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REVIEW ARTICLE

The pediatrician's role in the first thousand days of the child: the pursuit of healthy nutrition and development☆

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Abstract
Objectives: To describe the concept of the first 1000 days, its importance for health, and actions to be implemented, particularly by pediatricians, in order to attain healthy nutrition and development.
Sources: A nonsystematic review was carried out in the SciELO, LILACS, MEDLINE, Scopus, and Web of Science databases, encompassing the last decade, using the terms 1000 days, child nutrition, child development, childhood, and child. A non-systematic search was performed online for organizations that use the 1000-day concept and give recommendations on children's health.
Summary of the findings: The first 1000 days range from conception to the end of the second year of life. It represents an important period to implement interventions to ensure healthy nutrition and development, which will bring benefits throughout life. Children should receive adequate nutrition, through proper prenatal diet, exclusive breastfeeding for the first 6 months, addition of adequate complementary foods, and continued breastfeeding up to 2 years of life. Given the condition of absolute dependence on an adult's care, it is crucial to establish an enabling and friendly environment, necessary for the development of strong bonds with caregivers, laying the groundwork for a full and healthy development.

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Conclusions: The pediatrician, together with other professionals, can act by promoting actions emphasizing the concept of the first 1000 days to ensure healthy nutrition and development. Focusing on actions in this period may increase the child's chance of having a healthy and productive life in the future, strengthening family and community ties, helping to break the intergenerational cycle of poverty.

PALAVRAS-CHAVE
Nutrição infantil;
Desenvolvimento infantil;
Saúde da criança;
Saúde materno-infantil

Atuação do pediatra nos primeiros mil dias da criança: a busca pela nutrição e desenvolvimento saudáveis

Resumo

Objetivos: descrever o conceito dos primeiros mil dias, sua importância para a saúde, e ações a serem implementadas, em especial pelos pediatras, para que a criança alcance nutrição e desenvolvimento saudáveis.
Fonte dos dados: Revisão não sistemática nas bases SciELO, LILACS, MEDLINE, Scopus e Web of Science nos últimos dez anos utilizando os termos 1000 dias, nutrição infantil, desenvolvimento infantil, infância, criança. Busca não sistemática na Internet de organizações que adotam o conceito dos 1000 Dias e emitem recomendações sobre a saúde da criança.
Síntese dos dados: Os primeiros mil dias vão da concepção até o final do segundo ano de vida. É um importante período para intervenções que garantam nutrição e desenvolvimento saudáveis, que trarão benefícios em todo o ciclo de vida. As crianças devem receber alimentação adequada, por meio de nutrição pré-natal adequada, aleitamento materno exclusivo nos primeiros 6 meses, adição de alimentos complementares adequados e continuação da amamentação até os 2 anos. Face à condição de dependência absoluta de cuidados de um adulto, é fundamental que tenham um ambiente propicio e acolhedor necessário para desenvolver laços fortes com seus cuidadores, lançando as bases para um desenvolvimento pleno e saudável.
Conclusões: O pediatra, junto com outros profissionais, pode atuar promovendo ações com ênfase no conceito dos primeiros mil dias que garantam a nutrição e o desenvolvimento saudáveis da criança. Focalizar ações neste período poderá aumentar as chances da criança ter uma vida saudável e produtiva no futuro, fortalecendo famílias e comunidades, contribuindo para quebrar ciclo intergeracional da pobreza.

Introduction

In 2008, *The Lancet*[1] published a series on maternal and child malnutrition, which identified the need to focus on the period from conception to the end of the child's second year – the first thousand days, in which good nutrition and healthy growth would have benefits that would last for a lifetime. This series also drew attention to the need to prioritize national nutrition programs to encourage and strengthen the integration between health programs, among other recommendations. Since the publication of this series, the concept of the first thousand days has been adopted by agencies and international non-governmental organizations,[2,3] used as reference by researchers in the field of health,[4] and mentioned in scientific articles.[5]

In this sense, this article aims to describe and discuss the concept of the first thousand days and its importance for the health of children and adults, and to identify the actions to be implemented during this period, particularly by pediatricians, in order to attain healthy nutrition and development.

