

Building brains: The importance of nutrition in early brain neurodevelopment

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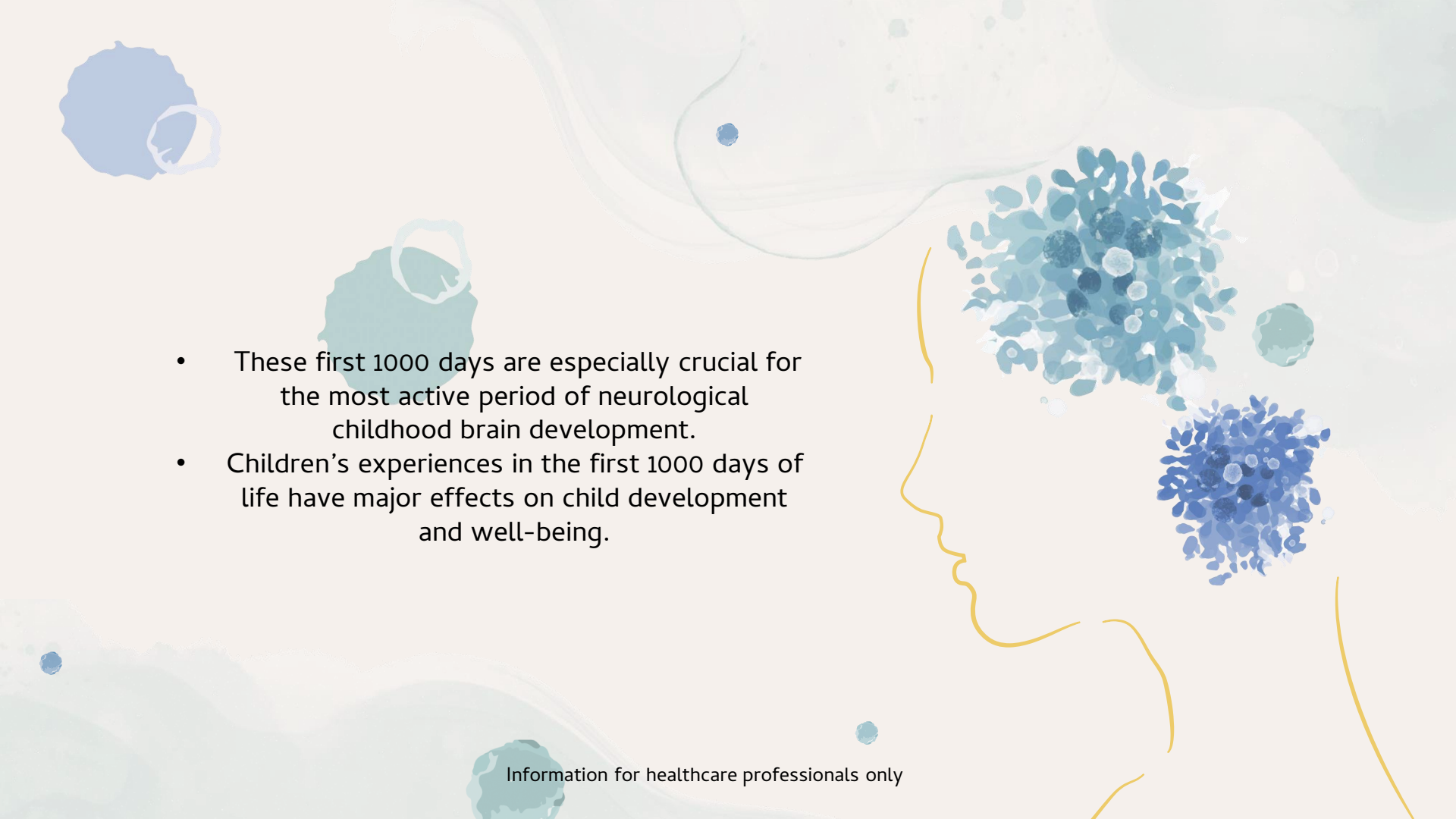


