

# Child Health 2016

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Much has improved in child health since 1970. The overall Child Mortality Rate (under-5-mortality rate) for the world has gone down from 148/1000 live born in 1970 to 90/1000 in 1990 and now to 43/1000 in 2015, the biggest improvement in the world's history. The number of child deaths has gone down from 12.5 million 1990 to 5.84 million 2015 with 4.5 million (75% of all under-five deaths) occurring within the first year of life.

However the gap between that group of countries who have the best child health and those with the worst has increased significantly with a 9-factor difference in 1970 and a 26-factor difference in 2005 (and a 29-factor difference in Sub-Saharan Africa). The difference 2013 between Angola (the highest) and Luxembourg (the lowest) is an 84-factor difference. Some countries have stood still between 1970 and 2005 (Zambia) and some have even got worse from 1990 (Zimbabwe, Cambodia, Botswana, Central African Republic). Some of this decline in child health or failure to make progress is due to the debt crisis, some to the advent of HIV / AIDS and some to internal conflicts. The UNICEF report for 2013 says **Ethiopia has cut the number of child deaths** to 68 per 1,000 births from more than 200 in 1990.

Around 5.84 million children below 5 yrs die each year globally with over 70% occurring in Africa and South Asia. Of all child deaths 50% are in 6 big countries and 90% are in 42 countries. These deaths are in the 3 age categories: Neonatal 2.8 million (2013); 2.2 million from 1-12 months age; 2.2 million from 1-5 yrs. The Global decline has been: in neonatals 2.1% /yr.; 1-12 months: 2.3% /yr; 1-5 yrs: 2.2% /yr.. There is evidence of an increase in the rate of decline in all regions of Sub-Saharan Africa from 2000-2011.

Eight of the 60 countries identified as 'high mortality countries' – with at least 40 under-five deaths for every 1000 live births – have already reached or surpassed the MDG target (67% reduction). The

countries are Malawi (72%), Bangladesh (71%), Liberia (71%) (*before Ebola!*), Tanzania (69%), Ethiopia (69%), Timor-Leste (68%), Niger (68%) and Eritrea (67%).

Annual deaths from diarrhoea - a leading killer among young children (9% of total deaths) - fell to less than 800,000 during the past two decades, but the drop occurred mostly in large countries like China, Brazil and India; overall “the incidence of diarrhoeal disorders has hardly changed”.

In a study by Johns Hopkins University, researchers used birth and death registries, household surveys, verbal autopsy (interviews with people familiar with the deceased to learn the cause of death) and multi-cause models to estimate the causes of death in children younger than five years during 2010 to monitor the progress of 193 countries towards Millennium Development Goal 4 (MDG) - slashing child deaths annually by 44 percent, or 66 percent over 15 years.

The study showed an average drop in mortality of only 2.6 percent annually, with preventable infectious diseases causing almost two-thirds of the deaths. Pre-term birth (before 37 weeks of pregnancy) followed by pneumonia were responsible for the highest number of deaths globally, with Africa and Southeast Asia hardest hit.

In Africa, 73 percent of all child deaths (2.6 million children) were attributed mostly to malaria and HIV/AIDS, while in Southeast Asia nearly one million babies died within their first 28 days of life because of too-early birth, problems during delivery, or infection.

## Causes of deaths in children 2013 WHO

3.6 million fewer child deaths in 2013 compared to 2000. Half of this progress was due to reductions in deaths due to pneumonia, diarrhoea and measles collectively. The lowest progress was seen in congenital, preterm, neonatal sepsis, injury and other causes.

Perinatal/neonatal conditions (50% infections in worst-affected countries)	44%
Lower-Respiratory Tract Infections	14.9%
Diarrhoeal Diseases	14%
Malaria	7%
Measles	1%
Congenital anomalies	4%
HIV/AIDS	2%
Non-communicable diseases (post-natal)	4%
Other Causes	7

The Millennium Development Goals signed by 189 countries aim at a 2/3 reduction in the global Child Mortality Rate between 1990 and 2015. This was thought unlikely to be achieved when the half way mark had passed. The two regions of the world with the most serious deficiencies in child health are Sub-Saharan Africa and South Asia. Two thirds of deaths are in 10 countries. However even within these two regions there are enormous variations, thus in India child mortality in Kerala was 18.8/1000 as compared to 137.6/1000 in Madhya Pradesh

Of the 6.3 million children who died before age 5 years in 2013, 51.8% (3.257 million) died of infectious causes and 44% (2.761 million) died in the neonatal period. The three leading causes are preterm birth complications (0.965 million [15.4%, uncertainty range (UR) 9.8–24.5]; UR 0.615–1.537 million), pneumonia (0.935 million [14.9%, 13.0–16.8]; 0.817–1.057 million), and intrapartum-related complications (0.662 million [10.5%, 6.7–16.8]; 0.421–1.054 million). Reductions in pneumonia,

diarrhoea, and measles collectively were responsible for half of the 3.6 million fewer deaths recorded in 2013 versus 2000. Causes with the slowest progress were congenital, preterm, neonatal sepsis, injury, and other causes. If present trends continue, 4.4 million children younger than 5 years will still die in 2030. Furthermore, sub-Saharan Africa will have 33% of the births and 60% of the deaths in 2030, compared with 25% and 50% in 2013, respectively.

Economic differences are the biggest underlying cause (80%) of continued ill-health in children, coupled with gender inequality, lack of schooling and empowerment of women and girls. However there are other major barriers: lack of access to basic health care and to sound public health measures. Vaccination and Vitamin A supplementation coverage have shown high and sustained coverage but the treatment of acute childhood illness has lagged behind. These deficiencies can be overcome even in poor settings as was shown in Kerala. Two thirds of child deaths occur in rural areas but in some settings slum dwellers have very high levels such as in Kenya where slum dwellers have a child mortality rate of 150.6/1000 compared to 113/1000 in rural areas. Of the estimated 6.3 million child deaths (under-5) world wide in 2013, 2.8 million were in the neonatal period (first 28 days of life). As child mortality improves so the proportion of neonatal deaths increases. Thus in populations with the highest child mortality, neonatal deaths account for 20% of the total whereas in those with Child Mortality ratios below 35/1000, neonatal deaths account for more than 50% of the total.

**Immediate underlying causes of child mortality** include unsafe and inadequate water, lack of access to sanitation, exposure to indoor smoke, short birth spacing, lack of breast feeding (non-breastfed children are 11 times more likely to die of diarrhoeal disease than exclusively breastfed children), (those not breast-fed in the first 5 months of life have a 7-fold increased risk of dying from diarrhoea and a 5-fold increased risk of dying from pneumonia). Those who have **non-exclusive breast feeding** have a 2-fold increase in deaths from diarrhoea and pneumonia compared with those who have exclusive breast-feeding. The benefits of maintaining breast-feeding up to one year are clear in preventing death and disease.

**After the neonatal period there are 5 immediate causes that account for 70% of all child deaths:** diarrhoeal diseases, pneumonia, malaria, measles, and malnutrition with the last being a factor in 45% of all child deaths (61% in diarrhoeal deaths are undernourished, 57% in malaria, 53% in pneumonia, 45% in measles). In children with vitamin-A deficiency the risk of dying from diarrhoea, measles and pneumonia is increased by 20-24%. Zinc deficiency increases the risk of dying from diarrhoea, pneumonia and malaria by 13-21%. In 2010 20 million children were suffering from severe acute malnutrition.

### **Preventive interventions**

1. Exclusive breast-feeding for 6 months and then continued breast-feeding up to at least 1 year and preferably 2 years. (non-breastfed children are 11 times more likely to die of diarrhoeal disease than exclusively breastfed children).
2. Sound complementary feeding beginning at 6 months and then gradually going over to the diet of older children and the rest of the family by 1 year with extra numbers of meals in poor families compared to adults (where 1 meal a day may be the norm).
3. Sleeping under insecticide treated bed-nets to prevent malaria.
4. In settings with high endemicity for malaria, intermittent presumptive treatment (IPT) may be

warranted to prevent severe anaemia especially in younger children.

5. Water, sanitation and hand-hygiene programmes to prevent diarrhoea (with an extra bonus that hand-hygiene reduces the risk of pneumonia).

6. Vitamin-A supplements where deficiency is significant.

7. Zinc supplements where deficiency is significant.

8. Clean delivery, anti-natal tetanus vaccination, antibiotics for premature rupture of membranes, ante-natal steroids where premature labour is imminent.

9. The use of the "kangaroo method" for maintaining close contact between mother and child, stabilizing breathing and circulation, reducing stress, improving breast-feeding and preventing hypothermia.

10. Measles vaccination, Whooping cough vaccination, where affordable Hib vaccination, and the improved conjugate pneumococcal vaccination where available.

By significantly scaling up the delivery of life-saving vaccines in developing countries to 90 percent coverage—including new vaccines to prevent severe diarrhoea and pneumonia— we could prevent the deaths of some 7.6 million children under 5 from 2010-2019. An additional 1.1 million children could be saved with the rapid introduction of a malaria vaccine beginning in 2014, bringing the total number of potential lives saved to 8.7 million. Bill and Melinda Gates announced recently (2012) that their foundation will commit \$10 billion over the next 10 years to help research, develop and deliver vaccines for the world's poorest countries.

New WHO data show that global vaccination rates have reached all-time highs, rebounding from years of decline in the 1990s. Between 2000 and 2009, the percentage of children receiving the basic DTP3 vaccine in the poorest countries of the world jumped from 66 percent to 79 percent, the highest on record. The number of people who died of measles worldwide fell by 77 percent between 2000 and 2008, and in Africa, measles deaths fell by 92 percent.

### **Treatment interventions**

1. Oral rehydration therapy for acute diarrhoea

2. Antibiotics for dysentery

3. Antibiotics for pneumonia

4. Antimalarials preferably with Artemisinin combination therapy (ACT) in *P. falciparum*

5. Newborn resuscitation.

6. Antibiotics for dysentery

7. Zinc in diarrhoea and pneumonia

8. Vitamin-A in measles

### **Bellagio Initiative 2003**

An informal consortium of researchers and policy-makers who met in Bellagio, Italy in 2003 showed that we do not need new technology but that if the simple interventions that have already been shown to work were widely available 63% of child deaths could be prevented immediately even without major improvements in the global economy. These are effective, off-the-shelf interventions which would reduce the child deaths world-wide by two thirds. The **major interventions** are: breast-feeding promotion, oral rehydration therapy, micronutrients including Vitamin-A and Zinc, antibiotics for pneumonia and sepsis (as identified by IMCI methods), antimalarials as Artemisinin combination therapy in most areas, safe delivery practices and insecticide treated bednets. Coverage of these basic interventions 2003 was low: exclusive breast-feeding for 6 months 39%, ORS in diarrhoea 20%, insecticide-treated bed-nets for children 2% (now

much higher since 2003), antimalarial and antibiotic availability when needed 10-40%.

It would cost \$USD 5.1 billion to save the lives of 6 million children (the cost per child would be \$USD 1.33 per child) who die of preventable and easily treatable causes each year in the 42 countries where 90% of child deaths occur. This sum is less than 1/2 of the resources which in 2004 went to treatment of HIV / AIDS alone.

In order of **expense per child saved, expressed in USD**, these interventions are as follows starting with the cheapest:

1. Intermittent presumptive treatment of young children against malaria in worst malaria areas (\$26)
2. Measles vaccination (\$30)
3. Antibiotics for Premature rupture of membranes in late pregnancy (\$52)
4. Insecticide treated nets for children to sleep under in malaria areas (\$77)
5. Nevirapine and promoting strict exclusive breast feeding when delivering mothers are HIV positive (\$82)
6. Complementary feeding where nutrition is inadequate (\$158)
7. Tetanus toxoid to mothers during pregnancy and to young children (\$161).
8. Whole range of Expanded programme of immunization (\$165)
9. Vitamin A supplementation where there is deficiency (\$271)
10. Zinc supplementation where there is deficiency (\$301)
11. Promoting in the whole community strict exclusive breast-feeding for 6 months (\$414)
12. Ante-natal steroids in impending premature delivery (\$420)
13. Delivery with skilled attendant (\$653)
14. Water, sanitation and hand-hygiene programmes (\$753)
15. Hemofilus influenza B vaccination (\$1051) but note that generic vaccines are cheaper.