Data source

A non-systematic review was carried out in the MEDLINE, SciELO, LILACS, EMBASE, Scopus, and Web of Science databases, encompassing a minimum period of 10 years, using the terms ''1000 days,'' ''child nutrition,'' ''child development,'' ''childhood,'' and ''child.'' A search was also conducted in Google Scholar publications, as well as in the website of organizations that adopt the concept of 1000 days and give recommendations on child's health. The term ''1000 days'' is not included in any of the searched databases as a descriptor and, thus, the search is rather limited when this term is used alone. However, when descriptors such as ''child nutrition'' are combined with ''1000 days,'' it is possible to identify articles related to this subject. Using this strategy, it was feasible to increase the number of articles to be assessed. For instance, the search in the MEDLINE database using the terms ''child nutrition'' and ''1000 days'' resulted in 122 articles. For ''child development'' and ''1000 days,'' 108 articles were identified. The articles found in the surveyed databases were evaluated regarding their association with the topic

of the first thousand days and their validity and, where applicable, were used in the preparation of this review.

Summary of the findings and discussion

The importance of the first thousand days for human health

The concept of the first thousand days arises, as previously mentioned, from the evidence presented in the 2008 *Lancet* series,[1] which identifies the first thousand days of life – the period beginning after conception – as a window of opportunity to improve individuals' health, as well as providing a set of highly effective interventions to reduce malnutrition, and proposes the prioritization of resource allocation to a group of most affected countries. Thus, the concept of the first thousand days emerges, based on scientific evidence, as a public health strategy to be implemented by countries or locations. Although it identifies and proposes specific interventions, it was not designed as a proposal to be carried out only at the individual or family level. However, following the recommendations will certainly benefit the child at an individual level, whether or not there is a government policy in this regard.

Five years after the 2008 series on maternal and child malnutrition, *The Lancet* launched a new series aimed at reassessing the situation of maternal and child malnutrition and assessing the growing problems of overweight and obesity in women and children, and their consequences.[6] In several countries classified as low- and middle-income, there was the occurrence of the double burden of malnutrition – the presence of chronic malnutrition and deficiency of essential nutrients coexisting with the growing problem of obesity. Additionally, this new series features a novel conceptual framework that depicts the means to attain optimal fetal and child growth and development.[7] This new framework, shown below, reinforces the importance of proper development of the fetus and child associated with good nutrition, which would bring benefits throughout the life cycle of the human being.

The importance of nutrition in child development has been accepted by most researchers and organizations working on behalf of children. However, there is evidence that small children cannot reach their full potential alone, which depends on good health and nutrition.[8] Children who have access to an adequate diet sometimes fail to adequately eat and grow due to the lack of stimulation when they are small.[9] Stimulation also plays an important role in the brain formation process, and developmental delays before 6 years of age are difficult to compensate.[7] A study in the neuroscience field has shown that synapses develop rapidly in the early years of life, and constitute the basis of cognitive and emotional function throughout life.[10] Additionally, there is strong evidence that early childhood development programs, aimed at health, nutrition, and early stimulation, instead of only health and nutrition, bring greater benefits in terms of child health and overall development.[11,12] Shonkoff[13] warns that the early childhood period must combine cognitive–linguistic development with greater attention to preventing, reducing, or mitigating significant adverse consequences on the developing brain.

Therefore, both proper nutrition, especially from conception to 2 years of age, and early stimulation in the first 5 years of life, play a critical role in the brain formation and development process, decisively contributing to the child's full development.[14] In this sense, the attention that should be given to early childhood in order to attain a balanced and healthy development becomes crucial for the health of children and adults.