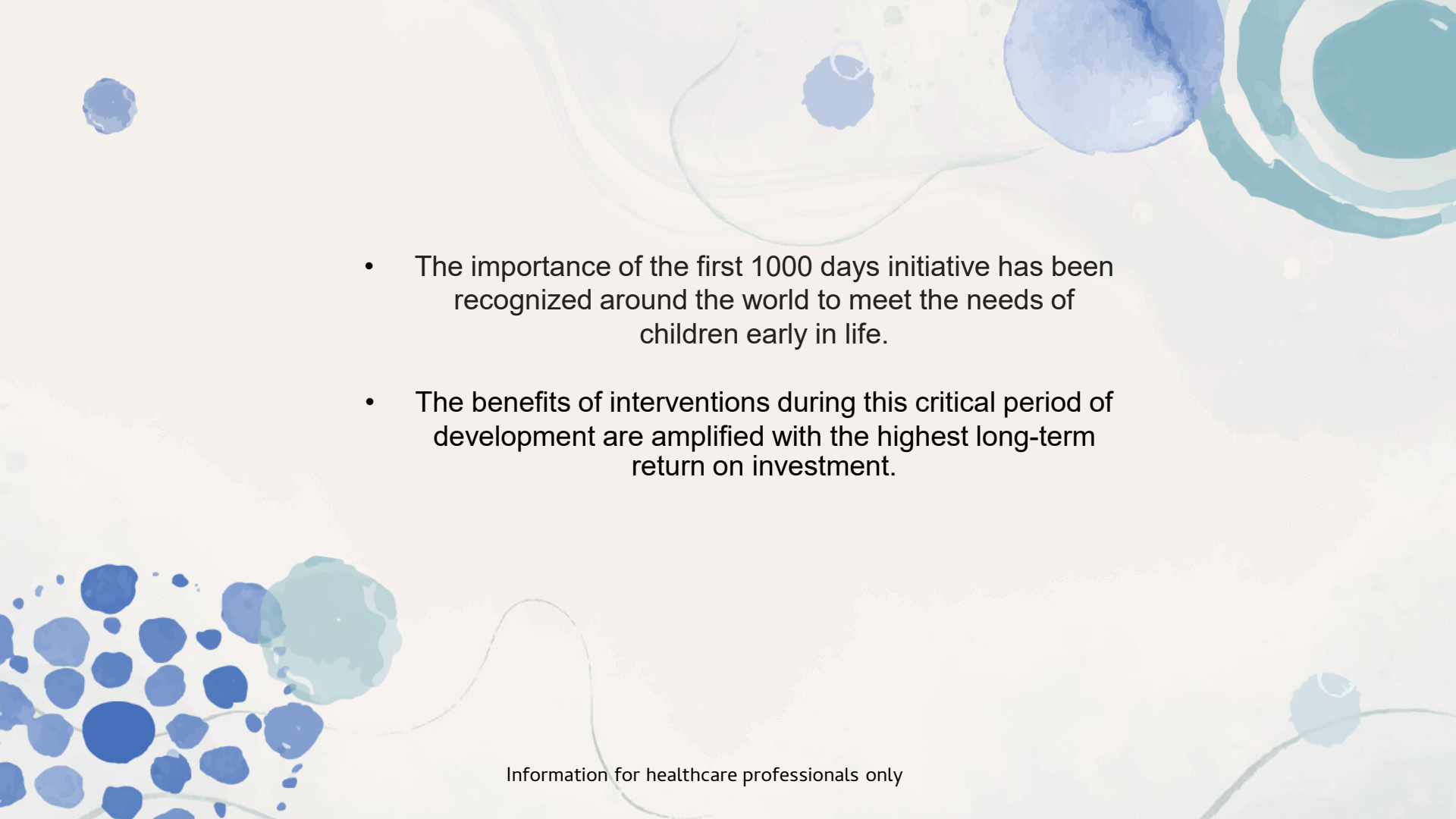
Introduction

- Science shows that life is a story for which the beginning sets the tone.
- That makes the early years of childhood a time of great opportunity, but also great risk.
 - Children's brains are built, moment by moment, as they interact with their environments.
- In the first few years of life, more than one million neural connections are formed each second – a pace never repeated.
- The quality of a child's early experiences makes a critical difference as their brains develop, providing either strong or weak foundations for learning, health and behavior throughout life.

The first 1000 days

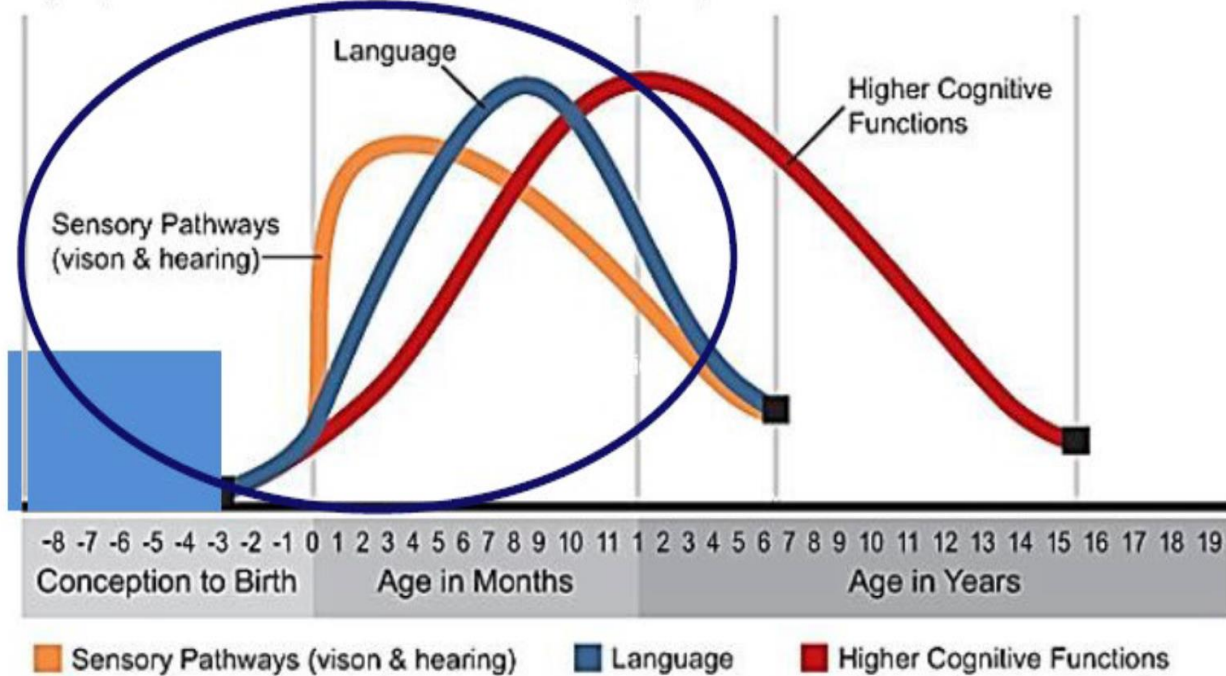
- The first 1,000 days of life – from conception until a child's second birthday –
- It is increasingly recognized as a unique period of opportunity when the foundations for optimum health and development across the lifespan are established.
- It is also a critical period for the development of childhood diseases and prevention.

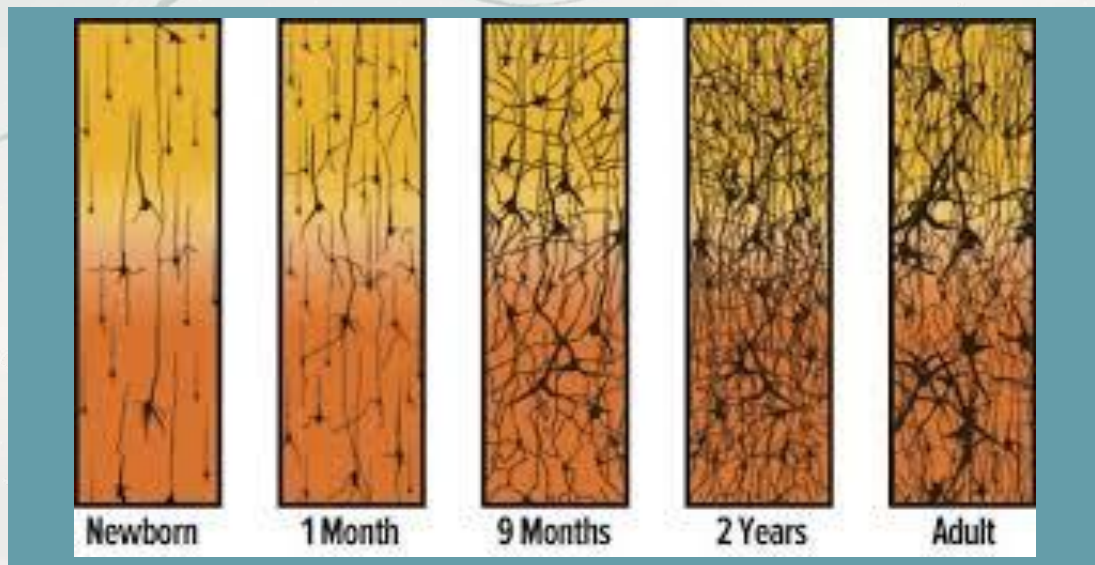
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- These first 1000 days are especially crucial for the most active period of neurological childhood brain development.
 - Children's experiences in the first 1000 days of life have major effects on child development and well-being.