### **Child Survival Initiative 2005**

This was set up to follow progress in the 60 countries with the highest absolute numbers or rates of child mortality. A one-sheet profile is prepared for each country every 2-3 years documenting progress and showing where additional intensified efforts are needed. Country profiles are assessed into 3 categories: "on track", "watch and act" and "high alert." By 2012 not one of the 60 priority countries had achieved acceptable coverage for all the essential survival interventions and only 7 (Bangladesh, Brazil, Egypt, Indonesia, Mexico, Nepal and Philippines) were "on track" to reach the MDG by 2015. 39 countries were assessed as "watch and act." 14 countries were in the category "high alert." Lack of progress was especially evident in the poorest countries, mostly in Sub-Saharan Africa.

Several other initiatives have been launched since Bellagio including the **Partnership for Maternal, Neonatal and Child Health, Accelerated Child Survival and Development**, and the **Global Business Plan for MDG 4 and 5** (on maternal survival), the **Global Health Initiative** May 2009 from USAID, the **Global Partnership on Maternal and Child Health** by USA and Norway launched on March 9th 2011.

### **Integrated Management of Childhood Illness (IMCI)**

This was a major new initiative in child health launched by WHO and UNICEF in 1997. In many low-income-countries 70% of child deaths and three out of four children who are taken to health centres are suffering from one of the 5 conditions: Diarrhoeal diseases, acute respiratory infection, malaria, measles and malnutrition. However many children present with symptoms and signs of more than one condition and so trying to get a single diagnosis for a sick child may be inappropriate in such a setting.

At the most peripheral level in poor countries it is likely that no doctors will be available, no lab, no Xray, and drugs and equipment will be scarce. Also the health workers who are going to deal with sick children may have had almost no formal health training (for many **community health workers** a 6 weeks training is the best they can hope for). As part of IMCI, health workers, including community health workers, were offered an 11-day training in the new programme at hospitals with a large paediatric clinic.

There is a need for a simple strategy using a sound triage system with an algorithm of symptoms and signs that can be taught to health workers at all levels. This will look at acute and chronic illness in children, at their nutrition status, immunization protection and their family and social support.

An enthusiastic group of doctors with wide experience from poor communities in various parts of the world worked to make this as scientifically and practically based as was possible. The key person was a paediatrician from New Zealand, Jim Tulloch.

### **The IMCI strategy focusses on 6 steps:**

**Assess for general danger signs: lethargy or unconsciousness, inability to breast-feed or drink, vomiting everything, history of convulsions.** Then ask about the common symptoms of the important diseases with: *cough or difficulty in breathing, diarrhoea, fever, ear problems*, other symptoms. For each of these if present carry out an assessment to decide the level of gravity of the illness in order to determine treatment.

**Classify the illness** depending on whether there are any danger signs and whether the specific signs of severe illness of any of the main diseases is present. These will be sorted into three groups: those with *severe illness* that need emergency treatment immediately, and then, if possible, referral to a hospital or bigger centre with specialized facilities for dealing with this level of danger to the child, *moderate illness* that can be dealt with at the village clinic or rural health centre, and *mild illness* that can be dealt with at home with advice being given to the mother.

**Treat the specific illness** or several illnesses that have been identified and decide on the basis of the classification where this treatment will take place. For all with severe illness, emergency treatment will be started immediately before referral and attempts will be made to fulfil this treatment on site when referral is impossible.

**Instruct on continuing treatment at home** when this is appropriate and vaccinate where this is needed

**Counsel the mother about feeding** including breast feeding and better nutrition support which

will be needed in a sick child. Then counsel the mother about her own health.

**Follow-up** so as to check that treatment has been effective and that no other problems have emerged.

## Acute Respiratory Infections (ARI) 2016

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*ARI accounts for 20% of consultations, 30% of work absences, 75% of antibiotic prescriptions*

ARI is the commonest cause of illness in the world. It is estimated that annually there are 2000 million episodes of ARI of which 1 in 50 are cases of pneumonia; between 10-20% of those with pneumonia die. In cities on average a person has 5-8 episodes per year whilst in the countryside the figure is 3-4 episodes per year. Pneumonia accounts for 15% of all deaths of children under 5 years old, killing an estimated 922 000 children in 2015. In 1998 this figure was 3 million in 2004, 1.8 million, 2011 1.2 million and 2015 0.92 million. ARI is the third biggest cause of death at all ages (behind ischaemic heart disease and cerebrovascular disease) and is still the leading cause of childhood death.

UNICEF estimated that 2.7 million people died from illnesses caused by air pollution (both adults and children). Recently WHO has estimated that 5.5 million die of air pollution each year (see p. 25,26 Primary Health Care). Of these 90% occurred in developing countries and as many as 80% i.e. 2.2 million were due to indoor air pollution (adults and children being exposed to smoke from cooking fires in a setting where there is no proper stove or chimney). A study in Karachi, Pakistan showed that the introduction of consistent hand washing with soap in a community can reduce the incidence of pneumonia by 50% (2005).

In an average out-patients department 20-50% come with an ARI and 20-30% of all admissions are due to lung infections. These figures increase when HIV prevalence is high.

### Divided into:

- 1. Upper Respiratory Tract Infections (URTI)** which is all infections in the respiratory tract down to the larynx. This includes the common cold, pharyngitis, tonsillitis, otitis media and externa, sinusitis, stomatitis etc.
- 2. Lower Respiratory Tract Infections (LRTI)** which is all infections below the larynx. This includes pneumonia, bronchitis, bronchiolitis, empyema, lung abscess etc.

### Upper Respiratory Tract Infections

The only examples of URTI that are life-threatening are epiglottitis and diphtheria. However there can occasionally be severe complications of tonsillitis, otitis media and sinusitis.

#### The Common Cold

There are 200 different viruses that can cause this illness of which 30-50% are due to rhinovirus (with >115 serotypes). During epidemics 70% of URTI is caused by rhinovirus. The next commonest is coronavirus (the same group as SARS) and then adenovirus. The newly detected bocavirus may show itself to be a common cause and may also cause LRTI including pneumonia. The most important aspect of management in these cases is to make the right diagnosis and stop doctors from prescribing antibiotics! It is worth training doctors in actively reducing their risk of prescribing antibiotics unnecessarily

e.g. at the first contact with the mother whose child has ARI saying:

1. "I want to hear a little about the illness of your child just to make quite sure that the child does not need antibiotics" (you have planted a seed in both her mind and in yours that maybe the best is

not to have an antibiotic).

2. After getting a clinical history you then say to the mother: "I would like to examine your child just to make sure that he/she doesn't need an antibiotic" (this is now reinforcing the idea above).

3. If the findings are satisfactory you then tell the mother/father: "Congratulations! Your child only has a viral infection and doesn't need any antibiotic with all the side effects that these can bring." If she is a nurse or doctor or other health worker or a teacher you can give her a name to take home with her: "This is probably a rhinovirus infection." You can even train her/him to use respiratory frequency to identify a worsening condition that now needs to be seen by a health worker.

*"I love the doctors-they are dears;  
But must they spend such years and years  
Investigating such a lot  
Of illnesses which no one's got,  
When everybody, young and old,  
Is frantic with the common cold?  
And I will eat my only hat  
If they know anything of that." Herrick*

### Otitis Media (OM)

In the tropics a higher proportion of these are due to bacteria than in industrialized countries. The most common are Strep. pneumoniae and H. influenzae. These are best treated with 3 days of Penicillin V or Procaine penicillin or Amoxicillin or Cotrimoxazole *especially in children <2yrs, bilateral disease and otorrhoea.*

In Europe the situation is different where 90% of clear-cut cases of otitis media in children 2-12 years are due to viruses which don't need antibiotic treatment. However even these need to be followed up carefully, something which is less likely to take place in a low-income-country. Mastoiditis is a complication of untreated OM especially after measles and/or malnutrition

### Tonsillitis

Many of these infections are due to viruses but some are due to Streptococcus pyogenes (Group A  $\beta$ -haemolytic Strep.).

A child with strep throat will start to develop **other** symptoms within about 3 days e.g.

- Red and white patches in the throat
- Difficulty swallowing
- Red and enlarged tonsils and enlarged and tender lymph nodes
- Nausea or vomiting
- Fever, headache and ear pain

The CENTOR criteria give some idea of Strep cause: *fever, tonsillar exudate, anterior cervical adenopathy, no cough.* Throat swabs have low sensitivity and specificity for a strep cause. Some can be trained to recognize Strep. by the smell. Strep. can cause severe tonsillitis and can result in complications such as glomerulonephritis or carditis. Strep. tonsillitis can be treated with Penicillin V or Benzathine penicillin or Procaine penicillin. Delay of two days in starting treatment gives 20% less recurrences. If it persists or recrudesces you can add an oral cephalosporin such as cefadroxil, or clindamycin (here it is not due to resistance of the streptococcus to penicillin but because other organisms nearby break down penicillin and so destroy its impact).

### Lower Respiratory Tract Infections

There are three important basic facts:



1. Acute Respiratory Tract Infections cause around 1.8 million deaths per year (2004). Nearly all deaths due to respiratory tract infections are due to pneumonia.
2. Most pneumonia in developing countries is due to bacteria with two major causes: *Strep. pneumoniae* and *Haemophilus influenzae*. Less common causes are *Staphylococci*, *Strep. pyogenes*, *Klebsiella* etc.
3. All countries in the world use too many antibiotics in dealing with acute respiratory infections. Overuse of antibiotics in ARI is the single biggest cause of antibiotic resistance developing.

### **Bacterial Lung Infection**

This is the commonest reason for admitting children with an acute respiratory infection. Thirty percent of all deaths in children are due to pneumonia in developing countries. There 70% of all pneumonias are caused by bacteria. Of the viruses that can cause pneumonia the commonest are measles, respiratory syncytial virus (RSV) and parainfluenza 3 virus with influenza and adenovirus less common..

### **Why is pneumonia such a threat in poor countries?**

#### ***The Effects of Malnutrition:***

1. This damages especially the cell-mediated immunity with atrophy of the thymus, lymph nodes and poor formation of lymphocytes. Malnutrition increases the risk of acquiring pneumonia 10 to 12 fold and increases the risk of dying 7-fold. Of severely malnourished children who are admitted to hospital with pneumonia 90% die.
2. Vitamin A lack especially damages cell-mediated-immunity (CMI) and leads to damage of mucous membranes and slow repair of epithelial tissues. Replacement of Vitamin A where there is deficiency, diminishes deaths from pneumonia.
3. Lack of breast feeding. Breast-feeding has a protective effect against developing or dying from pneumonia.

#### ***Low birth weight***

This occurs in 15-30% of all births in developing countries. These children have double the risk of dying in pneumonia compared to children with a normal birth weight.

#### ***Indoor air pollution***

As noted above where cooking is carried out with biofuels in kitchens without a chimney and with poor ventilation, children exposed to this smoke have a higher risk of ARI. UNICEF estimated that 2.2 million children who died of pneumonia had been exposed to too much indoor smoke. Introduction of appropriate technology in making stoves with chimneys using local skills and materials has a potential to bring huge benefits to families.

#### ***Poor personal hygiene***

A study in a slum area of Karachi, Pakistan showed that by introducing consistent hand washing with soap in a community the incidence of pneumonia was reduced.

### **WHO's Guidelines for Management of ARI in children 0-5 years**

These guidelines help to distinguish pneumonia from other forms of ARI, to identify sinister signs of severe pneumonia, to decide where treatment can take place (in the home, at a health unit or for referral to a more central hospital) and above all to decide when to give antibiotics in the 3-5% of ARI due to pneumonia and not to give them in the 95-97% due to viruses.

Central to making the diagnosis pneumonia in all children with cough or difficulty with breathing

are the use of the *respiratory rate* and looking for *indrawing of the lower chest* during inspiration.

These **two signs are sensitive indicators of pneumonia in children:**

**\*Under 2 months any respiratory rate above 60/min. is significant**

**\*2-12 months any rate above 50/min. is significant**

**\*12 months to 5 years any rate above 40/min is significant.**

If an increased rate is combined with indrawing of the lower chest during inspiration then this is virtually specific for pneumonia. Other possible causes to consider are bronchiolitis, asthma or heart-failure.

*Precautions when counting respiratory rate:*

1. The child must be quiet, at rest when counting
2. Exclude if possible asthma, heart failure, severe anaemia, or effects of high fever.
3. Look for evidence of malnutrition (where pneumonia could be present in the absence of increased breathing rate) and meningitis. If possible add auscultation, percussion and a chest Xray to help in making the diagnosis but these are not as sensitive as breathing rate.

*There are two significant questions to ask the mother:*

1. If the child is younger than 2 months, ask if the child has stopped feeding well.
2. If the child is 2 months or more ask if the child is able to drink normally.

*Signs of special significance*

Inspiratory stridor while the child is calm, severe malnutrition, a child who is abnormally sleepy or difficult to wake, a child who has had convulsions. Such children need special care.