From the above, it is clear that in the design and conceptualization of the first thousand days, two aspects are included and should be prioritized: healthy nutrition and development. These two complementary perspectives result in specific approaches by some international groups and agencies that emphasize one aspect or another. Among these groups are the ''1000 Days''[3] and the ''Center on the Developing Child at Harvard University''.[15] But there is no disagreement about the importance of implementing actions and strategies prioritizing the period comprising the first thousand days.

Causal explanatory model for optimal nutrition and fetal and child development

The new conceptual framework presented by the 2013 *Lancet* series (Fig. 1), which is a reference for all the article series, shows the means to achieve optimal fetal and child growth and development.[6] It describes the dietary, behavioral, and health determinants that lead to optimal nutrition, growth, and development, and how they are affected by the underlying food security, caregivers' resources, and environmental conditions, which in turn are shaped by economic and social conditions, national, and global contexts.[6] After adequate development and nutrition are achieved, the following is expected to occur: (1) decreased mortality and morbidity in children; (2) an increase in cognitive, motor, and socio-emotional development; (3) increase in social performance and learning capacity; (4) increase in adult height and decrease in obesity and chronic-degenerative diseases; (5) and increased work capacity and productivity. Therefore, according to our perspective and based on the conceptual framework, actions must be implemented, particularly in the first 1000 days, at the individual and collective levels, aimed at promoting healthy nutrition and development.

Determinants of child nutrition and key, effective nutritional interventions in the first thousand days

The determinants of child nutrition are distributed at several levels.[16] At the more immediate level are food and nutrient intake and the child's health status. Providing the child with a sufficient amount of food with adequate nutrients and at the same time, guaranteeing a good health status can ensure healthy nutrition in the first thousand days. However, it should be noted that the proximal or immediate determinants depend on intermediate and distal determinants, which in turn may promote or hinder the feasibility of the proximal ones.

Among the most important determinants of child nutrition is maternal nutrition, given that many children are born malnourished because their mothers are malnourished,[16]

