Vitamin A Facts for health workers
Vitamin A
Vitamin A is a nutrient required in small amounts for the body to function properly. It is called a micronutrient because it is needed in extremely small amounts. Unlike many other micronutrients, vitamin A is fat-soluble and can be stored in the body for long periods of time.

Physiological role
Vitamin A is essential for growth and development. More specifically, it contributes to the following processes: fetal development, the immune response, vision, taste, hearing, appetite, and growth. Vitamin A plays a very important role in the immune system and hence is critical in helping the body resist infection and disease. Vitamin A also limits the severity of illnesses and hence reduces mortality.

Dietary sources
Vitamin A is found in food in two forms:
• Preformed vitamin A (retinol) from foods of animal origin such as liver, milk products, fish, meat, and egg
• Provitamin A carotenoids, generally from plant foods, which can be biologically transformed into vitamin A

Globally, about 60 percent of dietary vitamin A comes from provitamin A (that is, plant food sources). Many factors influence the absorption and utilization of provitamin A, such as the amount, type, and physical form of the carotenoids in the diet; the intake of fat and fiber; protein, vitamin A, and zinc status; and the existence of certain diseases and parasitic infections.

Recommended daily intake
The recommended intake of vitamin A for children one to three years of age is 300 µg/day retinol activity equivalents (RAE) or about 1,000 International Units (IU) and 400 µg/day RAE or about 1,300 IU for children four to eight years of age.
What are the causes and consequences of vitamin A deficiency?

Causes of vitamin A deficiency
Vitamin A deficiency occurs when the stores of vitamin A in the body are depleted. Common causes include the following:

• Too little vitamin A is absorbed from the food eaten because 1) too little vitamin A is present in the food, 2) the vitamin A that is present is from plant foods, which is not as well absorbed as that from animal sources, and 3) the person’s diet does not have enough fat or oil to help with the absorption.

• The lining of the intestine may be damaged (by intestinal parasites and/or diarrhea) and unable to absorb vitamin A.

• Increased use of vitamin A by the body. The body needs extra vitamin A at certain times, such as during rapid growth (e.g., infancy, pregnancy, lactation) and during illness, such as measles, diarrhea, and malaria.

Consequences of vitamin A deficiency
Vitamin A deficiency (VAD) reduces resistance to infections, leading to more severe and prolonged illnesses and therefore increasing the risk of death. It can cause eye damage, such as lesions, and when severe, can cause blindness. Generally, the first clinical sign of vitamin A deficiency is night blindness (impaired vision in dim light). However, because vitamin A deficiency reduces the body’s resistance to infection, it is a threat even before any direct signs become apparent. Vitamin A deficiency can also cause anemia.

Vitamin A deficiency has been shown to increase a woman’s risk of dying during pregnancy and the first three months after delivery.
Improving vitamin A status of deficient children increases their chances of survival.
• Death from measles can be reduced by 50 percent.
• Death from diarrhea can be reduced by 40 percent.
• Overall mortality can be reduced by 25 percent.

Improving vitamin A status of children reduces the severity of childhood illnesses.
• Reduces use of clinic and outpatient services, and hospital admissions.
• Contributes to the well-being of children and families, including better school attendance.

Improving vitamin A status also
• Prevents night blindness, xerophthalmia, corneal destruction, and blindness.
• May reduce birth defects.
• May help prevent epithelial and other types of cancer.

Improving vitamin A status may reduce maternal death.
• Improves resistance to infection.
• Helps reduce anemia. Vitamin A helps to mobilize iron for body functions.

Improving vitamin A status is very cost-effective.
• Just a few cents per capsule. Also minimal extra cost for fortified foods.
• Reduces health costs by lessening hospital and clinic visits.
• Easily integrated into existing public health/immunization programs.
• Reduces educational costs for blind children.
• Reduces school absenteeism due to severe illnesses.
Supplementation. Supplements in the form of capsules or syrup can be delivered preventively through formal or informal routine delivery systems or through periodic dosing and can be administered therapeutically (as part of case management protocols).