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- The importance of the first 1000 days initiative has been recognized around the world to meet the needs of children early in life.
 - The benefits of interventions during this critical period of development are amplified with the highest long-term return on investment.

Human Brain Development

Synapse formation dependent on early experiences





The figure illustrates the rapid rate at which synapses are formed in the first few years of life. One can see that adults have thicker, but fewer synaptic connections.

'In the first few years of life, more than one million neural connections are formed each second – a pace never repeated again.'

The nurturing care framework



Developed in 2018 by UNICEF, WHO, WORLD BANK
Aimed to help children survive, thrive and transform
Nurturing care is what the infant's brain expects and
depends upon for healthy development



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The nutritional environment influences whether brain growth and differentiation proceed normally or abnormally. Both adequate overall nutrition (i.e., absence of malnutrition) and provision of adequate amounts of key macro- and micronutrients at critical periods in development are necessary for normal brain development.

02



Essential Nutrients for Brain Development

Nutrient	Function
Protein	Brain growth and neurotransmitters
Iron	Myelination and cognition
Iodine	Thyroid hormone production
Zinc	Neurogenesis and synaptic function



Essential Nutrients for Brain Development

Nutrient	Function
Choline	Memory and learning
DHA(Omega-3)	Neuronal membrane development
Folate	Neural tube development
Vitamin B12	Neurological function

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breastfeeding and neurodevelopment

Human Milk: Nature's First Brain Food

Breast milk provides:

Optimal nutrition

Bioactive growth factors

Hormones

Immune protection

Essential fatty acids

These components support healthy brain growth and cognitive development.

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Breastfeeding and Cognitive Outcomes

Research has shown associations between breastfeeding and:

- Improved cognitive performance
- Better language development
- Enhanced school achievement
- Higher intelligence test scores
- Improved executive function

Possible Mechanisms

Nutritional advantages

Parent-infant interaction

Enhanced bonding



Responsive Feeding

Breastfeeding promotes:

Skin-to-skin contact

Eye contact

Emotional bonding

Social and emotional development

These experiences strengthen neural
pathways involved in learning and
behavior.