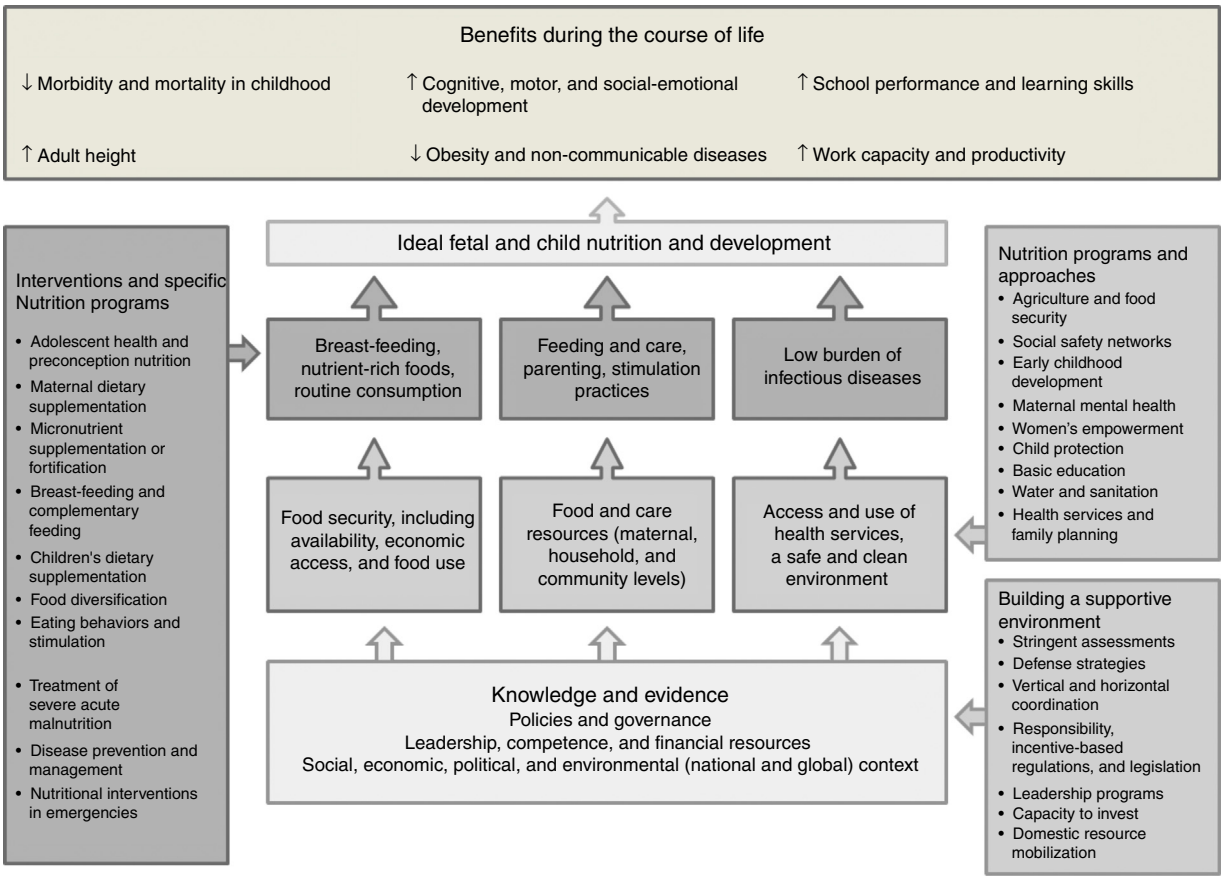

Figure 1 Table of actions to achieve optimum nutrition and fetal and child development.
Source: Modified from *The Lancet*.[6]

which shows the importance of nutrition for women of childbearing age. In most low-income countries, the nutritional status of these women is determined by the synergistic and cumulative effect of many risk factors, among which are: limited access to food; powerlessness of women in the family environment; customs and traditions that prevent women from eating certain foods with high nutritional value; energy demands of heavy physical labor; nutritional demands of frequent pregnancies and lactation; impact of frequent infections; and limited access to health services.[16] Establishing actions to decrease or eliminate the effects of these factors should be a priority and depends on political actors and health managers, while the pediatrician has limited power to influence such scenarios.

Another noteworthy aspect is that poverty as an isolated variable does not fully explain the high rates of child malnutrition, although children living in low-income countries have a higher chance of having malnutrition, especially the chronic form.[16] Political commitment, positive health policies, and effective strategies play an important role in the fight against child malnutrition. Countries with similar gross domestic product (GDP) may have very different chronic malnutrition rates in childhood, such as Nigeria and Ghana. Both have a 1250 USD GDP *per capita* income, although the chronic malnutrition rate in children in the former is 41% and, in the latter, 29%.[16]

Fig. 2 lists several interventions with proven effectiveness that are strategic for the first thousand days[16]; it is noteworthy that these interventions are started in pregnancy, considering that the first thousand days range from conception to the end of the 2nd year of life.

In order to prioritize interventions that would have a greater potential to save lives, some authors and organizations suggest six nutritional interventions[17]: iron and folic acid supplementation in pregnancy; breastfeeding; complementary feeding; vitamin A supplementation for children; zinc use in diarrheal episodes; and guaranteeing adequate water supply, sanitation, and hygiene practices for the families.

Iron requirements during pregnancy are increased due to the increase in erythrocyte mass to adjust to the fetal and placental growth, and blood loss that occurs during delivery. Iron deficiency decreases maternal synthesis of hemoglobin and oxygen transport, contributing to unfavorable outcomes such as premature birth and low birth weight. However, it is very difficult to achieve adequate iron intake only through diet, necessitating its supplementation.[18]

Folate plays an important role in DNA synthesis and therefore its requirement during pregnancy is increased, due to blood volume expansion and maternal tissue growth, as well as to ensure adequate fetal growth and development. Folate deficiency during pregnancy, especially around the time of