**Classification (children 2/12 to 5 years)**

1. **Very severe pneumonia:** a child with central cyanosis or who is not able to drink. Refer urgently to hospital or if referral is impossible try to give the following: treat with oxygen, chloramphenicol i.v., or i.m., and twice daily assessment
2. **Severe pneumonia:** fast breathing + indrawing of chest. Able to drink. No cyanosis. Refer to hospital or failing this: treat with Benzyl penicillin. Daily assessment.
3. **Pneumonia:** fast breathing. No chest indrawing. Treat with Cotrimoxazole or amoxycillin at home.
4. **No pneumonia,** i.e. a viral respiratory tract infection: No fast breathing or chest indrawing. Congratulations! Your child doesn't need an antibiotic. It probably has a viral infection such as rhinovirus. Give it warm lemon drinks with honey. ?Vitamin C

**Conclusion**

Two key clinical signs: fast breathing, chest indrawing

Two additional markers of severity: Cyanosis, inability to drink

**Appropriate technology**

If you are working in an area with health workers who cannot count or who do not possess watches you can still diagnose pneumonia in children with an acute respiratory infection by the sign of fast breathing.

Construct 3 pendulae using string and a stone (*or better still a single pendulum with silver tape at the three levels and then hold the string at the appropriate spot to give the required length*):

one with string **25cms long**; when it is swung will oscillate at 60 times/min.

one with string that is **36 cms long**; will oscillate at 50 times a minute

one that is **56 cms long**; will oscillate at 40 times a minute

Find out the age of the baby. If it is 0-2 months old use the first pendulum, if it is 2-12 months use the second, and if it is 1-5 years use the third.

Sit or lay the baby on its mother's lap so that you can watch its rate of breathing next to the pendulum of the appropriate length. If the baby breathes faster than the pendulum swings, it has pneumonia and needs an antibiotic. If slower the child does not have pneumonia and should not be given any antibiotic

### **Main Messages**

- \* Reduce the use of antibiotics.
- \* Reassure staff and parents.
- \* Train all staff to recognize the four markers above.
- \* Rely less on expensive technology.
- \* Go broadly rather than deeply.

### **The Effects of Malnutrition on Pneumonia:**

1. Malnutrition damages the cell-mediated immune system of the body with wasting of key parts of the immune system such as the thymus, lymph nodes and poor formation of lymphocytes.
  2. Making a diagnosis of pneumonia in severe malnutrition may be difficult because a malnourished child may be too weak to show the cardinal signs e.g. fever, fast breathing, indrawing. However 70% of these children have bacteraemia and so antibiotics are given.
  3. These malnourished children with pneumonia are especially at risk of dying.
- Thus all severely malnourished children with a cough or difficulty with breathing should be treated with broad spectrum antibiotics.

### **The effects of Pneumonia on malnutrition**

1. The poor appetite, blocked nose, and fast breathing may interfere with feeding.
2. Fever increases breakdown of tissues (catabolism) and the child needs more food.
3. Nausea, vomiting and diarrhoea may all accompany pneumonia and increase the nutritional risks.

### **Diagnosing pneumonia in adults**

Underlying risk factors such as HIV infection, smoking, exposure to air pollution and alcohol abuse are worth identifying. The breathing frequency is still of use and any previously healthy adult with no underlying lung, heart or chest disease who breathes faster than 25/min is likely to have pneumonia or sepsis. A breathing frequency faster than 30/min is a sign of severe pneumonia or sepsis. Following the breathing frequency is a useful sign of whether treatment is effective. Of course adults have a higher prevalence of other lung/heart conditions than children. These conditions include chronic obstructive lung disease and heart failure that give increased rate of breathing even in the absence of pneumonia or sepsis.

Auscultation is somewhat easier in adults than in children to identify fine crepitations maximal at the height of inspiration and/or bronchial breathing both of which give high diagnostic accuracy. If the pneumonia has occurred in a cluster within a family especially if it has a less dramatic onset think of mycoplasma as a cause. If this cluster is in a hotel or old age home or where there is central

air conditioning such as in hospital think of legionella especially if the illness is more serious in its impact with muscle pain, confusion and effects on the liver. If breathlessness is the dominant symptom think of a viral pneumonia or PCP (in immune deficiency) or an atypical pneumonia. If there are pleuritic symptoms with pain at the height of inspiration and focal pain at coughing, pneumococcal pneumonia with lobar pneumonia is more likely. The “pointing sign” (where a patient after coughing against resistance can point accurately to where the pain is maximal) is a good predictor of lobar pneumonia and often shows earlier than any signs at auscultation. The two causes of pneumonia with the most dramatic clinical course are pneumococcus and legionella and delay in diagnosing and starting treatment can be life-threatening. If there is treatment failure with a deteriorating clinical course think of a wrong diagnosis or the need to change antibiotics e.g. to cover legionella. It may also show that a complication has occurred such as empyema or a lung abscess. In HIV think of PCP and do not exclude TB until there is a good response to ordinary antibiotics although usually the clinical course is less acute. However in children it may come quickly.

## Treatment

In low-income-countries with early pneumonia give Tab. cotrimoxazole 480mg 2x2 or doxycycline 200mg stat, then 100mg daily is usually effective and very cheap. In more severe disease give benzyl penicillin 120mg/kg/day i.v. or i.m. in 3-5 divided doses for 5-7 days. In richer countries if lobar pneumonia with pneumococci is clearly shown, choose Benzyl penicillin unless there are penicillin resistant pneumococci in the community. Other alternatives that may be appropriate in richer countries if legionella or atypical pneumonia are suspected, clarithromycin 250 mg x 2 or moxifloxacin 400mg once daily. In low-income-countries atypical pneumonia causes less than 10% of pneumonias and if suspected is treated with doxycycline. The prevalence of legionella in the tropics is unknown but it is believed to occur world-wide. Nosocomial pneumonia has greater risk of gram negative organisms and is usually treated with wider spectrum antibiotics. In rich countries such may include cefotaxime with tobramycin, or meropenem. In low-income-countries gentamicin + chloramphenicol is a good choice. In aspiration pneumonia anaerobes and G- organisms may need to be covered in any treatment regime but new evidence suggests that Benzyl penicillin is still the drug of choice. In rich countries in treatment failure with penicillin, clindamycin + ciprofloxacin or meropenem or ceftazidime are good alternatives. In low-income-countries gentamicin + chloramphenicol again is a good choice. If PCP is likely in HIV infection with an insidious onset, much more dyspnoea and hypoxia than what auscultation or the chest Xray suggests, consider giving high dose cotrimoxazole 20mg trimethoprim + 100mg sulfamethoxazole/kg body weight /day in divided doses and in severe cases together with prednisolone 40-80mg/day for the first week and then reduce the dose over the next two weeks.

In March 2007 WHO and UNICEF launched a **Global Action Plan for Pneumonia (GAPP)** with focus on better case diagnosis and management, vaccination against measles, pertussis, HiB and the new conjugate pneumococcus vaccine, improving environmental health by reducing indoor air pollution and better hand washing, improved nutrition including micronutrients such as Vitamin A and Zinc and cotrimoxazole prophylaxis for children with HIV, encouraging exclusive breast-feeding for 6 months, better weaning foods and improved nutrition and micronutrient supplementation in childhood, reducing low birth weight by malaria protection, better nutrition for pregnant women, screening and treatment for syphilis and HIV in pregnancy.

# Measles 2016

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Measles is the most infectious disease known to man. Globally immunization prevents 80 million cases/yr and 4.5 million deaths/yr.

Before measles vaccine was introduced in 1963 around 5.7 million people died each year from this disease. During the prevaccine era, more than 90 percent of children acquired measles by age 15. Further back in 1900 this figure was thought to be 7 million/year. It is still one of the 5 commonest causes of death in children. In 1980 it caused 2.5 million deaths. (with 75 million sick). By 1992 this had decreased to 1 million deaths from 25 million cases and by 1997 800 000 deaths with 1/2 in Africa. Since 2000 measles deaths have fallen globally from 562 000 to 122 000 in 2012, i.e. a 78% decrease with 83% of the world's children receiving at least one dose of measles vaccine and 700 million doses being given in this period. In 2012, global measles immunization coverage was 84% among children aged 12–23 months. During 2000–2012, estimated measles deaths decreased by 78% from 562 000 to 122 000. In 2014 the numbers of deaths declined somewhat to 114,900.

In 2001 and 2002 the **measles initiative** was launched by WHO, UNICEF, American Red Cross, US centre for disease control and prevention and the UN Foundation. This helped to implement measles strategies in 19 countries in Africa with 70 million children vaccinated. Between 2000 and 2007 deaths due to measles in Africa have decreased by 89% from 395 000 to 45 000. However recent outbreaks occurred in Malawi and Zambia.

In 1989 and 1990 the World Health Assembly and the World Summit for Children set a target of reducing measles morbidity by 90% and mortality by 95% by 2010 with a long-term goal of measles eradication. This is possible since it is almost a disease of man only. In contrast to polio where 10 oral vaccinations may be needed to get good immunity in poor communities with much diarrhoeal disease, only one or a maximum of 2 doses are needed in measles.

It causes a case fatality of 1-5% in developing countries and 10% in those who are undernourished (this was as high as 25% in the early studies by Morley in Nigeria, recently in Sudan 33% and in some epidemics it can reach 40% and it may have been the cause of 80% of Incas dying in 15th century middle-America). In developed countries there is one death per 3000 cases.

Prior to the vaccine nearly all children contracted measles and there were epidemics even in the rich countries of the world every 2-5 years. 99% of adults had serologic evidence of past measles. WHO hopes that by 2010 it could envisage a global eradication ahead.

## Reasons for greater severity in Developing Countries

1. *Greater dose of virus.* Tends to come in epidemics in the cold season with overcrowding and poor ventilation. Overcrowded refugee camps are a classic high risk setting. Secondary cases have a higher case fatality rate than index cases: 23% versus 1%. Secondary cases have a higher mortality when infected by someone of the opposite sex. Nobody knows why this should be.
2. *Younger age.* The average age is 17 months. Compare this with an average age of 3-4 years in Europe before vaccination came (now 5 years and rising).
3. *Malnutrition.*

**The incubation period is 10-14 days (median 11 days) and the child is contagious from around 4**

**days prior to rash appearing until 4-5 days (longer in malnourished) after the rash disappears.**

Spread by droplets. Highly infectious. Attack rates in home contacts are around 90%.

Passive immunity from mother to child gives protection for 3 months and some defence up to 6-9 months. However 20-40% of measles cases are between 6-12 months.

Measles is caused by an RNA virus of the paramyxovirus family. It spreads to the reticuloendothelial tissue especially at the back of the throat and lungs. It lyses epithelial cells and damages the immune response. It causes paralysis of the cilia in the respiratory system which opens the way for secondary infections.

### **Clinical**

A case definition is of a generalized rash and fever and one of the following: cough, runny nose or red eyes. When measles occurs linked to HIV the symptoms may be hidden or less apparent.

The child usually has 3-4 days of fever, coryza, cough, malaise, conjunctivitis. Then Koplik's spots appear on the 3rd. or 4th. day of the illness: these look like tiny grey-white grains of sand on a red background on the posterior buccal mucosa.

The rash usually appears on the 14th day after exposure to the virus when the fever is high (39° or more). The rash usually starts behind the ears and the hairline, on the forehead, then to the face, trunk, arms, buttocks, and reaches the legs after 3 days. the rash lasts on average for 4 days and then starts to fade as the temperature goes down with wide-spread desquamation.

By the time the rash is generalized, the child has a raw red mouth.

There is commonly diarrhoea due to the viral invasion of the lining of the intestine with denudation of the micro-villi.

### **Complications**

Measles damages the cell-mediated immunity and so there is greater risk for secondary infection caused by ordinary bacteria but also by fungi and TB.

Respiratory: Otitis media with risk for mastoiditis, croup, laryngotracheobronchitis, pneumonia (75% of deaths in measles are due to pneumonia), flare-up of TB

Malnutrition: due to anorexia, stomatitis, diarrhoea. There is an increased need due to fever, poor digestion with decrease in enzymes.

Severe conjunctivitis which may lead to corneal ulcers and blindness especially if there is a Vitamin A lack. Here the risk of blindness is 50% with measles being the main cause of blindness in children. There may be secondary herpes simplex in the eyes.

Gastro-intestinal: Mouth ulcers may make feeding difficult. Diarrhoea is due to the viral invasion of enterocytes but also due to secondary infection with fungi, parasites, bacteria. Prolonged *Cryptosporidium* enteritis mimics that in HIV/ AIDS.