- Giving vitamin A directly to an infant increases liver reserves of vitamin A when the infant is never breast-fed or breast-feeding is discontinued or the mother has not received postpartum doses of vitamin A.
- Giving vitamin A capsules twice yearly at six-month intervals to children six months to five years of age is protective and meets much of a child’s requirement.
- Giving vitamin A to mothers immediately after birth increases the amount of vitamin A in breast milk and therefore increases the infant’s intake of vitamin A. It also improves the mother’s own stores of vitamin A and utilization of iron stores.

Exclusive breast-feeding. A child should be exclusively breast-fed for six months, without addition of other foods or fluids. Consumption of colostrum should be promoted.

- Exclusive breast-feeding helps prevent illnesses which deplete vitamin A stores.

Fortification. Adding vitamin A to foods consumed by the vulnerable population.

- Food fortification with vitamin A—of sugar, maize flour, wheat flour, and other foods—has dramatically increased vitamin A intake and reduced vitamin A deficiency among children in several Asian and Latin American countries.
- Commonly available foods already fortified with vitamin A include vegetable oil, margarine, and milk powder.
- Fortification can reach large numbers of people without requiring changes in eating habits.
- Fortification adds very little to the cost of staple products to consumers.

Food-based approaches. Production and regular consumption of vitamin A-rich foods

- Eggs, fish, meats, and liver
- Orange/yellow colored vegetables and fruit: e.g., pumpkins, carrots, yellow/orange fleshy sweet potatoes, papaya (papaw), and mango
- Dark green leafy vegetables: e.g., spinach, cassava leaves, bean leaves, and pumpkin leaves
- Red palm oil

Opportunities to reduce vitamin A deficiency with locally available foods

- Agricultural extension services, especially for women, can provide technical support for production of vitamin A-rich foods.
- Community development or nutrition programs and women’s groups
- Production and processing of vitamin A-rich foods
- School programs and school gardens promote consumption through increased availability and sensitization of school children and parents on the foods’ nutritional value.
- Nutrition education on the utilization and nutritional value of locally available foods

Other related public health measures

- Immunization, particularly for measles
- Proper treatment and management of common illnesses
- Improving water and sanitation
- Regular deworming of individuals at risk
- Control of diarrheal diseases
**Prevention.** High-dose universal distribution schedule for prevention of vitamin A deficiency*

<table>
<thead>
<tr>
<th>Age and target group</th>
<th>Dose</th>
<th>Frequency</th>
<th>No. of drops/capsules</th>
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</thead>
<tbody>
<tr>
<td>Infants below 6 mos. (Non-breast-fed infants)</td>
<td>50,000 IU</td>
<td>Once</td>
<td>100,000 IU 200,000 IU</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 drops 2 drops</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>½ capsule ½ capsule</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100,000 IU 200,000 IU</td>
</tr>
<tr>
<td>Infants 6 up to 12 mos.</td>
<td>100,000 IU</td>
<td>Once</td>
<td>All drops 4 drops</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 capsule ½ capsule</td>
</tr>
<tr>
<td>Children 1 to 5 years</td>
<td>200,000 IU</td>
<td>Every 6 mos.</td>
<td>All drops All drops</td>
</tr>
<tr>
<td>Postpartum women</td>
<td>200,000 IU</td>
<td>Once within 8 wks. of delivery</td>
<td>2 capsules 1 capsule</td>
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* Based upon 1997 WHO/UNICEF/IVACG guidelines

**Targeting high-risk children.** Vitamin A supplementation re-establishes body reserves drained by chronic or repeated infectious disease, thus protecting the high-risk child against deficiency and the severity of subsequent infections.

**Treatment.** For *treatment of measles*, persistent diarrhea, xerophthalmia, and severe malnutrition, three doses should be given, selecting the dose that is appropriate for the child’s age: the first dose should be given in the clinic; the mother should be given the second dose to take home and give to her child the next day; the mother should be asked to bring her child back for a third dose two to four weeks later. For *supplementation* of children six months or older, give a single dose in the clinic if no vitamin A was given in the previous month. Record dose on the child health card.