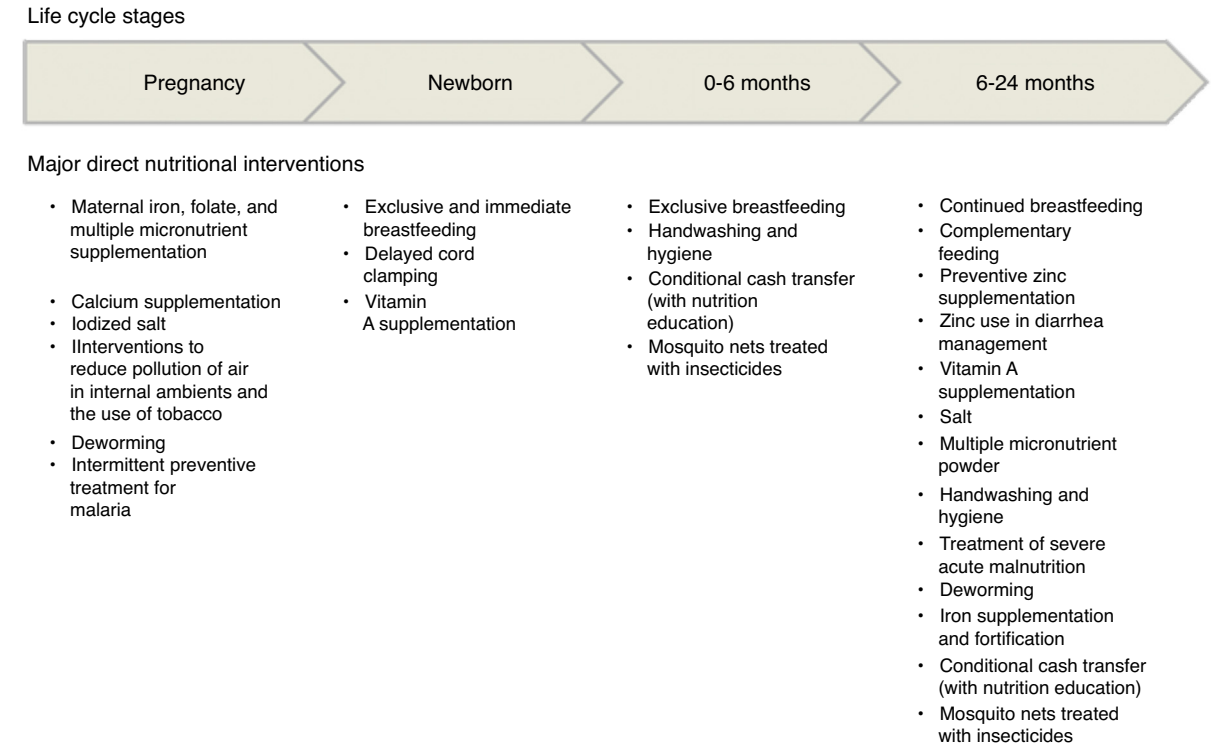

Figure 2 Nutritional interventions, according to life cycle stages, throughout the 1000 days.
Source: Modified from *Save the children*.[16]

conception, is strongly correlated with increased risk of neural tube defects such as spina bifida, and it represents the second most common cause of anemia in the gestational period.[19]

A recent study showed that folic acid supplementation significantly reduced the rates of maternal preeclampsia and infants born small for gestational age.[20]

Studies suggest that iron and folic acid supplementation during pregnancy reduces the chances of death in childbirth and also contributes to the intellectual development of the child.[21] A study performed in South Korea demonstrated that folic acid supplementation significantly reduced the rates of maternal preeclampsia and infants born small for gestational age.[20]

Breast milk is considered the ideal food for infant nutrition because it contains all the essential nutrients for the child's growth and development. The colostrum is notable for containing substances that provide protection against immune-mediated infections and diseases, and also stimulates the immune system maturation of the infant's intestinal mucosa.[22]