CNS: Febrile convulsions are the commonest CNS complication. In about 1/1000 cases there are CNS manifestations with encephalitis especially in immunosuppressed children. This risk is higher than with any other childhood infectious disease and is more sinister with a mortality rate of 10-15% and 25% of survivors having permanent brain damage. A rare very late complication is Subacute Sclerosing Panencephalitis occurring on average 6 1/2 years after the measles attack with profound dementia leading inevitably to death within a year. It is due to persisting measles virus in the brain.

Gangrene of extremities is an unusual complication

### **The effects of malnutrition on Measles (10% case fatality rate)**

1. The body needs good cell-mediated immunity as well as humoral immunity to overcome a measles infection especially in the early stages to stop the very widespread invasion of the whole

body. Cell mediated immune deficiency is especially a feature of severe malnutrition. When linked to HIV the effects can be devastating.

2. Vitamin-A deficiency is especially dangerous with a high risk of pneumonia complications and severe eye damage.

3. The virus remains in the body for a longer period in a malnourished child with the risk of infecting others. All contacts need to be immunized.

### **The effects of measles on nutrition**

1. Malnutrition is the most frequent late complication of measles for children in poor countries. Almost all children lose weight and many take many weeks or months to regain this weight. A study in Nigeria showed that 25% of children lost 10% or more of their body weight during measles infection.

A specific complication is cancrum oris or noma where there is sloughing of the tissues of the face around the mouth especially when kwashiorkor is complicated by measles and there is poor dental hygiene. It is caused by Vincent's organisms and fusiformis bacteria sensitive to a combination of penicillin and metronidazole. There is often herpes simplex as a secondary invader. The severe infection causes local gangrene due to circulatory disturbance.

2. During the illness the increased catabolism due to the fever increases the nutritional demands.

3. The anorexia, nausea, vomiting and blocked nose may all interfere with feeding

4. The diarrhoea in measles causes the child to lose considerable amounts of protein. Vomiting makes feeding difficult.

5. The sore mouth and pharynx (especially if a fungal invasion increases this soreness) interferes with feeding.

6. There is poor digestion due to damage to the enzyme production.

These children who have had measles need follow up with extra nutritional supplementation for several months. If there is poor weight gain, suspect active TB and investigate and treat as necessary. Delayed mortality is at least 2-3 times higher among previous measles cases than among controls. *In Bangladesh measles vaccination was accompanied by 36% reduction in child mortality even though acute measles only accounted for 4% of deaths in this group.*

### **Prevention**

The live attenuated measles vaccine was introduced in the United States in 1967, but already in 1962 David Morley by special consent was able to vaccinate virtually all children in the Ilesha district of Nigeria thereby reducing measles deaths by 78%. By giving a live attenuated vaccine: the standard way in most parts of the world was to give a single dose at 9 months which gave 85% efficacy in protection. Now in the Measles Initiative two doses are recommended one at 9 months (6 months in an epidemic) and one at 1 year. A vaccination coverage of 90% is needed to reduce or interrupt transmission. After 1 decade of this Initiative 2011, 1 billion children had been vaccinated. Targeted vaccination campaigns reached 700 million children from 2000 to 2008 resulting in a 78% decline in measles deaths. A single vaccination costs US\$ 0.85-1.10 per child when done by National Immunization Days as was done in Southern Africa (7 countries) between 1996-2000. Of this cost US\$ 0.25 was the cost of vaccine, injection equipment and disposal boxes. 24 million children between 9/12 and 14 yrs were vaccinated with a coverage of 91% and reported cases of measles went down from 60 000 cases in 1996 to 117 cases in 2000 and reported deaths from measles from 166 in 1996 to zero in 2000. This was an impressive result given the high prevalence of HIV which

theoretically might interfere with the immune response.

**In 2012 measles immunization coverage is holding steady at 85% and 145 countries have introduced a routine second dose of the vaccine to ensure immunity and stop outbreaks. In addition 145 million children were vaccinated during mass campaigns in 2012 and reached more than 1 billion since 2000.** According to WHO and UNICEF estimates, global routine coverage with a first dose of measles vaccine increased between 2000 and 2013 from 72 to 85 percent, and 76 percent of countries included two doses of measles-containing vaccine regimens.

**More than 60% of the 21.5 million children who did not receive one dose of measles vaccine in 2013 came from only 6 countries: India 6.4 million, Nigeria 1.7 m., Ethiopia 1.1 m., Indonesia 0.7 m., DR Congo 0.7 m.**

In 2014, about 85% of the world's children received one dose of measles vaccine by their first birthday through routine health services – up from 73% in 2000.

During 2000-2014, measles vaccination prevented an estimated 17.1 million deaths making measles vaccine one of the best buys in public health.

It may also be used in a refugee camp where overcrowded conditions can lead to massive epidemics. Measles vaccination is one of the earliest health interventions needed when a catastrophe causes people to flee to a place where a camp is established. In one study by giving measles vaccination to all children admitted to hospital there was (in those with pneumonia or gastroenteritis) a 49% reduction of mortality rates in African children.

If a measles case is admitted to a general paediatric ward by mistake the whole ward of those over 6 months should immediately be vaccinated including even those who have been vaccinated before since the risk of secondary cases is so high.

Other important measures are improving nutrition especially Vitamin A status, decreasing overcrowding and improving access to health care. Expensive human g-globulin gives passive protection 5 days post exposure.

### **Treatment of clinical measles**

1. Vitamin A 200 000 units orally immediately on making the diagnosis in children over 1 year and 100 000 units to those under 1 year. Repeat after 24 hrs. This reduces case fatality rates by up to 50% in areas with Vit A deficiency.
2. Tetracycline (or chloramphenicol) eye ointment after wiping away pus with moist cotton wool.
3. Gentian violet (or a topical antifungal such as clotrimazole) to the mouth to prevent or treat candida.
4. Any secondary fever or evidence of pneumonia or stridor with purulent sputum or otitis media or skin infection give broad spectrum antibiotics e.g. chloramphenicol.
5. High calorie diet. Add extra vegetable oil to the food to increase its calorie content.
6. ? Steam if croup is severe with stridor. If available 1 ml adrenaline 1:1000 mixed with 1 ml of saline can be given by nebulizer. Some may need a tracheostomy.
7. Rinse the mouth with clean water with a pinch of salt 4 times a day. Apply gentian violet to any mouth sores. If any deep mouth ulcers are detected give an antibiotic with penicillin and metronidazole as well as extra vitamins and minerals (including zinc). This could prevent the ghastly complication of Cancrum oris where aggressive infection in the tissues of the cheek and face causes ischaemia and necrosis which can be on a major scale.
8. In Senegal it was shown that prophylactic antibiotics to all measles cases decreased mortality in an epidemic.
9. Oral rehydration therapy is often needed when diarrhoea is significant but all need extra fluid.



I.v. fluid may be needed for the very dehydrated but with malnourished cases caution is needed in all rehydration in not overloading with sodium.

10. Anticonvulsants will be needed when there are convulsions. These may be due to the encephalitis but could also be due to dehydration or febrile convulsions. Malaria is less likely to be a cause for convulsions when measles is present but is worth excluding.

**Target:** The Measles Initiative has a target of reducing measles mortality by 95% by 2015 (compared to 2000) and eventually leading to eradication.

Measles is one of the leading causes of death among young children even though a safe and cost-effective vaccine is available.

In 2014, there were 114 900 measles deaths globally – about 314 deaths every day or 13 deaths every hour.

Measles vaccination resulted in a 79% drop in measles deaths between 2000 and 2014 worldwide.

In 2014, about 85% of the world's children received one dose of measles vaccine by their first birthday through routine health services – up from 73% in 2000.

During 2000-2014, measles vaccination prevented an estimated 17.1 million deaths making measles vaccine one of the best buys in public health.

## Malnutrition in LIC 2016

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### Introduction

It is often emphasized that there are two main forms of malnutrition: **Malnutrition + and Malnutrition -**. The former is now at a higher level than the former. However in this compendium only the latter will be studied.

**Global hunger affects nearly a billion people.** The **five major forms of malnutrition** worldwide are: Protein-energy malnutrition, iron, iodine, zinc and vitamin A deficiencies. These deficiencies affect the mental, physical and emotional development of children and adults. They also impact on economic productivity.

**Globally 45% of childhood deaths are directly or indirectly due to malnutrition** with effects varying between different illnesses. Malnutrition is a significant factor in diarrhoea deaths in 61%, malaria 57%, pneumonia 52% and measles 45% i.e. 2.6 million of the total of 6.9 million child deaths globally (2010). The worst affected areas are sub-Saharan Africa, South Asia and Burma (Myanmar), North Korea and Indonesia. Huge problems in some communities to control or treat TB, diarrhoeal disease, malaria, measles, HIV and whooping cough are linked to a major risk of severe malnutrition. There are an estimated 1.02 billion children who are undernourished in 2008 and most of these are among the 1.3 billion people living in extreme poverty (living on <USD 1.25/ person/day).

**Globally 27% of all children are stunted** (170 million) and in India this is 48%. Stunted children will on average earn 20% less when adults than non-stunted. However over the last 20 years there has been a significant positive shift of the curve for distribution of the height and weight of children in most countries of the world indicating some improvement in the general nutrition although the food price crisis in 2007/8 has had a negative effect. In Sub-Saharan Africa the number of people in extreme poverty has increased over the last two decades mainly due to the debt crisis, conflicts and diseases such as malaria and HIV/AIDS. There will almost certainly be an increase in both stunting and wasting in at least 7 countries in this region.

### **Malnutrition on average reduces GNP in the poorest countries by 2-3%**

Specific areas of malnutrition include **Vitamin A deficiency** affecting 100-140 million children with up to 500 000 becoming blind each year as a result. **Iron deficiency** affects 2 billion people and in pregnant women **anaemia** contributes to 20% of all maternal deaths. **Iodine deficiency** affects 740 million people and results in mental impairment in at least 50 million with many others failing to achieve their potential educational goals.

Refugees are at great risk of malnutrition with 36 million in this risk group.

**In 2008 a package of 13 direct interventions** - such as Vit.A and zinc supplements, iodised salt, promotion of healthy behaviour such as regular handwashing, exclusive breast-feeding and complementary feeding practices - were proven to have an impact on nutrition and health of children and mothers. These were identified in an article in Lancet. They could prevent 2 million deaths if delivered to children in the 36 countries that are home to 90% of the malnourished children and reduce stunting by 36%. This would cost USD 10-12 billion.

In a best practice setting even severe malnutrition should not have a mortality exceeding 5% but in practice there are many areas where the mortality is around 50% for these severely ill children.

Some of this failure to achieve good results is from the persistence of:

#### ***4 myths which lead to errors of management:***

- a. The assumption that a low plasma albumin is the basis of oedema and can be effectively treated with a high protein diet. The old idea that kwashiorkor was due to protein deficiency and marasmus due to calorie deficiency is a lie. Too early introduction of high protein diets to kwashiorkor children killed many as their liver went into failure.
- b. Trusting in the use of diuretics to treat oedema. Many are already dehydrated and have sepsis such that diuretics could kill them.
- c. Belief in the early use of iron to treat anaemia. Iron supplementation at this stage stimulates bacterial growth and 70% of the severest malnourished already have bacteraemia which will become life-threatening especially if iron is given.
- d. Early introduction of catch-up feeding is dangerous before dealing with the life-threatening trio of **hypoglycaemia, hypothermia and infection** as well as marked fluid and electrolyte disturbances.

### **Effects of malnutrition**

The body's coping mechanism comes devastatingly into play in severe malnutrition:

1. Energy consumption is reduced by stopping growth, decreasing physical activity, reducing the work in many organs (heart, liver and kidneys), the active pump in cells pushing potassium in and sodium out is reduced or stopped, the response to infections is reduced or stopped e.g. less fever and less inflammation.
2. Body fat is used for energy, and muscle and other tissues are broken down for energy

### **Clinical assessment of undernutrition: wasting and stunting**

There are at least three stages in the downward spiral of malnutrition. The first step is failure to grow and develop normally. This is followed by a child becoming underweight or stunted or both, and can end with a child who is obviously unwell with marasmus, kwashiorkor or a combination of both as marasmic-kwashiorkor. Many of the early stages will be missed unless children are

followed up and weighed regularly since many of these will look normal if rather thin but otherwise well.

**Stunting** is a condition where the child is short for its age. It is often a sign of chronic malnutrition over a longer period.

**Wasting** is a condition where a child is underweight for its age and loses muscle and fat. It is a sign of current and often recent malnutrition.