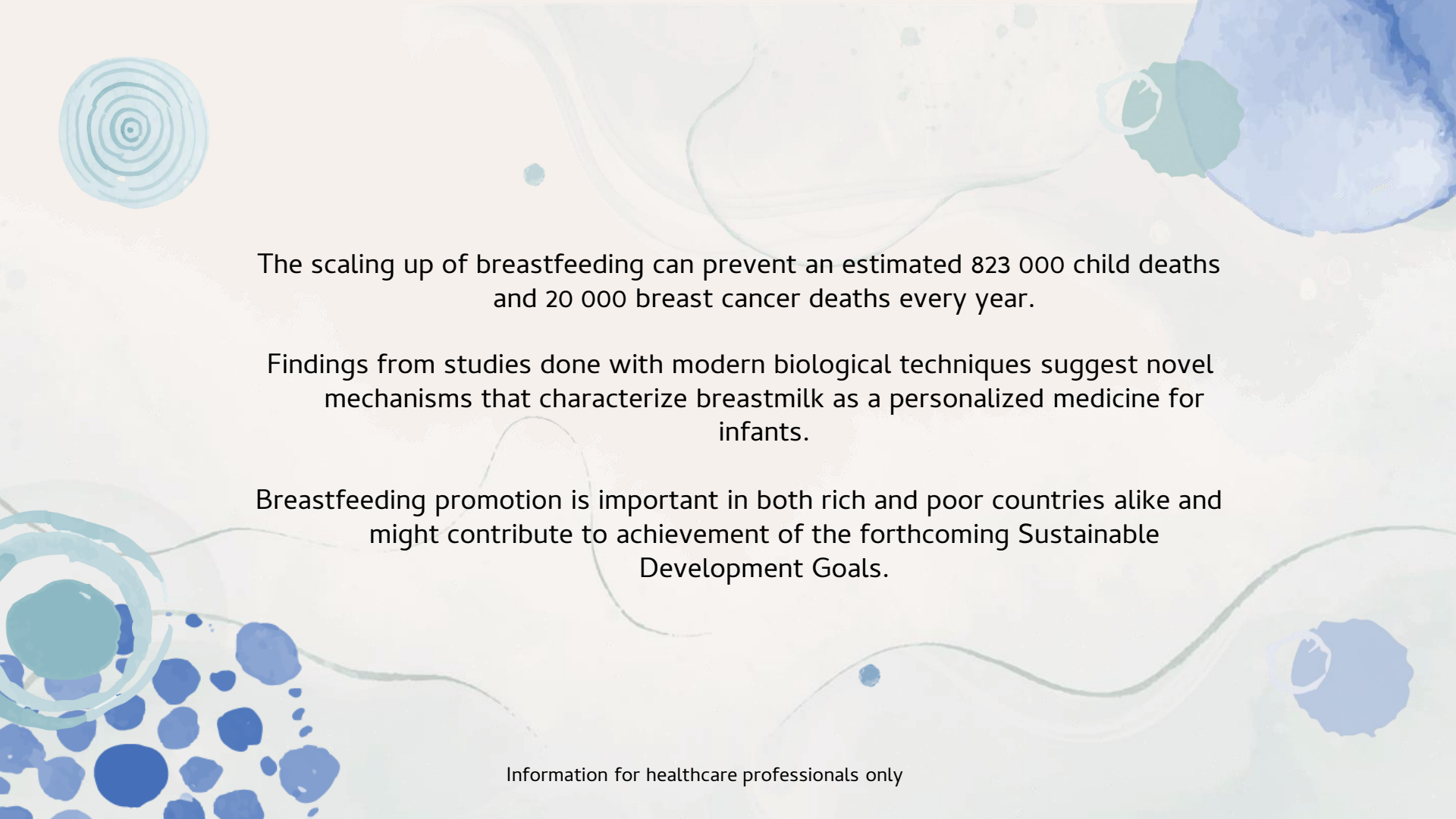


Breastfeeding and neurodevelopment

Children who are breastfed for longer periods have lower infectious morbidity and mortality, fewer dental malocclusions, and higher intelligence than do those who are breastfed for shorter periods or not breastfed. This inequality persists until later in life.

Growing evidence also suggests that breastfeeding might protect against overweight and diabetes later in life.

Breastfeeding also benefits mothers. It can prevent breast cancer, improve birth spacing, and might reduce a woman's risk of diabetes and ovarian cancer. High-income countries have shorter breastfeeding duration than do low-income and middle-income countries. However, even in low-income and middle-income countries, only 37% of infants younger than 6 months are exclusively breastfed.

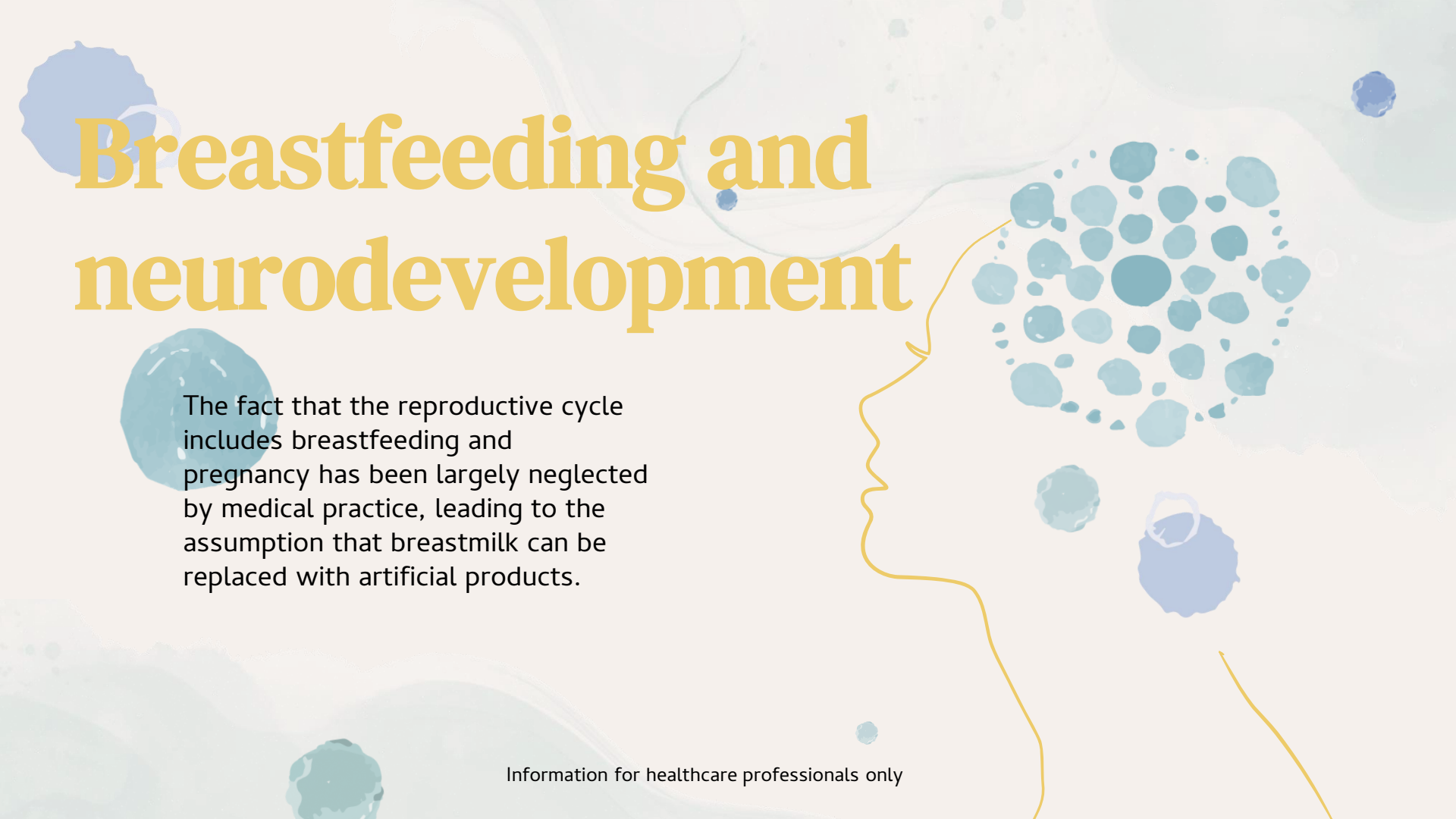


The scaling up of breastfeeding can prevent an estimated 823 000 child deaths and 20 000 breast cancer deaths every year.