How capsules of different doses can be used to make age-appropriate doses:

<table>
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<tr>
<th>Age</th>
<th>Number of drops/capsules</th>
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</thead>
<tbody>
<tr>
<td>Up to 6 mos.</td>
<td>½ capsule (4 drops) ½ capsule (2 drops)</td>
</tr>
<tr>
<td>6 mos. up to 12 mos.</td>
<td>1 capsule (All drops) ½ capsule (4 drops)</td>
</tr>
<tr>
<td>1 to 5 yrs.</td>
<td>2 capsules (All drops) 1 capsule (all drops)</td>
</tr>
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*Note:* Evidence suggests that vitamin A reserves in deficient individuals can fall below the optimal level three to six months after a high dose. However, dosing at six-month intervals should be sufficient to prevent serious consequences of vitamin A deficiency.

**Postpartum dose for women.** Giving women vitamin A supplements after delivery will improve their vitamin A status and increase the vitamin A content of their breast milk. Infants who drink breast milk with a higher vitamin A content will have better vitamin A status and better health outcomes. The following are guidelines for areas where vitamin A deficiency is a problem:

<table>
<thead>
<tr>
<th>Population group</th>
<th>Dose</th>
<th>Time frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers who are breast-feeding</td>
<td>200,000 IU orally</td>
<td>Within 8 wks. postpartum</td>
</tr>
<tr>
<td>Mothers not breast-feeding</td>
<td>200,000 IU orally</td>
<td>Within 6 wks. postpartum</td>
</tr>
</tbody>
</table>


*Note:* Women who are pregnant, or who could become pregnant, MUST NOT consume high-dose supplements. Doses greater than 10,000 IU per day or 25,000 IU per week are not recommended for pregnant women or women who could become pregnant.
While clear, positive impacts can result from integrating vitamin A supplementation into routine health services, it is important to recognize that this approach focuses on children within the first year of life. Once children have been immunized, they are likely to come back for services only when they are sick. To realize the full potential of vitamin A supplementation in reducing child mortality, it is necessary to use an active approach that reaches the largest number of children between six months and five years of age.

Periodic, active, institutionalized distribution of vitamin A supplements has worked well in a number of countries. Different approaches have been used but all utilize a distribution that is

- **Periodic** (usually twice a year) either during a specified week or day(s);
- **Active** in that, just prior to a scheduled distribution, mothers are reminded and encouraged to take their child to designated centers or outreach posts for delivery of the supplements;
- **Institutionalized** in that it is run or managed routinely by health workers, frequently with the support of officials from other sectors; and,
- Often integrated with other interventions, such as growth promotion, deworming, bed nets, vaccinations, and other micronutrient programs.

Three active outreach-type strategies could be used to achieve high vitamin A coverage: child health weeks or days, micronutrient days, and community-based outreach. Although these strategies are described separately, there is enormous potential for benefit in overlap among them.

**Child Health Weeks or Days.** Vitamin A supplementation has been incorporated into a package of preventive services designed to improve child survival. Establishing a twice-yearly cycle of district and subdistrict activities designed to increase use and coverage of preventive services will improve delivery of several key child survival interventions. This approach works well in decentralized health systems where district-level health staff develop a strong sense of ownership of the intervention. This model has worked well in Nicaragua, where twice-yearly National Health Rallies have integrated vitamin A supplements, ORS, de-worming, growth monitoring, iron supplements, and routine immunization with coverage exceeding 70 percent, the highest in all of Latin America.

A similar approach is also being used with success in Zambia where vitamin A provides the foundation of the preventive package. Health center district managers view this approach as an opportunity to upgrade coverage on other preventive health interventions—such as routine vaccination coverage (particularly nine-month measles), treating helminth infections, and growth promotion—and to promote health education messages, including exclusive breast-feeding, iron supplementation, postnatal vitamin A, and using treated bed nets to prevent malaria.

**Micronutrient Days.** In many countries, vitamin A has been distributed successfully with National Immunization Days, providing one vitamin A supplement per year. Micronutrient days were developed to provide the second. Niger and the Philippines provide examples of micronutrient days when specific dates during the year were identified as the focus for distributing vitamin A supplements and other micronutrients such as iron and folic acid tablets. Philippines National Micronutrient Days from 1993 to 1996 typically achieved vitamin A coverage rates greater than 80 percent among children one to five years of age.