A child who is both stunted and wasted indicates both long-standing and recent malnutrition.

The *height for age chart* is the best method to diagnose stunting. Any child who is less than 90% of the expected standard is stunted. For wasting, the *weight-for-age* chart or the *weight-for-height* chart is the best method. Any child who is under 80% of the standard is wasted. A simpler method in wasting is to measure *mid-upper-arm circumference* (MUAC) which normally remains almost unchanged from the age of 1-5 years. Normal circumference at this age is around 16.5 cms. There is one cut-off point which is at 14 cms and below this the child is moderately wasted. A second level which shows severe wasting is if the circumference is below 12.5 cms.

There are some important preceding factors that may be involved and these are worth asking about. Any recent famine, disaster, migration or family loss is important to know about. Other questions include the birth weight of the child, the mother's age (either very young or very old mothers are at a greater risk of having a child who becomes malnourished), where the child has lived over the past three months. In some cultures the practice of leaving the child in the care of a grandmother or another relative may expose the child to a greater risk of malnutrition. If the child has suffered from an inter-current infection such as malaria, measles, diarrhoea, or a respiratory infection, this makes the child who is marginally undernourished vulnerable to sliding into true malnutrition.

If there is tuberculosis in the family, the child may have been exposed to the bacilli and may show malnutrition especially in a slightly older age-group (3-4 years). This may be the first sign of active tuberculosis.

One of the most important questions especially in younger children is the history of the breast-feeding pattern. This includes asking about the length of breast-feeding, how often, and whether or not this was exclusive.

### **Dominant causes of malnutrition vary with age**

These are as follows:

**0-6 months:** Failure to breast feed dominates.

**6-12 months:** Here the risk increases with infections. The child's age and nature of complementary food is critical as well as whether breast-feeding is still being given.

**1-3 years:** This is the commonest age where malnutrition shows clinically. The risk is increased if the child is sent away to a grandmother or if famine or a family crisis supervenes. This is the time where kwashiorkor is most common.

**3-5 years:** Here the picture is dominated by tuberculosis and HIV/ AIDS. However, in times of famine or disaster, pure lack of food may become the main cause at any age. At all ages and especially in marginal groups heavy intestinal worm infestation may tip the balance towards malnutrition.

### **Damage to the body's functions**

1. The liver cannot cope with large quantities of protein in the diet and makes less glucose.
2. The heart becomes smaller and weaker and cannot cope with excess fluids.

3. The gut wall becomes thinner, more porous and makes less digestive enzymes with resultant decrease in digestive and absorptive capacity.
4. The kidneys cannot cope with excess sodium or fluid.
5. Cell walls become "leaky" with potassium and magnesium leaking out and sodium leaking in. This means that the body finally has too little potassium and magnesium and too much sodium. With excess sodium comes excess fluid leading to oedema.

## Most severe forms of malnutrition: marasmus and kwashiorkor

### Marasmus

Here the child is often under two years of age and if there has been failure to breast feed it may be under 1 year. There is usually extremely low weight for age under 60% of the standard with evident extreme wasting of arms, legs and buttocks. The child may show a face that looks old. There is usually a pot-belly. The child may be irritable and fretful but is often alert and hungry unless there



is an active infection. .

### Child with Marasmus

### **Kwashiorkor** (named by Cicely Williams in Ghana from the Ga language - "the displaced one")

This child is usually 1-3 years. There is oedema of the face, legs and arms. There is often a moon face and the child has usually a moderately low weight for age around 60-80% of the standard. There are wasted muscles especially over the shoulders, upper arms, and the scapulae. There is often a pot belly and the muscles are usually flabby. The child is usually miserable and apathetic

with poor or no appetite. It is often pale, thin with peeling skin where dark “flaky paint” contrasts against pale “milk chocolate” coloured skin. The hair is often sparse and thin with a lighter colour and with poor roots so that it can easily be pulled out. It often has a reddish tinge. There is usually an enlarged liver.



Fig. 17-2 A child with kwashiorkor.

### Cell and biochemical damage

In all three of the above there is a major imbalance between the potential for **damage by free radicals** and the **protective antioxidant systems**. Infection, oxidative bursts and free iron all contribute to the risk for damage. Children with oedematous malnutrition have **severely reduced levels of glutathione** in blood and mortality is greatest in those with impaired activity of glutathione peroxidase. Marked malnutrition reduces the activity of the sodium/potassium pump with an imbalance in the distribution of electrolytes and fluids. The cell membranes become more “leaky” as ATP runs out and leads inevitably to **low intracellular potassium and high intracellular sodium**. Protein synthesis begins to shut down and all cell processes are damaged. Immune systems collapse and the microvilli of the intestine become more porous allowing bowel organisms into the blood stream. **Kwashiorkor is always severe malnutrition + infection or a toxin such as aflatoxin or extreme lack of antioxidants or micronutrients.**

The first serious attack on the protein deficiency hypothesis came from Gopalan who examined the diets of village children in India. He could find no antecedent dietary difference between those who developed marasmus and those who developed kwashiorkor. Michael Golden then showed in Jamaica that kwashiorkor patients treated with low protein diets made a marked clinical improvement without any change in their plasma albumen and they lost all their oedema. Their survival was better than those children given a high protein diet in the early stages. In fact they

were on a diet that had less protein than what they had before becoming ill. The rate of loss of oedema was entirely independent of the protein content of their diet. Further studies in adults with kwashiorkor by McCance showed the same results.

### **Treatment in malnutrition**

There are three overall **aims of treatment** in malnutrition:

- \*to help recovery from severe complications including infections
- \*to regain lost weight so that weight-for-height returns to the normal range
- \*to grow at a healthy rate

### **Three stages of treatment:**

**resuscitation, early catch-up phase, late catch -up phase.**

### **Interventions needed to achieve these aims:**

#### *Medical*

**1. Treatment of dehydration:** when this is needed be careful not to overload with sodium.

Potassium is needed in higher levels than in other children. Even children with gross oedema in kwashiorkor may be hypovolaemic because of the maldistribution of electrolytes and water. They are thus “dehydrated” in their blood system and need rehydration treatment. Rehydration should be with low sodium, high potassium fluids such as **Resomal (water 2 litres, WHO-ORS 1 packet, sucrose 50 g, electrolyte/mineral solution 40 ml)**.

**2. Treatment of infections.** Virtually all children with severe malnutrition have multiple infections and up to **70% in the severest cases will have bacteria in their blood stream**. Thus in this group all should be treated with broad-spectrum antibiotics such as **chloramphenicol** or **penicillin + gentamicin**. They sometimes don't show up shadows on their chest xrays in pneumonia or pyuria in urinary tract infection as their immune system is so depressed that severe infection can take place without significant inflammation. Fever is often absent and tachypnoea may be absent in pneumonia. Some add **metronidazole** to reduce the bacterial overgrowth in the bowel.

**3. Keeping the body at normal temperature.** Severe malnutrition often leads to hypothermia even in the tropics. A blanket and radiant heat and frequent feeding are needed.

**4. Hypoglycaemia** is common in severe malnutrition and they need frequent feeds day and night to survive, in the worst cases hourly. Occasionally i.v. glucose 50% may be needed if they do not respond.

**5. Mineral, vitamin and micronutrient supplementation.** All severely malnourished children are deficient in **potassium, magnesium** and those with chronic diarrhoea and with skin changes are short of **zinc**. **Zinc and Vitamin-A are important in healing the microvilli**. Zinc supplementation reduces the incidence, frequency, severity and persistence of diarrhoeal disease. Many are short of copper, iodine and selenium.

*Be wary of iron supplementation in the early phases* as free transferrin exerts bacteriostatic effects and if bound to iron this is lost. If anaemia is severe rather give a blood transfusion 10 mls/kg. Most are short of folic acid, vitamin A, niacin, riboflavin, and other vitamins.

#### *Dietary*

Feeding at three stages:

**Resuscitation** - usually with a milk mixture aiming at 400kJ/kg body weight per day for children

6-24 months. The amount of protein should be kept low at this stage with 0.6 g/kg/day. While the anorexia is severe this might have to be by tube feeding. If there is serious hypoglycaemia and hypothermia feeding may need to be hourly day and night. A voracious appetite usually signals the end of the resuscitation phase.

**Early Catch-up phase** - build up the calorie intake slowly and thereafter the protein intake. The number of feeds can now be reduced. If suddenly high energy refeeding is introduced too early the child may develop cardiac failure, profuse diarrhoea and circulatory collapse.

**Late Catch-up phase** - high energy feeds

Return to good mixed meals using family foods

Vitamin and mineral supplements including iron if they are anaemic.

### **Failure to respond**

Any child who fails to respond to the above measures within 3 weeks must be assessed carefully for other possible causes of malnutrition especially TB or HIV.

***Social and emotional.*** These aspects are at least as important as the first two  
Comfort, affection, and mental stimulation for the child

Support and sympathy for the family

Help with the family's social problems

Counselling for AIDS if necessary

### ***Educational***

Show the family how to feed the child

Talk with the family about the children's food needs

Encourage mothers to learn from each other in the ward

If available follow up with a period in a Nutrition unit with practical experience of better cultivating and preparation of the most nutritious foods that are appropriate and affordable locally.

## **Conclusion**

*"We are guilty of many errors and many faults, but our worst crime is abandoning the children, neglecting the foundation of life. Many of the things we need can wait. The child cannot. Right now is the time his bones are being formed, his blood is being made and his senses are being developed.*

*To him we cannot answer "Tomorrow". His name is "Today"."*

Gabriela Mistral, 1948

### **Progress in MDG 4 Child Health and reducing Child Mortality Ratio**

Even with the limitations that certain areas of the world have faced progress has been impressive:

<b>Area</b>	<b>Year CMR</b>		<b>Year CMR</b>	
<b>Sub-Saharan Africa</b>	<b>1990</b>	<b>179</b>	<b>2013</b>	<b>92</b>
<b>West and Central Africa</b>	<b>1990</b>	<b>197</b>	<b>2013</b>	<b>109</b>
<b>Eastern and Southern Africa</b>	<b>1990</b>	<b>165</b>	<b>2013</b>	<b>74</b>

<b>South Asia</b>	<b>1990</b>	<b>129</b>	<b>2013</b>	<b>57</b>
<b>Middle East and North Africa</b>	<b>1990</b>	<b>70</b>	<b>2013</b>	<b>31</b>
<b>East Asia and Pacific</b>	<b>1990</b>	<b>58</b>	<b>2013</b>	<b>19</b>
<b>Latin America Caribbean</b>	<b>1990</b>	<b>54</b>	<b>2013</b>	<b>18</b>

## **Appendix - the current debate about the best solutions 2013**

Food security and malnutrition remain some global development's biggest challenges. Latest UN figures show that 870 million people were chronically undernourished between 2010–12; the vast majority of whom, 850 million, live in developing countries. Yet despite this the UN's Scaling Up Nutrition (SUN) movement said in its report that 2012 was the year "when chronic under-nutrition moved from the side-lines to the centre". It argues that the international community has now realised the need to shift focus from simply food quantity, to one of food quality. In a word: nutrition.

There are, however, differing views as to how best to increase nutrition levels. Monique Mikhail, policy adviser on sustainable agriculture at Oxfam, welcomes initiatives such as SUN, which has 28 developing country government members. But she and many others in the NGO community fear that international efforts to target government agricultural policies often result in more cereals to be sold as export, rather than the locally-produced diverse foods needed to improve nutrition. "A lot of the discourse out there is pushing this large-scale, mono-culture model, without realising the impacts of that on communities", says Mikhail. "Land is being taken away from small-scale producers."

**The World Bank** identifies **five 'pathways'** that link food production to nutrition: subsistence-oriented production, income-oriented production for sale in markets, increased agricultural production, empowerment of women to control household food and health, and macroeconomic growth.

But in practice, one is favoured over another. According to SUN, a 2005 Ethiopian health survey found that chronic malnutrition was highest in its most agriculturally productive regions. The inference was large-scale production can lead directly to export, or simply a lack of local food diversity. It is a problem that Samuel Hauenstein Swan, senior policy adviser, Action Against Hunger, recognises. "Malawi promoted corn (maize) – it didn't dramatically improve the food security of the people, but it dramatically improved the exports. They are one of the big maize exporters now. But did that reduce the numbers of stunting? Not really ... ministers of agriculture are still focussed on these very few grains while nutritious crops like sweet potatoes are not easily commercial."