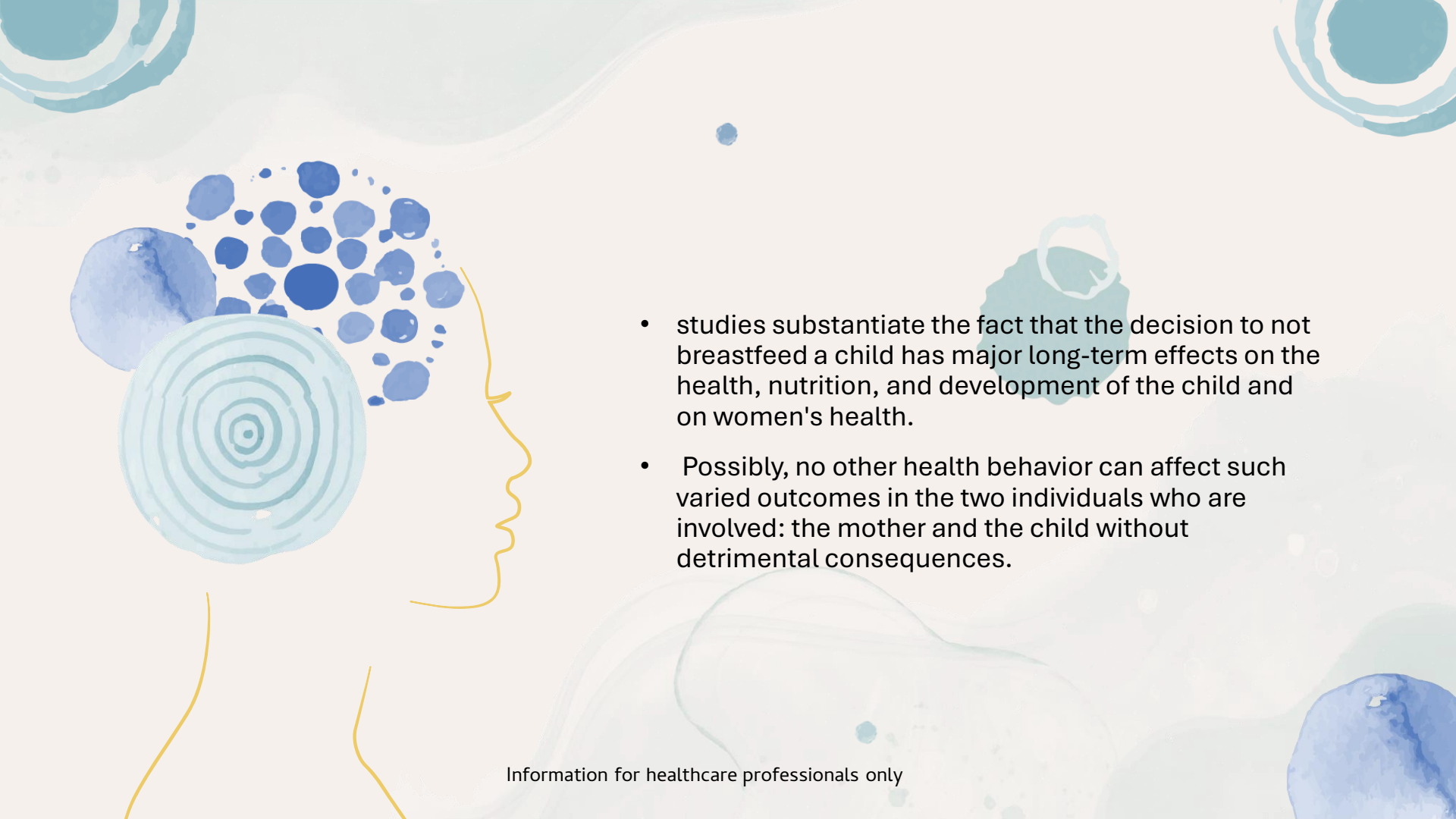
Findings from studies done with modern biological techniques suggest novel mechanisms that characterize breastmilk as a personalized medicine for infants.

Breastfeeding promotion is important in both rich and poor countries alike and might contribute to achievement of the forthcoming Sustainable Development Goals.

Breastfeeding and neurodevelopment



The fact that the reproductive cycle includes breastfeeding and pregnancy has been largely neglected by medical practice, leading to the assumption that breastmilk can be replaced with artificial products.

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- studies substantiate the fact that the decision to not breastfeed a child has major long-term effects on the health, nutrition, and development of the child and on women's health.
 - Possibly, no other health behavior can affect such varied outcomes in the two individuals who are involved: the mother and the child without detrimental consequences.



Breastfeeding and Sustainable developmental Goals (SDGs)

The protection, promotion, and support of breastfeeding supports the achievement of many of the newly launched Sustainable Development Goals by 2030

Breastfeeding is clearly relevant to the third sustainable goal, which includes not only maternal and child health but also non-communicable diseases such as breast cancer and diabetes as well as overweight and obesity.



Breastfeeding and SDGs

It is also relevant to the second goal (on nutrition).

The effect of breastfeeding on intelligence and on human capital is relevant to the fourth goal (education), the first goal (poverty), and the eighth goal (inclusive economic growth).

Finally, by helping close the gap between rich and poor, breastfeeding can contribute to goal number ten—reducing inequalities.