There is evidence that the longer the delay in initiating breastfeeding, the greater the chance of death of newborns in the neonatal period caused by infections.[23] Furthermore, breastfeeding within the first hour of life has shown to be associated with a reduction in neonatal mortality by 22%.[24]

During this sensitive period, the protective effect of breastfeeding provided by the colostrum may be related to several mechanisms, which include intestinal colonization by certain bacteria found in breast milk and the capacity of breast milk to produce bioactive immune factors beneficial to the newborn.[25]

Exclusive breastfeeding is recommended up to 6 months of age, as is its continuation up to 2 years of age, when the thousand days are reached.[2]

There are many benefits related to breastfeeding, such as reduction in morbidity and mortality from diarrhea and respiratory infections, decreased risk of obesity in childhood, and of hypertension, diabetes, and hypercholesterolemia in adulthood.[26]

Complementary feeding refers to the introduction of new foods in the child's diet and should begin at 6 months of age, concomitantly with breastfeeding, which should continue up to 2 years of life. It must provide sufficient amounts of water, energy, protein, fat, vitamins, and minerals, and must include all food groups, which must be properly hygienized and safe for children. Breastfeeding should not be reduced with the introduction of complementary feeding. Food should be offered with a spoon or cup, avoiding the bottle, as it is a source of contamination and negatively influences breastfeeding.[26]

Vitamin A should be supplemented in children aged 6–59 months because its deficiency affects, worldwide, approximately 190 million children of preschool age – most of them located in Africa and Southwest Asia.[27]

Lack of drinkable water and adequate sanitation in many parts of the world contribute to maintain diarrhea as the leading cause of death among infants and children in low and middle-income countries. Zinc supplementation has been able to reduce the duration and severity of diarrheal

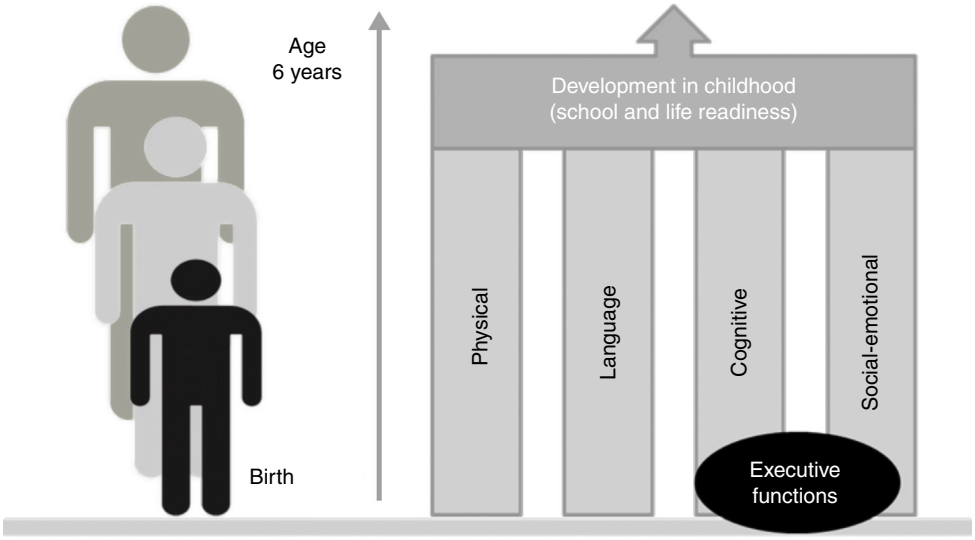

Figure 3 Child development domains.
Source: Modified from Naudeau et al.[8]

episodes, as well as the probability of subsequent infections. The benefits in children with diarrhea are due to the fact that this mineral participates in protein synthesis, cell growth and differentiation, immune function, and intestinal transport of water and electrolytes.[28]

Handwashing with soap is one of the most effective and inexpensive actions to prevent diarrhea and pneumonia,[29] diseases that are still responsible for high worldwide mortality.