NGOs working on the ground, therefore, are increasingly promoting small-scale food production within communities. Cristina Ruiz, humanitarian programme unit manager, Africa, at Christian Aid, has recently returned from two years in the Sahel region of Africa – one of the world's most malnourished regions. "We start by working with communities to do a capacity assessment, which lasts for two or three days in a community, conducting an in-depth analysis of the risks and threats they face and the capacity they have in the community to deal with that", she explains. "Out of that comes an action plan for how they could improve their resilience to those risks."

The Sahel's staples of millet and maize, of low nutritional value and severely diminished by years of drought, are now supplemented by market gardening, says Ruiz. "We help them to grow vegetables they can eat but also sell as a cash crop locally. That has been the biggest change and the biggest success. You need water to do that – so we have been providing bore holes and solar



pumps."

Mikhail also advises that development professionals look to small-scale farming when addressing malnutrition. "Small-scale livestock is also incredibly important. Consuming more meat, milk and protein contributes greatly to your overall nutritional status in a way that allows you to absorb vitamins from the other vegetable products," he says.

Crucially NGOs seem to be finding more success by concentrating their efforts on women. The FAO argues that when women have control over household income, more money tends to be spent on items that improve nutrition and health. Mikhail agrees: "The important role that women play as carers, food producers and providers is the critical nexus for improving agricultural production, increasing production, as well as improving the quality and nutrition at consumption ... I think where we had mainly fallen short in the past was that we hadn't focussed directly on women." Hauenstein Swan believes that food security remains dominated by calorie intake and food aid. But he says the knowledge now exists to move beyond that towards resilience, empowerment and hardier, more nutritious staples such as sweet potato, QP Maize and golden rice, rather than allocating vast amounts of land for export crops. "On the global level", he says, "you can't escape nutrition now when you talk about food security."

### **A field guide nutrition checklist**

1. Identify the scale and cause of undernutrition. Collect information about the magnitude of undernutrition, its causes and severity. Then identify and target the most vulnerable groups, especially pregnant mothers and children under two.
2. Assess food consumption patterns. Gain an understanding of what the community eats, where they obtain food, and the nutritional gaps.
3. Assess the level of government commitment. Look at the national nutrition strategy and policy framework and the level of current/planned budget to roll that out, including local representation and extension services.
4. Identify care and health practices. This includes informal care –mothers, siblings, fathers, as well as formal health care services in the area.
5. Promote biodiversity and sustainable agricultural practices.
6. Give women the means to empower themselves.
7. Promote the production and consumption of meat, dairy products and fish (where available).
8. Reach out through multiple channels. Home visits, agricultural extension services, nutrition counselling, women's groups, dramas and storytelling. These could be combined with other essential health services such as immunisation.

## **Breaking News**

### **Lancet article on malnutrition: Maternal and Child Nutrition**

**Published June 6, 2013**

Malnutrition is the underlying cause of death for at least 3.1 million children, accounting for 45% of all deaths among children under the age of five and stunting growth among a further 165 million, according to a set of reports released ahead of a nutrition summit in London.

The shocking figures, published in the Lancet on Thursday, emerged as world leaders prepare to meet on Saturday to pledge extra money for nutrition, ahead of the G8 summit of industrialised countries on 17 June.

"The Lancet series today shocked us into a new truth: undernutrition is an even deadlier threat to child survival than we ever thought," said Molly Kinder, director of agriculture and nutrition policy at ONE, the anti-poverty group. "These alarming facts are now irrefutable. Undernutrition is responsible for 600,000 more child deaths each year than was previously realised."

The latest Lancet reports follow the journal's series in 2008, which helped put nutrition on the development agenda.

"Countries will not be able to break out of poverty or sustain economic advances when so much of their population is unable to achieve the nutritional security that is needed for a healthy and productive life," said Professor Robert Black, of Johns Hopkins Bloomberg School of Public Health, who led the Lancet research.

"Our findings strengthen the evidence that good nutrition is a fundamental driver of a wide range of development goals, and while the impetus for improving nutrition today is stronger than ever, the costs of inaction are enormous."

Aid for basic nutrition came to \$418m in 2011, only 0.4% of total official development assistance. Similarly, nutrition has been a low government priority in Africa.

Saturday's nutrition summit, co-hosted by the UK, Brazil and the Children's Investment Fund Foundation (CIFF), is expected to see financial pledges from rich governments and declarations of commitments from poor countries.

Aid campaigners, who see the summit as the biggest opportunity in a decade to secure financial and political commitments on nutrition, expect pledges that will take the overall figure for nutrition to between \$600m and \$800m a year. Enough Food For Everyone IF, a coalition of more than 200 NGOs and faith groups, which is holding a rally in Hyde Park on Saturday to coincide with the summit, is calling for \$1bn a year by 2015.

Even if the summit comes up with more money, it will fall far short of the \$9.6bn a year the Lancet says is needed to reduce the number of deaths from malnutrition among under-fives by 1 million. The money would be targeted at 34 countries with high malnutrition rates, supporting interventions identified in the 2008 Lancet series as cost-effective. These include exclusive breastfeeding and appropriate, healthy foods for infants; providing mothers and children with sufficient vitamins and minerals, including vitamin A and zinc supplements, iodised salt, and other micronutrient powders and fortified foods; and the prevention and treatment of cases of acute, severe malnutrition.

Maternal nutrition is also crucial, said the Lancet, not just for the mother's own survival, but for her child's chances of survival and development. Undernourished women are more likely to die in pregnancy, to give birth prematurely, and to have babies who are too small for their gestational age. Iron and calcium deficiency are identified as key contributors to maternal death, putting mothers at increased risk of anaemia and pre-eclampsia; maternal iron deficiency is also found to be associated with low birth weight.

"They [governments] need to do something as they have so many stunted children," said Kinder. "They need to come up with money."

Brazil has been one of the success stories in reducing malnutrition. Daniel Silva Balaban, a director at the UN World Food Programme who was involved in Brazil's nutrition policy, emphasised that hunger and malnutrition was a political problem, not an economic one.

"When countries have the political will to tackle malnutrition, it is possible to deal with it, for example in Rwanda," he said.

Balaban pointed out that the success of a school feeding programme key to Brazil's success in tackling malnutrition involved not just the ministry of education but also the co-operation of the education, health, social development and finance ministries.

"You also need a line in the budget to show that you believe in the programme and that you have a plan," he said. "You put what money you can in the budget and donors can support you in finding the money."

Balaban said it was important to create a legal framework so that the commitment to tackle malnutrition outlasts any government changes. He also stressed the need to enlist the public, including smallholder farmers who can provide produce directly to school or municipalities.

The Lancet's 2008 series stimulated political commitment to a reduction in malnutrition and led to the creation of the Scaling up Nutrition (Sun) movement, which emphasises the importance of a child's first 1,000 days. National commitment in poorer countries is growing, donor funding is increasing, and civil society and the private sector are more engaged.

"Undernutrition has a complex set of political, social and economic causes, none of which are amenable to easy solutions that fit within the timeframe of a single political cycle," said Dr Richard Horton, editor-in-chief of the Lancet.

"For this reason, the outlook today for nutrition is not wholly good. However, the forthcoming nutrition for growth event in London and G8 leaders' summit present an immediate opportunity to foster political support for the interventions that can be quickly scaled up or linked to nutrition programmes."

## **Breaking News**

### **JAMA article on Estimates of Global Prevalence of Childhood Underweight in 1990 and 2015 Published June 2, 2014**

Worldwide, underweight prevalence was projected to decline from 26.5% in 1990 to 17.6% in 2015, a change of -34% (95% confidence interval [CI], -43% to -23%). In developed countries, the prevalence was estimated to decrease from 1.6% to 0.9%, a change of -41% (95% CI, -92% to 343%). In developing regions, the prevalence was forecasted to decline from 30.2% to 19.3%, a change of -36% (95% CI, -45% to -26%). In Africa, the prevalence of underweight was forecasted to increase from 24.0% to 26.8%, a change of 12% (95% CI, 8%-16%). In Asia, the prevalence was estimated to decrease from 35.1% to 18.5%, a change of -47% (95% CI, -58% to -34%). Worldwide, the number of

underweight children was projected to decline from 163.8 million in 1990 to 113.4 million in 2015, a change of  $-31\%$  (95% CI,  $-40\%$  to  $-20\%$ ). Numbers are projected to decrease in all subregions except the subregions of sub-Saharan, Eastern, Middle, and Western Africa, which are expected to experience substantial increases in the number of underweight children.

In Africa, the prevalence of underweight was forecasted to increase from  $24.0\%$  in 1990 to  $26.8\%$  in 2015, a change of  $12\%$  (95% CI,  $8\%$ - $16\%$ ). The prevalence of childhood underweight was estimated to increase in sub-Saharan Africa by  $9\%$  (from  $26.8\%$  to  $29.2\%$ ) and in Eastern Africa by  $25\%$  (from  $26.7\%$  to  $33.3\%$ ). The prevalence of childhood underweight was projected to be reduced by  $15\%$  for Middle Africa;  $5\%$ , Southern Africa; and  $6\%$ , Western Africa. Only Northern Africa, with a forecasted reduction in the prevalence of childhood underweight from  $9.5\%$  to  $4.2\%$ , was estimated to reach the Millennium Development goal.

In Asia, between 1990 and 2015 the prevalence was estimated to decrease from  $35.1\%$  to  $18.5\%$ , a change of  $-47\%$  (95% CI,  $-58\%$  to  $-34\%$ ). The largest decline was estimated in Eastern Asia, where the prevalence of underweight children was forecasted to decrease by  $84\%$  in the same period. Southeastern and South Central Asia were also forecasted to experience substantial improvements, with reductions in the prevalence of underweight of  $49\%$  and  $42\%$ , respectively. However, both subregions are projected to still have high levels of childhood underweight in 2015. Western Asia was estimated to be the Asian subregion with the lowest reduction in the prevalence of childhood underweight ( $29\%$ ).

According to our analysis, despite an overall improvement on the global situation, neither the world as a whole nor the developing regions are expected to achieve the goal. This is largely due to the deteriorating situation in Africa where all subregions, with the exception of Northern Africa, are expected to fail to meet the goal. Moreover, sub-Saharan and Eastern Africa are forecasted to experience an increase in the prevalence of underweight children during the 25-year period. In Asia, Eastern Asia (mainly driven by China), and Southeastern Asia are forecasted to reach the goal, while South Central and Western Asia are not. Moreover, our estimates project that in 2015, most subregions in Africa and South Central Asia will continue to have very high prevalences of underweight children. According to our projections, all subregions in Latin America will achieve the Millennium goal.

The vast majority of underweight children live in developing regions, mainly in Asia and Africa. The projected trends in the prevalence of underweight children combined with the different population growth these regions are experiencing (increasing in Africa, decreasing in Asia)<sup>11</sup> will narrow the gap between their respective contributions to the total number of underweight children. While in 1990, of 100 underweight children, 80 were estimated to live in Asia and 16 in Africa; in 2015, these numbers are expected to change to 60 and 38, respectively, if recent trends continue.

## PROGRESS IN REDUCING MALNUTRITION 2015

Two sets of global targets exist for nutrition, both ratified by the world's health ministers at the World Health Assembly (WHA) in 2012-2013. The first set relates to maternal and child nutrition. Here the world is making some progress, albeit too slowly and unevenly. The second set relates to adult overweight and diabetes. Here the world is failing to meet the global target of halting the rise in the prevalence of these conditions.

### MATERNAL AND CHILD NUTRITION

To measure countries' progress on maternal and child nutrition, data on five of the six WHA global targets are tracked: stunting, wasting, and overweight among children under age 5; anaemia in women 15–49 years of age; and rates of exclusive breastfeeding for infants younger than 6 months. Nearly every country (70 of the 74 for which data exist) is on course to meet at least one of the five global targets. This breadth of performance is good news. However, only one country (Kenya) is on course to meet all five WHA maternal and child nutrition targets, and only four (Colombia, Ghana, Vanuatu, and Vietnam) are on course to meet four targets.

Target by target, countries' performance varies tremendously. Only 3 percent of countries are on course to meet the anaemia target, whereas 41 percent of countries (32 of 78) are on course to meet the target on exclusive breast-feeding

## Conclusion

*"We are guilty of many errors and many faults, but our worst crime is abandoning the children, neglecting the foundation of life. Many of the things we need can wait. The child cannot. Right now is the time his bones are being formed, his blood is being made and his senses are being developed.*

*To him we cannot answer "Tomorrow". His name is "Today"."*

## Breaking news:

**16 SEPTEMBER 2014 | NEW YORK** - New data released today by the United Nations show that under-five mortality rates have dropped by 49% between 1990 and 2013. The average annual reduction has accelerated – in some countries it has even tripled – but overall progress is still short of meeting the global target of a two-thirds decrease in under-five mortality by 2015.