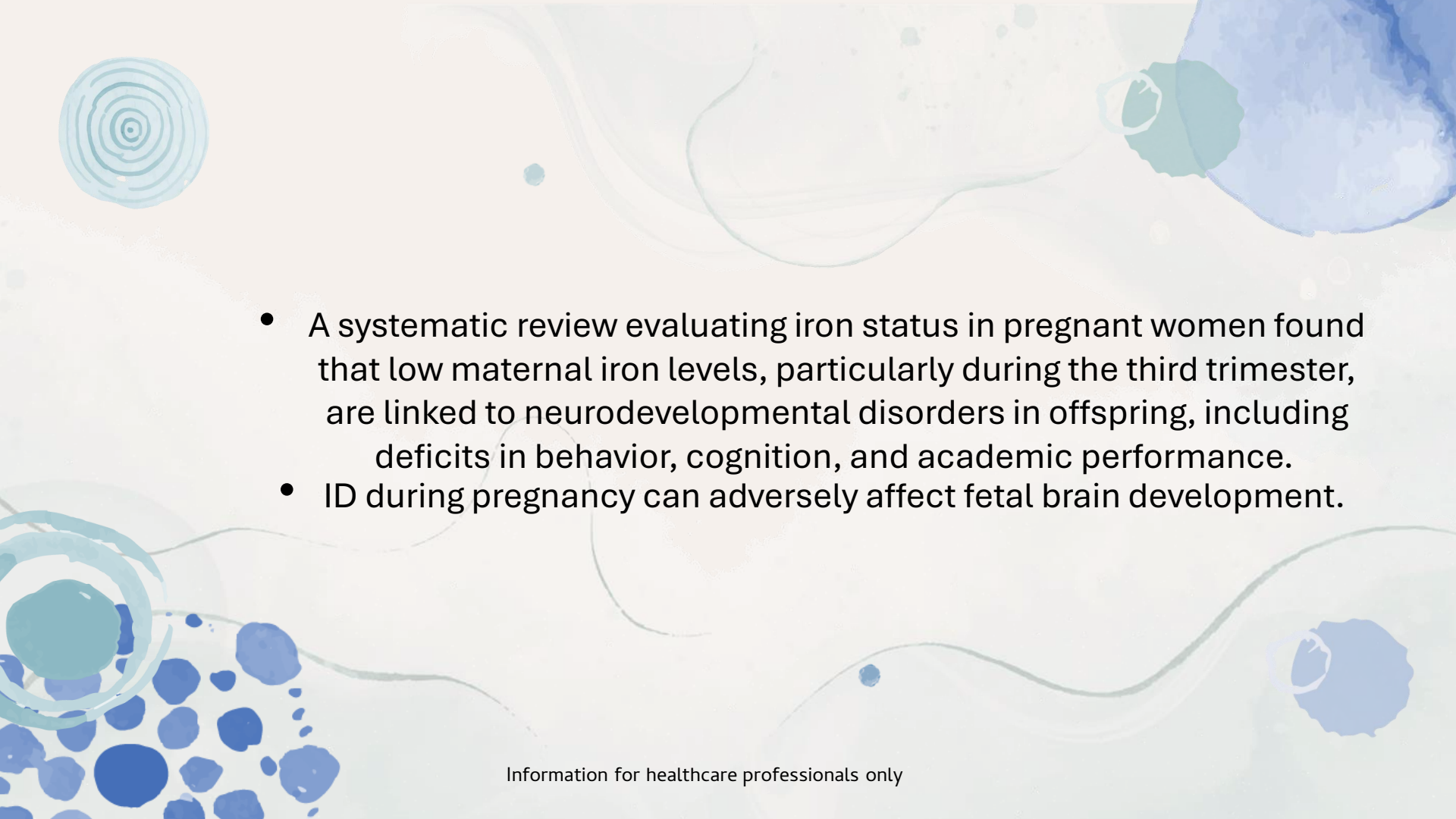


Breastfeeding and SDGs

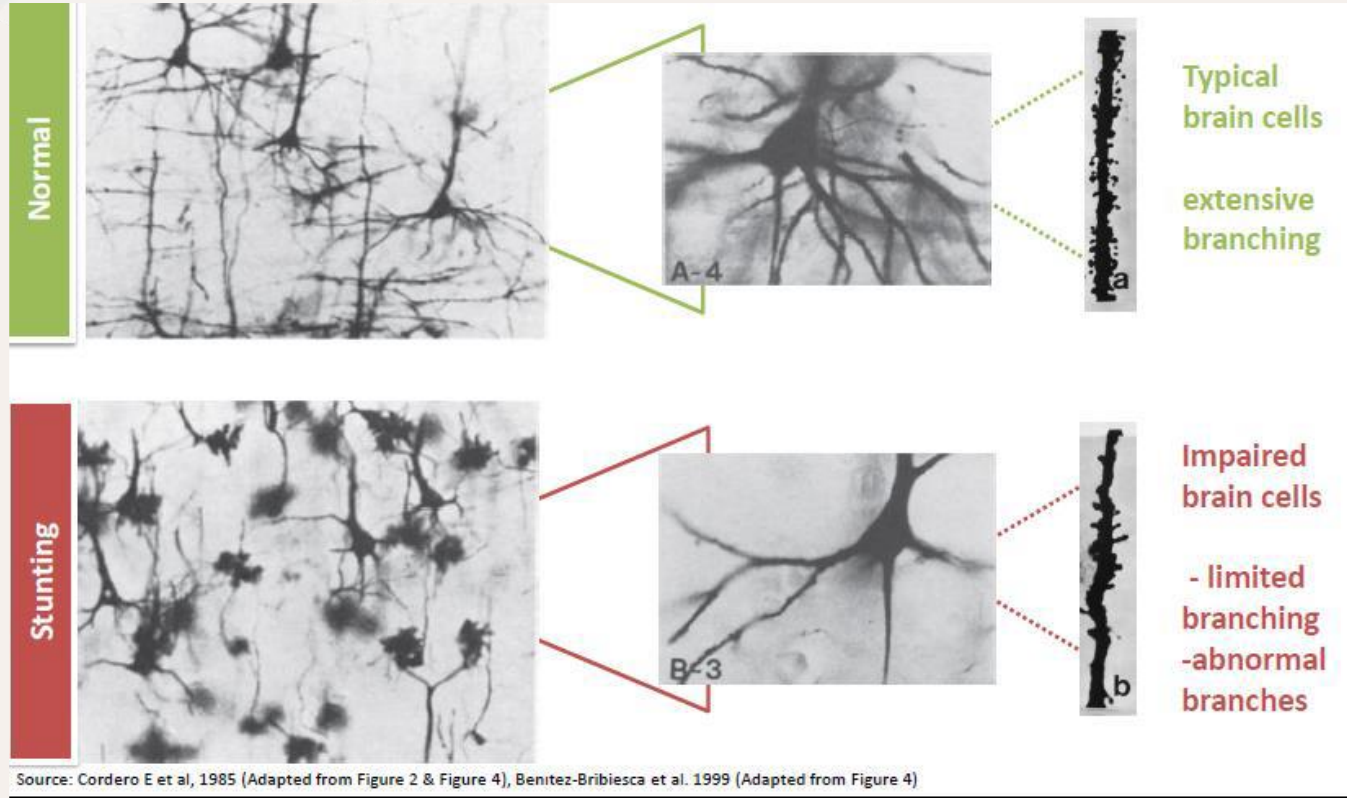
‘Human breastmilk is therefore not only a perfectly adapted nutritional supply for the infant, but probably the most specific personalized medicine that he or she is likely to receive, given at a time when gene expression is being fine-tuned for life. This is an opportunity for health imprinting that should not be missed.’

Iron and neurodevelopment

- Iron deficiency (ID) accounts for approximately 30-50% of anemia cases in children.
- Iron plays a vital role in brain development by supporting myelination, neurotransmitter synthesis, and oxygen transport in hemoglobin.
- ID within the first 1,000 days of life can lead to long-term, irreversible impairments in motor function, cognition, and behavior.

