costs in the evaluation through probabilistic sampling. |
| Views and experiences of the stakeholders                | It is important to work on monitoring the use of supplementation at home in order to verify adherence and correct use.                                                                                      |
Equity aspects of the three options

As mentioned previously, the problem of childhood anemia is closely related to poverty (Figure 2) and though it even exists in the superior quintiles, it has much higher prevalence in the inferior ones. Peru is one of the countries with major regional inequity and the income distribution is quite unequal\textsuperscript{48}. Furthermore, multiculturalism and geographical differences in the regions make access to health also widely variable. Addressing the problem of anemia in remote and poor areas of the country is a way of working to decrease inequity, as decreasing rates of anemia helps improve children's living conditions in the future. However, it is necessary to take into account that any of the options to be implemented will encounter more barriers, particularly economic ones, in the most remote areas. For instance, administration of one dose of vaccine against hepatitis B can cost approximately $12 U.S. dollars in the capital, while the same vaccine costs $300 when administered to a child native in the area of Pastaza River in the Peruvian Amazon. This proportion would not be the same with MMNP because it does not imply cold chain or specialized personnel, but it is nevertheless necessary to consider that the options presented in this document, both educational and communication strategies, as well as the incorporation of community workers in health and the strengthening of the surveillance and monitoring will be more difficult to implement in remote areas. Differences in language and culture between the zones undergoing interventions, for instance, could infer a barrier for the communication between the population and the health care personnel. Another aspect to be taken into account are gender considerations, as there are men who do not accept that their partners participate as CHW and in some cases do not even allow them to attend health centers. On the other hand, these areas that are remote, with populations mainly in the low socioeconomic quintiles are precisely where it will be more important to combat grave anemia, and where the intervention will be more cost-effective for the high prevalence of the condition to be addressed\textsuperscript{49,50}.

These considerations acquire greater relevance in a framework in which the main motivation of the current, recently elected government is the "social inclusion of all." The social inclusion of children should be the start of this approach and an anemia free childhood is one of the best achievements to improve their cognitive development.
## Analysis of barriers and considerations for implementation

<table>
<thead>
<tr>
<th>Levels</th>
<th>Option 1: Educational interventions aimed at: a) health personnel awareness on the importance of using MMNP and knowledge of nutrition in childhood b). sensitization of the child's caregivers about the risks of anemia in childhood and importance of using MMNP, training in the use of MMNP, and inappropriate behavior modification c) use of media for the transmission of messages.</th>
<th>Option 2: Working together with community organizations and/or community health workers. Integration of the community to the program of MMNP to avoid them seeing it as an intervention alien to the population and rather a service to which they are entitled for the good of their community.</th>
<th>Option 3: Supervision of activities in health centers, especially those located in rural and remote areas, correcting defects found in order to encourage the proper use and highlight importance of MMNP</th>
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</table>
| Patient / individual | - Culturally rooted beliefs about how to feed children and food preparation in impoverished areas.  
- Reluctance in patriarchal communities that women go to health centers run by men. Mothers’ spouses should be involved in the training.  
- Interculturalism. Language limitations in Quechua-speaking areas.  
- Perceptions: mothers think that MMNP have a bad taste or change the flavor of foods. In addition to side effects (abdominal pain, constipation) can be a major constraint. | - Gender inequality for using women as community workers (men in many native communities do not accept women's participation in these labors).  
- Community involvement is related to perceived importance of the problem, so first it must be worked on the awareness of the impact of anemia. | - No barriers identified |
| Health care providers | - Multiple tasks and functions make that health staff does not want to spend time to be trained nor train families in these issues and give priority to healthcare activities. High turnover of health personnel in rural areas makes that the training should be given periodically | - High turnover of health personnel does not permit establishing a sustained relationship with the community.  
- Cultural differences between community and health providers are often significant. A critical view of the latter should be | There is currently a vision of supervision as a punitive activity. Thus there is a tendency to "embellish" the results and not asking for help and support, rather than exposing the difficulties.  
- Supervisors in the |
<table>
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<tr>
<th>System</th>
<th>There are budgetary constraints. A major effort should be made to begin the work from the design of educational campaigns, the material for health personnel, materials for families, plan the strategy, etc. The General Directorate of Health Promotion and the General Office of Communications Ministry of Health could assume responsibility, for the experiences in other diseases and ad hoc working team.</th>
<th>Not just for MMNP but for the majority of health interventions, the role of CHWs is not well defined in the Peruvian system, as well as the remuneration to be received and the mechanisms of sustainability of its long-term involvement.</th>
<th>- Constraints of budget and human resources. - Lack of commitment of health authorities with the program.</th>
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<tr>
<td>Organizational</td>
<td>The need for logistical support for educational sessions involves a cost, as well as the mobilization of training personnel to users and health personnel. It is necessary to identify trained personnel to design appropriate educational messages for use in the media and to be accepted in rural areas (multiculturalism). There is a major constraint for extramural activities that would be supported by community workers; as it is not sustainable to provide incentives to CHWs. A organizational chart should be created that is related to the roles and responsibilities of the community within the intervention. Assignment of personnel engaged in supervision. Awareness of supervisory personnel since these activities must have a supporting character and not merely punitive, they must also understand various aspects of the program and not a &quot;checklist&quot;. The geographic isolation of communities should be taken into account.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cultural barriers between health providers and users (e.g. language) avoided in its community outreach.</td>
<td>- There is lack of supervisors.</td>
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</table>