New estimates in "Levels and Trends in Child Mortality 2014" show that in 2013, 6.3 million children under five died from mostly preventable causes, around 200 000 fewer than in 2012, but still equal to nearly 17 000 child deaths each day.

"There has been dramatic and accelerating progress in reducing mortality among children, and the data prove that success is possible even for poorly resourced countries," said Mickey Chopra, head UNICEF's of global health programmes. "There is now a gathering momentum from countries in every part of the world to make sure proven, cost-effective interventions are applied where they will save the most lives."

In 2013, 2.8 million babies died within the first month of life, which represents about 44% of all under-five deaths. About two-thirds of these deaths occurred in just 10 countries. While the number of neo-natal deaths have declined, progress has been slower than for the overall under-five mortality rate.

In June this year, WHO, UNICEF and partners issued the first-ever global plan to end preventable newborn deaths and stillbirths by 2035. The Every Newborn Action Plan calls for all countries to take steps to provide basic, cost-effective health services – in particular around the time of childbirth, as well as for small and sick babies – and to improve the quality of care.

"The global community is poised to end preventable maternal, newborn and child deaths within a

generation."

### **Dr Flavia Bustreo, WHO Assistant Director-General**

"The global community is poised to end preventable maternal, newborn and child deaths within a generation," said Dr Flavia Bustreo, Assistant Director General at WHO. "We know what to do and we know how to do it. The challenge now is to move from plan to action – we are pleased to see countries like India beginning to lead the way."

Among the report's other major findings:

Eight of the 60 countries identified as 'high mortality countries' – with at least 40 under-five deaths for every 1000 live births – have already reached or surpassed the MDG target (67% reduction). The countries are Malawi (72%), Bangladesh (71%), Liberia (71%), Tanzania (69%), Ethiopia (69%), Timor-Leste (68%), Niger (68%) and Eritrea (67%).

Eastern Asia, Latin America and the Caribbean and Northern Africa, have already reduced the under-five mortality rate by more than two-thirds since 1990.

Two countries, India (21%) and Nigeria (13%), together account for more than one-third of deaths among children below 5 years of age.

While Sub-Saharan Africa has cut under-five mortality rates by 48% since 1990, it still has the world's highest rate – 92 deaths per 1000 live births – nearly 15 times the average in high-income countries.

Children born in Angola, which has the highest under-five mortality rate in the world (167 deaths per 1000 live births), are 84 times more likely to die before the age of five than children born in Luxembourg, with the lowest rate (2). Within countries, relative wealth, education, and location are key – a child's risk of dying increases if she or he is born in a remote rural area, into a poor household or to a mother with no education.

The leading causes of under-five deaths are pre-term birth complications (17%); pneumonia (15%); complications during labour and delivery (11%); diarrhoea (9%); and malaria (7%). Under-nutrition contributes to nearly half of all under-five deaths.

"For continued progress, it is essential to invest more in health systems that deliver high-quality, affordable services to all women and children who need them," said Olusoji Adeyi, Director of Health, Nutrition and Population at the World Bank Group.

The report notes that major improvements in child survival are in part due to affordable, evidence-based interventions against the leading infectious diseases, such as immunization, insecticide-treated mosquito nets, rehydration treatment for diarrhoea, nutritional supplements and therapeutic foods. The major causes of neonatal mortality – pre-term birth complications (35%) or problems during delivery or birth (24%) – require health interventions closely linked with protecting maternal health.

## **UNICEFs report from 2012 on progress in MDG 4**

In the last decade alone, progress on reducing child deaths has accelerated, with the annual rate of decline in the global under-five mortality rate rising from 1.8% in 1990-2000 to 3.2% in 2000-2011.

Between 1990 and 2011, nine low-income countries — Bangladesh, Cambodia, Ethiopia, Liberia, Madagascar, Malawi, Nepal, Niger and Rwanda — reduced their under-five mortality rate by 60% or more.

Nineteen middle-income countries, among them Brazil, China, Mexico and Turkey, and 10 high-income countries, including Estonia, Oman, Portugal and Saudi Arabia, are also making great

progress, reducing under-five mortality by two-thirds or more over the same period.

On average, around 19,000 children still die every day from largely preventable causes.

More than four-fifths of all under-five deaths in 2011 occurred in sub-Saharan Africa and South Asia. Given the prospect that these regions, especially sub-Saharan Africa, will account for the bulk of the world's births in the next years, we must give new impetus to the global momentum to reduce under-five deaths.

Pneumonia is the leading killer of children under 5, causing 18% of all child deaths worldwide — a loss of roughly 1.3 million lives in 2011. Most of these deaths occur in sub-Saharan Africa and South Asia.

Diarrhoea is still a major killer of children under 5, although its toll has dropped by a third over the past decade, from 1.2 million deaths in 2000 to 0.7 million in 2011.<sup>a</sup> Diarrhoeal diseases now cause about 11% of child deaths worldwide. Nine-tenths of these deaths occur in sub-Saharan Africa and South Asia. Deaths are largely preventable through optimal breastfeeding practices (non-breastfed children are 11 times more likely to die of diarrhoeal disease than exclusively breastfed children), adequate nutrition, vaccinations (including for rotavirus), handwashing with soap, and safe drinking water and basic sanitation, among other measures. Open defecation, which is still practised by around 1.1 billion people worldwide, remains a major contributing factor to diarrhoeal disease.

Effective treatment of diarrhoeal disease rests on three key interventions: administration of oral rehydration salt (ORS) solutions to prevent life-threatening dehydration; continued feeding; and zinc supplementation. ORS is the 'gold standard' for rehydration therapy; a formulation developed in the early 2000s (low-osmolarity ORS) has improved overall outcomes. Continued feeding supports fluid absorption and nutritional status. Zinc, a recently added component of standard diarrhoeal treatments, reduces the duration and severity of illness.

These inexpensive life-saving treatments remain inaccessible for the vast majority of children in the poorest countries, and those in the poorest groups within countries. Even more worrisome is the lack of any real progress in expanding treatment coverage since 2000. Globally, less than one-third of children with diarrhoea receive ORS. Zinc use is also low.

Malaria is among the biggest killers of children under 5, accounting for 7% of child deaths worldwide — a loss of roughly 0.5 million lives in 2011. Nearly all of these deaths occur in sub-Saharan Africa. Nevertheless, the last decade has seen substantial gains in combating malaria transmission and reducing deaths. Global financing for malaria control has risen substantially over the past decade, thanks in large part to efforts by the Global Fund to Fight AIDS, Malaria and Tuberculosis; the US President's Malaria Initiative; and the World Bank Malaria Booster Program. Today, about half of all African households have Impregnated bed nets (ITN).

The proportion of children under 5 in Africa that sleep under ITNs has risen from 2% in 2000 to 38% in 2010,<sup>b</sup> with some countries attaining levels of over 60%

About 40% of all under-five deaths are neonatal, occurring during the first 28 days of life; in 2011

this amounted to 3 million deaths worldwide. The heaviest burdens are in South Asia and sub-Saharan Africa, which have both the highest neonatal mortality rates among regions and the largest numbers of annual births.

The majority of neonatal deaths result from complications related to preterm birth (before 37 completed weeks of gestation) or from complications during birth.

An estimated 287,000 maternal deaths occurred in 2010. The lifetime risk of maternal mortality (the probability that a woman will die from complications of pregnancy and childbirth over her lifetime), is 1 in 39 in sub-Saharan Africa, compared with a lifetime risk of 1 in 4,700 in wealthy countries.

### Radio report 13-09-02

Globally 1 million children under 5 die because of absence of breast-feeding and its replacement by bottle feeding.

### Costello et al and Nepal study of Neonatal deaths and MMR - Lancet

**Summary Background** Neonatal deaths in developing countries make the largest contribution to global mortality in children younger than 5 years. 90% of deliveries in the poorest quintile of households happen at home. We postulated that a community-based participatory intervention could significantly reduce neonatal mortality rates.

**Methods** We pair-matched 42 geopolitical clusters in Makwanpur district, Nepal, selected 12 pairs randomly, and randomly assigned one of each pair to intervention or control. In each intervention cluster (average population 7000), a female facilitator convened nine women's group meetings every month. The facilitator supported groups through an action-learning cycle in which they **identified local perinatal problems and formulated strategies to address them**. We monitored birth outcomes in a cohort of 28 931 women, of whom 8% joined the groups. The primary outcome was neonatal mortality rate. Other outcomes included stillbirths and maternal deaths, uptake of antenatal and delivery services, home care practices, infant morbidity, and health-care seeking. Analysis was by intention to treat.

**Findings** From 2001 to 2003, the **neonatal mortality rate was 26.2 per 1000** (76 deaths per 2899 livebirths) in **intervention clusters** compared with **36.9 per 1000** (119 deaths per 3226 livebirths) in **controls** (adjusted odds ratio 0.70 [95% CI 0.53–0.94]). Stillbirth rates were similar in both groups. The **maternal mortality ratio was 69 per 100000** (two deaths per 2899 livebirths) in **intervention clusters** compared with **341 per 100000** (11 deaths per 3226 livebirths) in **control clusters** (0.22 [0.05–0.90]). Women in intervention clusters were more likely to have antenatal care, institutional delivery, trained birth attendance, and hygienic care than were controls. These preliminary impressive results are now being tested in several other settings and the first results from India were equally impressive but from Bangladesh less so. Bigger studies are underway.

## Breaking News neonatal deaths 2014

**One Million Babies Die Globally on the First Day of Their Life, says Save the Children**

**WESTPORT, Conn. (Feb. 24, 2014)** — The first 24 hours of a child's life are the most dangerous, with more than one million babies dying each year on their first and only day of life, according to



new research published today by Save the Children.

The new report, "Ending Newborn Deaths," shows one half of first day deaths around the world could be prevented if the mother and baby had access to free health care and a skilled midwife. The children's aid agency says the deaths happen because of premature birth and complications during birth, such as prolonged labor, pre-eclampsia and infection, which can be avoided if quality health experts are present.

The research also found an additional 1.2 million babies are stillborn each year, their heartbeats stopping during labor because of childbirth complications, maternal infections and hypertension. In a bid to save millions of newborn lives, Save the Children has called on world leaders to commit in 2014 to a blueprint for change – The Five Point Newborn Promise – which focuses on training and equipping enough skilled health workers to make sure no baby is born without proper help, and removing fees for all pregnancy and birth services.

The world has made amazing progress in reducing child mortality during the past decade – nearly halved from 12 million to 6.6 million – thanks to global political action on immunisation, treatment of pneumonia, diarrhoea, and malaria, family planning and nutrition.

But this progress could stall without urgent action to tackle scandalously high numbers of newborns dying. This report warns that newborn deaths now account for nearly half of all under-five deaths.

Carolyn Miles, President and CEO of Save the Children, said:

"The first day of a child's life is the most dangerous, and too many mothers give birth alone on the floor of their home or in the bush without any life-saving help. We hear horror stories of mothers walking for hours during labor to find trained help, all too often ending in tragedy.

"It's criminal that many of these deaths could be averted simply if there was someone on hand to make sure the birth took place safely and who knew what to do in a crisis."

Each year, 40 million women give birth without trained help. In Ethiopia, only 10 percent of births have skilled help whereas in some areas of rural Afghanistan there is just one midwife for 10,000 people.

In countries such as the Democratic Republic of Congo (DRC) or the Central African Republic (CAR), some mothers have to pay for emergency maternal care, often costing as much as their monthly food bill. There have even been reports of mothers being kept under jail-like conditions for months until they have been able to pay for their emergency caesarean.

Carolyn Miles added: "These new statistics reveal – for the first time ever – the true scale of the newborn crisis. The solutions are well-known but need greater political will to give babies a fighting chance of reaching their second day of life. Without targeted action now, progress made in cutting child mortality through vaccines and tackling malnutrition will stall."

Save the Children is calling on world leaders, philanthropists and the private sector to meet and commit to the Five Point Newborn Promise in 2014:

- Issue a defining and accountable declaration to end all preventable newborn mortality, saving 2 million newborn lives a year and stopping the 1.2 million stillbirths during labor
- Ensure that by 2025 every birth is attended by trained and equipped health workers who can deliver essential newborn health interventions
- Increase expenditure on health to at least the WHO minimum of US\$60 per person
- To pay for the training, equipping and support of health workers, and remove user fees for all maternal, newborn and child health services, including emergency obstetric care
- The private sector, including pharmaceutical companies, should help address unmet

needs by developing innovative solutions and increasing availability for the poorest to new and existing products for maternal, newborn and child health.