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- A systematic review evaluating iron status in pregnant women found that low maternal iron levels, particularly during the third trimester, are linked to neurodevelopmental disorders in offspring, including deficits in behavior, cognition, and academic performance.
 - ID during pregnancy can adversely affect fetal brain development.

malnutrition on the brain

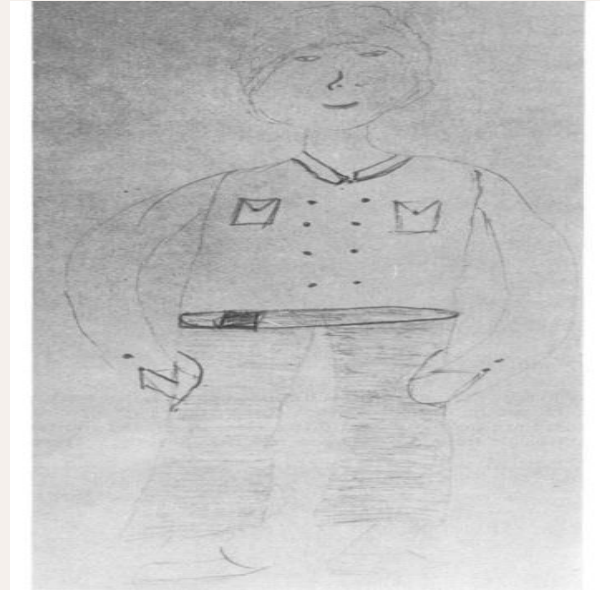


15-year developmental study on effects of severe undernutrition during infancy on subsequent physical growth and intellectual functioning



Index Subject

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Control Subject



Consequences of malnutrition

- Malnutrition, whether due to nutrient deficiency or poor-quality diets, may result in:
- Delayed cognitive development
- Reduced attention and learning capacity
- Behavioral difficulties
- Lower educational achievement
- Potentially irreversible deficits in brain function if deficiencies occur during critical developmental windows

Eswatini countdown to 2030

HEALTH

- Treatment for HIV+ pregnant women 95%
 - ANC 4/more visits- 76%
- Care seeking for child pneumonia- 60%

NUTRITION

- Early initiation of breastfeeding – 48%
- Minimum acceptable diet -37%
- Exclusive breastfeeding- 67%

OPPORTUNITIES FOR LEARNING

- Children's books -6%
- Attendance in early education – 30%
- Early stimulation at home 39%
- Playthings- 67%



SECURITY AND SAFETY

- Birth registration- 54%
- Basic sanitation – 64%

RESPONSIVE CARE GIVING NO DATA

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Eswatini countdown 2030

Maternal mortality- 437/100000

Under 5 mortality- 43/1000

Under 5 stunting – 23%

Child poverty- 49%

Violent discipline- 87%

Children developmentally on track – 67%

Adolescent birth rates- 87/1000

Vit A supplementation- 30%

Secondary school completion for females- 33%

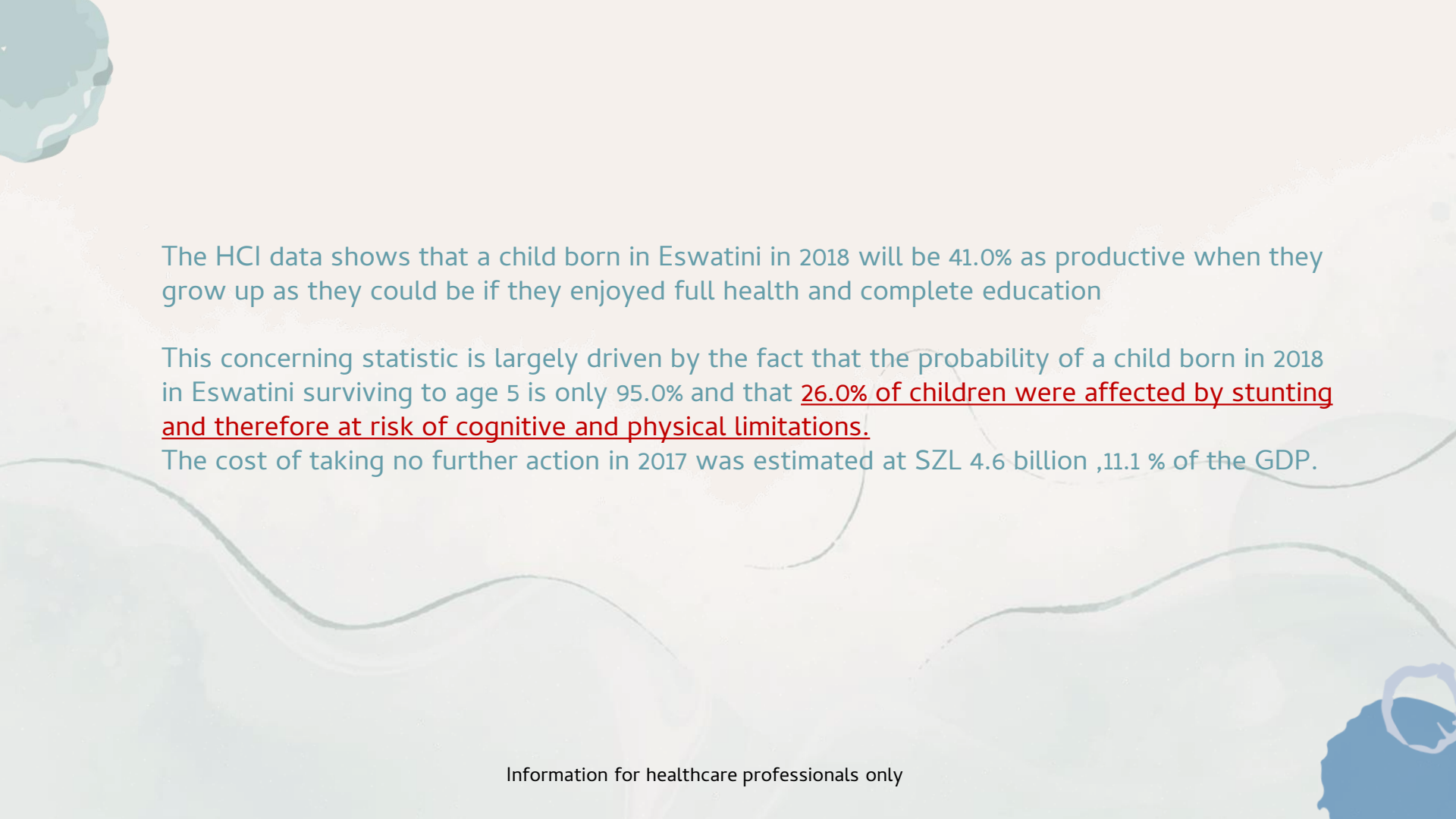
<https://data.unicef.org/countdown-2030/>

Cost of inaction Eswatini



The World Bank (2018) developed the Human Capital Index (HCI) to measure the amount of human capital that a child born today can expect to attain by age 18.