**Economic considerations**

Sharieff et al estimated three different measures of cost of MNP distribution program: cost per death avoided (effect of zinc supplementation in reducing the longitudinal prevalence of...
diarrhea), the cost of "disability-adjusted life year" (DALY) avoided, and the gain in revenue due to increased cognitive ability per dollar invested. Based on data from low-income country like Pakistan with an income per capita of $ 417, a high rate of infant mortality, a high prevalence of anemia (93%) and a cost per child of $ 1.20 including production and distribution; the cost per death avoided was estimated at $ 406 ($ 273 - $ 324), per DALY gained $ 12.2 ($ 8 - $ 97) and the increase in profit for every dollar spent on the program at $ 37 ($ 18 - $ 15). These figures were comparable with other public health programs (the cost per death avoided for supplementation of vitamin A was $ 67.2 and $ 327 in the Philippines and Nepal respectively, and $ 115-919 for breastfeeding)\textsuperscript{51}.

In Ecuador, an estimation was made of the relationship between costs and benefits prior to the implementation of MMNP supplementation program (Chris Paz). The cost of each sachet of Chris Paz range from $ 0.024 (India) and $ 0.040 (Bolivia) depending on the volume and location of production, to which are added the costs of training to the community and personnel as well as the distribution of the MMNP. Two measures of economic evaluation were estimated: the Net Present Value (NPV) and Internal Rate of Return (IRR). The former could be understood as the profit of the program we will have above what we would have had for the interest rate on a financial investment, and the second indicator would be the interest rate in that the NPV is zero i.e. the interest rate on an investment we should get to have the same profit than with the program to be implemented. It was calculated that for the period 2010-2014, starting with population coverage of 275,000 to 926 019 on the fifth year of the program a NPV would cost $ 2,334,846 and an IRR of 56%. These figures show that in such a country this intervention is cost effective even without the ability to produce the product within the country\textsuperscript{51}.

In relation to costs, it is estimated that in the year 2012, in which the program coverage will increase in all regions, the acquisition of MMNPs will cost around US$7,500,000, while US$500,000 will be invested in the educational and communications component and US$140,000 in monitoring and evaluation.

In Peru, both the economy and the costs are similar, so we believe that such intervention would be cost-effective in our context, although the ideal would be develop local studies.

It should be noted that the Ministry of Economy and Finance has agreed to fund the scale-up of the intervention to 11 additional regions of the country. Currently this funding is scheduled to cover the costs of MMNP and their distribution. However, the education and communication campaigns raised in this document should also have adequate funding sources to be implemented.
Finally, it is important to mention that there the National Institutes of Health is willing to undertake national production of MMNPs in order to reduce costs and increase availability of data for distribution on a large scale. It is ready to conduct feasibility studies and seek financing to start production.

**IDENTIFIED KNOWLEDGE GAPS**

It is recommended to conduct individual research in the following topics related to knowledge gaps identified during the development process "policy brief":

1) Prevalence of deficiency of zinc and vitamin A in children under 3 years in Peru.

2) Causes of anemia among children in Peru

3) Systematic reviews on effectiveness of educational and communication strategies to improve compliance with the MMNP

4) Systematic reviews on the effectiveness of the participation of community health workers in implementing the MMNP

5) Economic evaluations on the cost-effectiveness of implementing MMNP in large-scale in the country.

6) Considerations on distribution (delivery arrangements), including feasibility study of producing MMNP in Peru at a low cost.
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52. Minesterio de Inclusion Economica y Social de Ecuador

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