**Community-based outreach approaches.** This strategy is usually administered through the government health infrastructure and is based upon massive social mobilization. Supplements are distributed to the district health office, then on to health posts, and then through village workers. One successful example of this approach comes from Nepal where, in 1993, a program was initiated to have female community health volunteers distribute capsules on the same four days every year (two days for the first distribution and two for the second). After the first year, the program was taken over by the local authorities and, impressively, there has been no measurable drop in coverage to date. This success is attributed to the pride of ownership in the program established by the cadre of female community health volunteers. Another critical success factor is the leadership and management expertise of the local Technical Assistance Group (an NGO).
Breast-feeding promotion
- Exclusive breast-feeding for the first six months of life is the most important first step to improving vitamin A intake as well as the overall health of all babies.
- The concentration of vitamin A in breast milk depends on a woman’s vitamin A status.
- Infants depend primarily on the vitamin A in breast milk to build their stores during the first few months of life.
- Breast-fed infants of mothers with low vitamin A stores may become vitamin A deficient.
- Breast-fed infants are protected against vitamin A deficiency, especially if the mother receives a high dose of vitamin A supplementation immediately after birth to increase the amount of vitamin A in her breast milk.
- The more breast milk the child consumes the better. Increasing the number and/or length of feedings will increase an infant’s vitamin A intake.
- Children under six months of age who are not breast-feeding will need to receive a vitamin A capsule (see supplementation schedule) to increase their vitamin A status.

Consumption of vitamin A-rich foods
- Encourage consumption of locally available plant and animal products.
- Vitamin A in orange/yellow fruit (mango and papaya) and yellow/red vegetables (pumpkin, sweet potatoes) are twice as effective in enhancing serum vitamin A levels as those found in dark-green leafy vegetables.
- Because vitamin A is fat soluble, it can be more fully utilized and absorbed when fruits and vegetables are mixed or eaten with a fat source.
- Animal food sources are a better source of vitamin A than plant food sources.

Things to note
- Dark-green leafy vegetables should be cooked until tender to increase digestibility for young children.
- Vegetables should be shredded (mashed or sieved for infants) and mixed with the staple food to encourage consumption.
- Vegetables should be combined with a small amount of edible oil or ghee or cooked with oil seeds (e.g., groundnuts, simsim), to improve vitamin A absorption.
Supplements
• A single oral dose, if given at least one month apart for appropriate age, poses no risk for children. Age-appropriate doses are the following:

<table>
<thead>
<tr>
<th>Age</th>
<th>IU</th>
</tr>
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<tbody>
<tr>
<td>Below 6 months</td>
<td>50,000</td>
</tr>
<tr>
<td>6–12 months</td>
<td>100,000</td>
</tr>
<tr>
<td>1–5 years</td>
<td>200,000</td>
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</tbody>
</table>

• For children, a single dose of vitamin A should not exceed approximately 330,000 IU because this may cause problems. The level of vitamin A in the blood from high doses is cleared over one or two days, so separating doses by a month allows a wide margin of safety.

• Women who are pregnant, or who could become pregnant, **MUST NOT** consume high-dose vitamin A supplements. High doses of vitamin A can cause problems for the developing fetus, particularly in the first few weeks of gestation when the woman may be unaware she is pregnant. Doses greater than 10,000 IU per day or 25,000 IU per week are not recommended for pregnant women or women who could become pregnant.

• Postpartum mothers should be given 200,000 IU immediately after delivery to increase the vitamin A concentration of breast milk. This dose **MUST NOT** be given more than eight weeks after birth for a breast-feeding mother (six weeks for a mother who is not breast-feeding) because she could become pregnant after this time.

Fortification
Fortification of foods with vitamin A is a safe and effective intervention practiced in both developed and developing countries. At the currently practiced levels of fortification, enormously high and practically impossible amounts of these foods would have to be consumed daily to reach the vitamin A toxicity threshold for humans. In developed countries where many foods are fortified with vitamin A, there have been no reports of vitamin A toxicity attributed to the intake of fortified foods.

Dietary intake
Consumption of other vitamin A-rich foods at the time of high-dose supplementation does not pose any additional toxicity risk.