The HCI estimates the productivity of the next generation of workers compared to a benchmark of full health and complete education.



The HCI data shows that a child born in Eswatini in 2018 will be 41.0% as productive when they grow up as they could be if they enjoyed full health and complete education

This concerning statistic is largely driven by the fact that the probability of a child born in 2018 in Eswatini surviving to age 5 is only 95.0% and that 26.0% of children were affected by stunting and therefore at risk of cognitive and physical limitations.

The cost of taking no further action in 2017 was estimated at SZL 4.6 billion ,11.1 % of the GDP.

How do we respond??



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Pre-conception and Maternity
Optimal maternal nutrition – starting preconception
Micronutrient supplementation
Prevention of low birth weight
Food security

At 0-2 years:

Delayed cord clamping

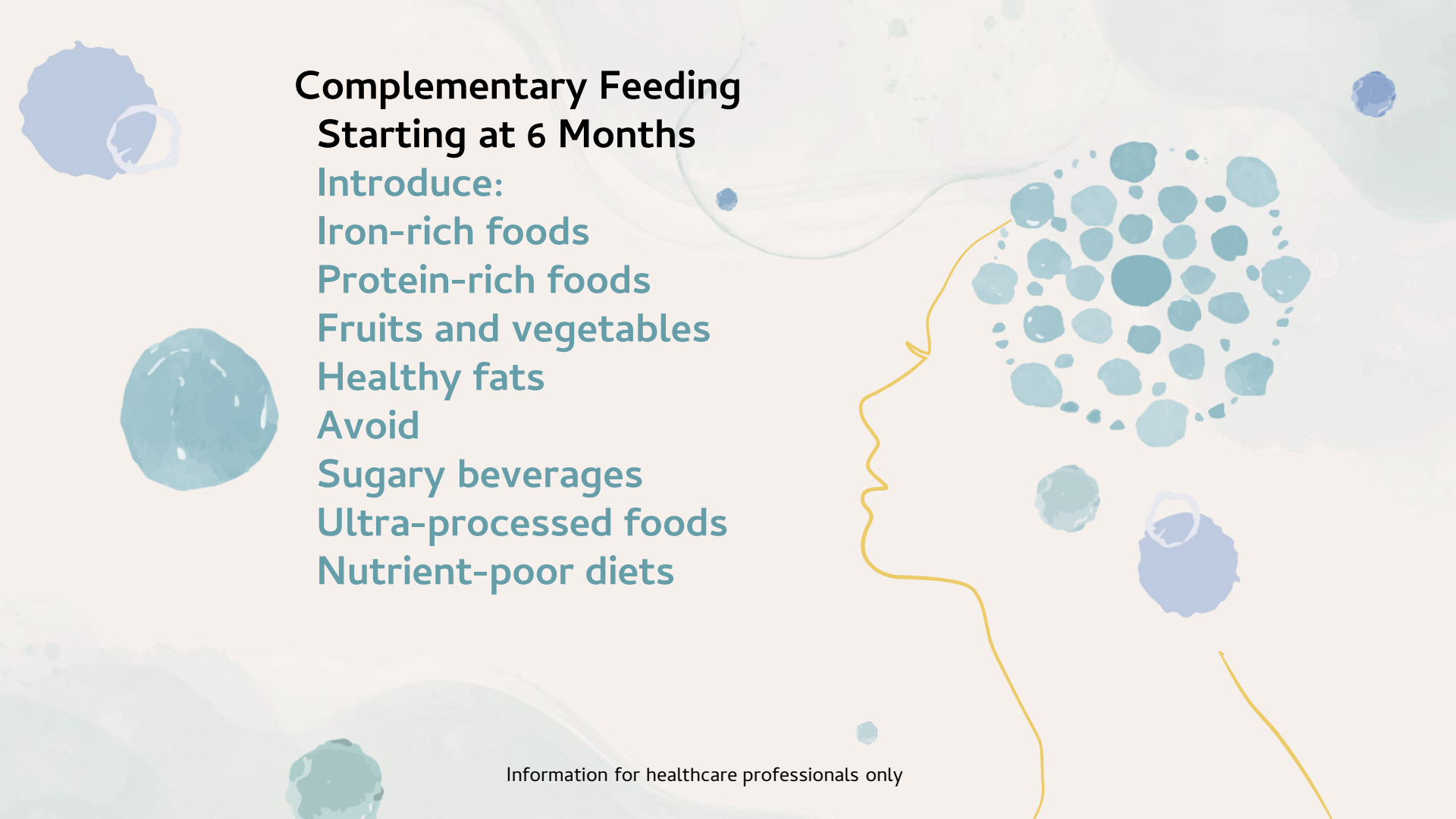
Support for breastfeeding and complementary feeding; breastfeeding within one hour of birth, exclusive breastfeeding

Vitamin A supplementation and deworming

Growth monitoring and counselling ; time to revise the Eswatini RTHC

Early identification and treatment of malnutrition

Food security



Complementary Feeding Starting at 6 Months

Introduce:

Iron-rich foods

Protein-rich foods

Fruits and vegetables

Healthy fats

Avoid

Sugary beverages

Ultra-processed foods

Nutrient-poor diets

Key take home messages



- Brain development begins before birth.
- The first 1,000 days are critical for lifelong cognitive health.
 - Nutrition is a major determinant of neurodevelopment.
- Iron, iodine, DHA, choline, zinc, protein, folate, and vitamin B12 are essential nutrients.
- Breastfeeding and appropriate complementary feeding support optimal brain growth.
- Early nutritional interventions can improve developmental outcomes across the lifespan.

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Thank you

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