Conceptual framework and interventions for the child's full development

Early childhood development is a multidimensional process in which progress in one domain often acts as a catalyst for progress in other areas.[8] Delays in one area of development can also catalyze delays in other areas. For instance, malnutrition in early life leads to poor physical development and is an indicator for cognitive development delay and poor academic performance in school life.[30] Four areas are interrelated in child development (Fig. 3): physical, cognitive, linguistic, and social-emotional aspects.

Physical development is defined as an individual rate of growth, physical fitness, fine motor skills, gross motor skills, and capacity to take care of oneself. Chronic malnutrition is predictive of lower cognitive and overall development during early childhood and later in life.[31]

Cognitive development involves progress in analytical skills, solving mental problems, memory, and early math skills. At 3 years of age, children should be able to solve simple problems and match colors and shapes, as well as demonstrate awareness of concepts such as ''more'' and ''less.''[8]

Language development is manifested by the infant through the acts of babbling, pointing, and gesturing; and later, by the uttering of the first words and phrases, until the explosion of words between 2 and 3 years of age. The capacity to absorb the language and distinguish sounds appears at approximately 9 months, before the child starts speaking. Hence, it is paramount that parents and caregivers verbally interact with the child from the time of birth.[8]

The social-emotional development in the first 2 years of life, thus within the first thousand days, occurs through the relationship of children with caregivers, when they learn to trust those with whom they live and meet their needs. These acquisitions aid social-emotional development in preschoolers, which expands to include social competence, behavior management, social awareness, and self-control skills.[8] Some of these skills involve both social-emotional and cognitive processes, and have been called ''executive function processes.''[32] Competence in these processes is essential to ensure the child will become a healthy and productive adult.

The development of the abovementioned domains is cumulative during childhood. However, some interventions are important at specific periods, which are characterized as windows of opportunity and should be prioritized, as summarized in Fig. 4. It is observed that in addition to the importance of adequate nutrition in the first 2 years of life, it is essential in this period that the children have a supportive and welcoming environment in order to develop strong attachments (also known as bonding) with their caregivers, thus laying the foundation for further development in all areas.[33] Failure to provide children with adequate nutrition and stimulation during this window of opportunity, which is within the first thousand days, impairs the human potential.[31]

The pediatrician's role in the 1000 days

Pediatricians can play a key role both in the education of parents and other caregivers, as well as in the implementation of curative, preventive, and health-promoting interventions through their professional practice. In general, these interventions are encouraged and led by pediatric societies, such as those recommended by some authors to prevent obesity[34] and violence.[35] Thus, pediatricians can act by using the

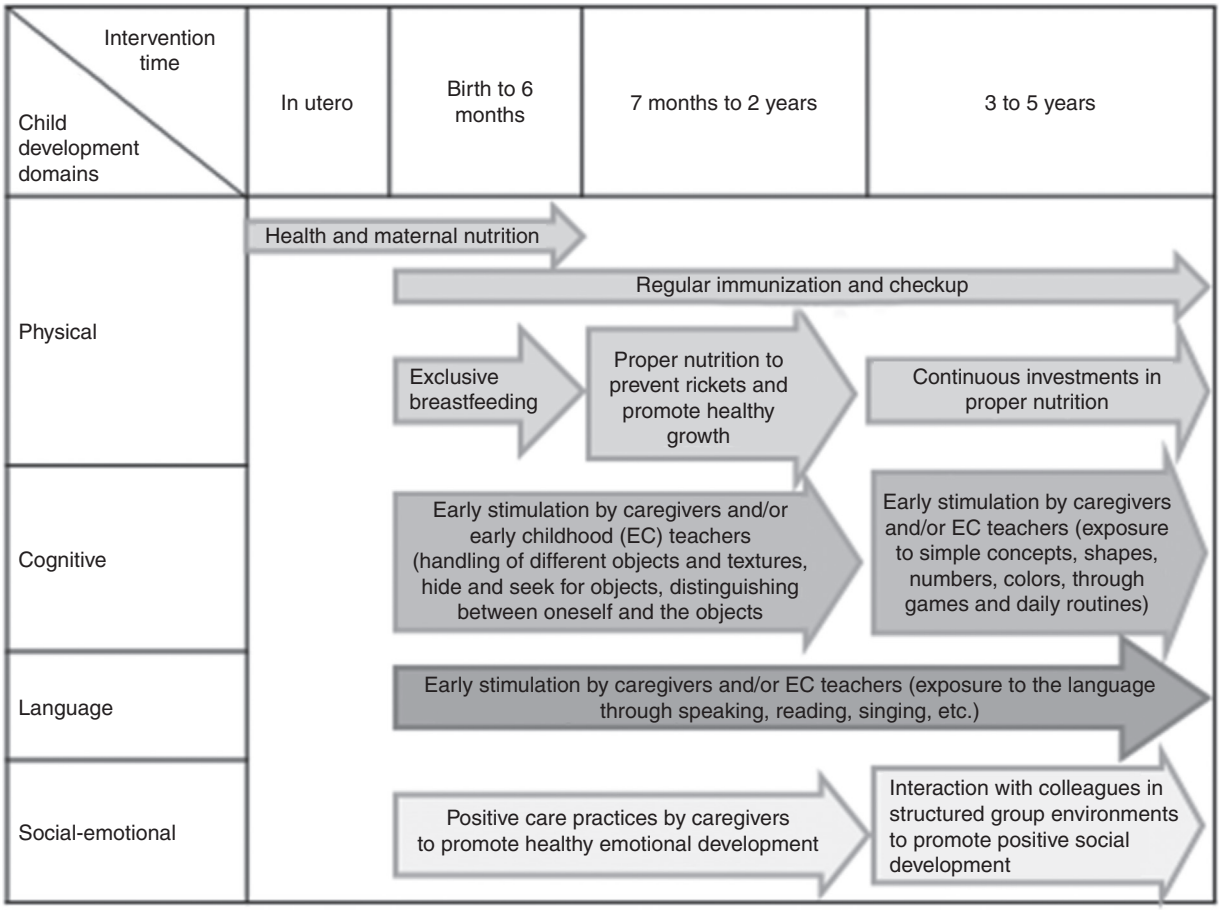

Figure 4 Interventions according to child development domains, with emphasis on the 1000 days.
Source: Modified from Naudeau et al.[8]

concepts and recommendations proposed for the first thousand days in their professional practice. However, they can also act by participating in the planning and implementation of community interventions based on this concept.

Additionally, some authors emphasize that science has an important role to play in advising policy makers on the development of effective responses to social problems that affect children's development. They consider that professionals from different areas, such as neuroscientists, psychologists, pediatricians, economists, and communication researchers have an important role: that of explaining complex scientific concepts to non-scientists, in an integrated way.[36] In this sense, the pediatrician can work together with other professionals in the development and performance of studies and research, as well as in the preparation and publication of scientific articles, which highlight the importance of actions and interventions focused on the concept of the first thousand days, emphasizing the aim of healthy nutrition and development, contributing with the spreading of scientific knowledge to support health policies and practices.

Conclusions

The first thousand days range from conception to the end of the 2nd year of life and represent an important period for the implementation of actions and interventions that will guarantee healthy nutrition and development, whose repercussions will persist throughout life.

In addition to nutritional interventions, such as exclusive breastfeeding for the first 6 months, it is essential that children have a supportive and welcoming environment to develop strong attachments with their caregivers, laying the groundwork for full development.

Pediatricians can act by promoting actions emphasizing the concept of the first thousand days, both in their professional practice, as well as advocating in support of this concept. Focusing on actions in this period may increase the child's chance of having a healthy and productive life in the future, strengthening family and community ties, helping to break the intergenerational cycle of poverty.

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Conflicts of interest

The authors declare no conflicts of interest.

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