Of the one million newborns who die within 24 hours of birth 200,000 deaths occur in Pakistan putting them at the top of the list of newborn death rates globally. Child mortality rate in Pakistan is the highest followed by Nigeria, Sierra Leone, Somalia, Afghanistan and several others.

## **Breaking news for Global Child Pneumonia 2014**

*Why the World is Losing More Than 1 Million Children to Pneumonia Every Year*

by: Leith Greenslade, Co-Chair, Child Health, MDG Health Alliance

*Revolution, transformation, breakthrough, modernization, ingenuity, inspiration, invention, innovation.*

This is what is so desperately needed to fight the leading killer of children under five and what we have been lacking for more than a decade. The last great innovation in childhood pneumonia was the introduction of the pneumococcal conjugate vaccine in the United States in 2000. Since then, nothing much has changed in the way we prevent, diagnose and treat childhood pneumonia and this is one of the major reasons more than one million children are dying from pneumonia each year and the world is so off-track to achieve **MDG 4**. Without a revolution in the way we respond to childhood pneumonia and particularly in those parts of the world where deaths are concentrated, we cannot fundamentally advance the health of the world's children.

*Here's what we know.* According to [UNICEF](#), pneumonia kills more children under five than any other single cause – an estimated 1.1 million children in 2012 and 17 percent of all child deaths (6.5 million). 80 percent of deaths are among children under two years of age and 330,000 are among newborns. 60 percent of deaths occur in just six countries – India, Nigeria, Democratic Republic of Congo, China and Ethiopia – because in these high population countries most children with suspected pneumonia are *not* taken to an appropriate health care provider and even fewer receive antibiotic treatment, and the pneumonia-fighting vaccines – especially the pneumococcal vaccine — are often not routinely available. Further the behaviors that protect against pneumonia infection like exclusive breastfeeding, good infant feeding practices, hand washing with soap and reducing indoor air pollution are not widespread practices in countries with high child mortality.

*Here's what we don't know.* Why do most families fail to seek care for a child with suspected pneumonia and why is treatment with antibiotics so low? Is it because families don't recognize the danger signs – rapid breathing, cough, fever and chest indrawing – and don't understand the seriousness of the infection, which can lead to death very quickly? Or is it because they mistake these signs for something else – malaria, a common cold, a spiritual malady – and use the wrong medicine or no medicine at all but a local remedy? And for those children who do make it to a health care professional, how are they diagnosed and treated? Is a respiratory rate counter used to count their breathing; are they referred to another facility for treatment or given antibiotics on the spot? If antibiotics are given, is a full course taken when the child returns home? And if the child is referred to a facility, does the child go and once there what is the quality of treatment provided? Is pulse oximetry used to test for oxygen deprivation and does the facility have a supply of oxygen? And if a child arrives severely ill, can the facility intervene to prevent death?

We don't really know how to answer these questions, but a [2008 study by Karin Källender](#) and colleagues sheds some light onto the path to death for children with pneumonia. This study analyzed all of the deaths of children aged one month to five years from 2005 to 2007 in the Iganga/ Mayuge Demographic Surveillance Site in Uganda. During this period 164 children died, 44 (27

percent) of pneumonia. Importantly, pneumonia was the primary cause of only 12 of the 44 deaths because most children who died were also suffering from other conditions including AIDS and malnutrition, malaria, anemia and diarrhea. At the time of death the majority of children were in hospital (21) with the remainder either at home (14), in a clinic or health center (5) or en route to a health facility (4). A clear pattern of care seeking behavior emerged in this study with most parents opting to treat a sick child at home first using malaria medicines, antibiotics or both either bought from local drug shops or obtained from neighbors or leftover from previous illnesses. Even though most families lived less than an hour from the nearest health facility, children typically had to wait for two days until professional care was sought outside the home, with most being taken to a government hospital or center and a minority to private or NGO clinics. Even after arriving at a facility, one third of children were referred on again. The high proportion of children who died in facilities suggests that children were very sick once they arrived and that the facilities struggled to treat such severely ill children.

What we learn from this study is that we need the kind of innovations that can disrupt every stage of the path to death for children with pneumonia. We need **behavior change innovations** that simultaneously increase both the proportion of children who are taken to qualified health professionals and innovations that decrease the time between onset of symptoms and care seeking. Communications campaigns that educate families about pneumonia – its causes and symptoms, how to prevent it and the high risk of death for small children if you don't act fast – are urgently needed, particularly in the regions where child pneumonia deaths are concentrated. In malaria endemic countries families and health care providers need to know how pneumonia differs from malaria and that home-based management of pneumonia can be deadly. To reduce the time between onset of symptoms and care seeking outside the home, families may need incentives such as vouchers to reduce the cost of seeking care at qualified facilities in both the public and private health sectors (e.g. transport vouchers, free service vouchers, food vouchers) and help with the costs of treatment.

We need **diagnostic innovations** that make it easy for all health workers – from the local drug shop owner to the community health worker to the facility doctor – to diagnose a child with pneumonia accurately, quickly and affordably. The Holy Grail is a point-of-care rapid diagnostic test that can tell you whether a child has viral pneumonia, bacterial pneumonia or malaria, or a combination, in the space of minutes. Such a test does not yet exist but would entirely disrupt the current approach which tries to identify children with pneumonia by counting their rate of breathing using counting beads, handheld timers, mobile applications, or sensors that fit to the child – each with its own limitations in terms of accuracy, affordability and usability. New devices to identify children who need oxygen are also a priority with innovations in pulse oximetry showing great promise but much more investment needed to bring these innovations to market and to wide use in health facilities. It is critically important that all diagnostic innovations are designed to meet the needs of the children most at risk of death from pneumonia – newborns and children under the age of two years.

A variety of **treatment innovations** are needed to give children with pneumonia access to treatment close to home and to lower the burden of treatment compliance on caregivers. In places where most treatment is sought first from local drug shops we need programs to train and equip these providers to treat childhood pneumonia with the recommended antibiotics in child-friendly formulations (i.e. amoxicillin dispersible tablets) and government and NGO-funded community health workers should also be trained and equipped in the same way, with all of the usual caveats on rational use of antibiotics and the need to refer very sick children to the nearest facility. Simplified antibiotic regimens that make it easier for families to comply with treatment will make a

difference and new antibiotic formulations such as one-dose formulations that can be given on the spot by health providers have the potential to revolutionize compliance and treatment coverage. For children who are referred to facilities, supply of oxygen is a major gap (only one of the children in the Källender study received oxygen) and innovations in oxygen concentrators and generators specifically designed for children and for settings without electricity or access to spare parts and technicians are an urgent priority.

And finally we need **integrated delivery innovations** that offer families one-stop shop services where they can have their children immunized against the leading causes of pneumonia, receive guidance and support to practice pneumonia prevention (e.g. exclusive breastfeeding, proper infant feeding, hand washing with soap, reducing indoor air pollution) and return to have their child diagnosed and treated should they suspect pneumonia. Integration of pneumonia and malaria diagnosis and treatment in countries where both are leading killers of children is particularly important as the evidence suggests many children with pneumonia are paying a heavy price for the current lack of coordination and malaria medicines are being wasted on children who do not have malaria. Further, when we know that the children who die from pneumonia are also malnourished and can be suffering from other illnesses including diarrhea and AIDS, we need services that can treat the entire child and not one or two diseases. This is exactly what the new Integrated Global Action Plan for Pneumonia and Diarrhoea recommends and donors need to step up and start investing in integrated solutions and partnering with agencies who can effectively work across the leading disease areas of child survival – particularly pneumonia, diarrhea, malaria and nutrition. On World Pneumonia Day 2013 and with 780 days left to prevent the deaths of an estimated 3.5 million children under five and achieve Millennium Development Goal 4 the call needs to go out to all innovators to step up to fight the leading killer of children under five. We need the best and brightest talent – healthcare professionals, inventors, scientists, academics, entrepreneurs, designers, entertainers, journalists, engineers, students and more – working in partnership on the biggest challenge in child survival. To provide a platform for engagement a Pneumonia Innovations Team has come together with membership from UN agencies, governments, non-profits, corporations, universities and investors from all over the world with a mission to accelerate the development and adoption of the new technologies and practices with the greatest potential to reduce child deaths from pneumonia. *We invite all who have something innovative to contribute to join with us.* Make World Pneumonia Day 2013 the day when you decided to step up to the pneumonia innovation challenge. The next great innovation can be just around the corner...

### **Achievements in MDG 4**

Despite population growth, the number of deaths in children under five worldwide declined from 12.7 million in 1990 to 6.3 million in 2013, which translates into about 17,000 fewer children dying each day.

Since 2000, measles vaccines have averted over 14 million deaths.

Despite determined global progress in reducing child deaths, an increasing proportion of child deaths are in sub-Saharan Africa and Southern Asia. Four out of every five deaths of children under age five occur in these regions.

As the rate of under-five deaths overall declines, the proportion that occurs during the first month after birth is increasing.

Children born into poverty are almost twice as likely to die before the age of five as those from wealthier families.

Children of educated mothers—even mothers with only primary schooling—are more likely to survive than children of mothers with no education.

Globally, significant progress has been made in reducing mortality in children under 5 years of age. In 2012, 6.6 million children under 5 died, compared with 12.6 million in 1990. Between 1990 and 2012, under-5 mortality declined by 47%, from an estimated rate of 90 deaths per 1000 live births to 48. The global rate of decline has also accelerated in recent years – from 1.2% per annum during 1990–1995 to 3.9% during 2005–2012. Despite this improvement, the world is unlikely to achieve the MDG target of a two-thirds reduction in 1990 mortality levels by the year 2015.

More countries are now achieving high levels of immunization coverage; in 2012, 66% of Member States reached at least 90% coverage. In 2012, global measles immunization coverage was 84% among children aged 12–23 months. During 2000–2012, estimated measles deaths decreased by 78% from 562 000 to 122 000.

### **Looking to the future Bill and Melinda Gates foundation.**

What do we expect? Cutting the number of children who die before age 5 in half again. In 1990, one in ten children in the world died before age 5. Today, it's one in 20. By 2030, that number will be one in 40. Almost all countries will include vaccines for diarrhoea and pneumonia, two of the biggest killers of children, in their immunization programs. Better sanitation — through simple actions like hand-washing as well as innovations like new toilets designed especially for poor places — will cut the spread of disease dramatically. And we're learning how to help more mothers adopt practices like proper breastfeeding and skin-to-skin contact with their babies that prevent newborns from dying in the first month after they're born. (Newborn deaths have gone down at a slower rate than deaths of older children and now account for almost half of all child deaths.) Many poor countries have built strong health care systems in the past 25 years, and in the next 15 years other countries will pick up on their ideas and provide more care — and higher quality care — for newborns and young children. Ultimately, this will mean millions of people alive and thriving who would have died.

Wiping polio and three other diseases off the face of the earth. Destroying a disease utterly is a very difficult thing to do — so difficult, in fact, that it's happened only once in history, when smallpox was eradicated in 1980. But if we keep working hard, we can eradicate four diseases by 2030. We can get polio out of Africa this year and out of every country in the world in the next several years. Guinea worm, an incredibly painful disease whose sufferers spend months incapacitated while worms that can be several feet long burst out of their legs, will also be gone soon, thanks in large part to the leadership of President Jimmy Carter and the Carter Center. We'll also see the last of diseases like elephantiasis, river blindness, and blinding trachoma, which disable tens of millions of people in poor countries. The drugs that can stop these scourges are now being donated in huge numbers by pharmaceutical companies, and they're being used

more strategically thanks to advances in digital maps that show where diseases are most prevalent. Last year these free medicines were distributed to 800 million people.

Finding the secret to the destruction of malaria. We won't be able to completely eradicate malaria by 2030, but we will have all the tools we need to do so. These will include a vaccine that prevents people with malaria from spreading it to the mosquitoes that bite them, a single-dose cure that clears the parasite completely out of peoples' bodies, and a diagnostic test that can reveal right away whether a person is infected. Early versions of all these tools are in development now. In 15 years, we'll be poised to send malaria the way of smallpox and polio.

Forcing HIV to a tipping point. As we make progress toward a vaccine or a cure, the number of people beginning treatment in sub-Saharan Africa will finally outstrip the number of people newly infected. When we reach that point in the region with the most dense HIV transmission in the world, cases will start going down everywhere around the globe for the first time since the disease was discovered more than 30 years ago.

This (partial) list of breakthroughs gives a phenomenal picture of how much progress can be made in just 15 years. Life will get better, faster, because the number of innovations reaching the poor will be greater than ever before.

## **Breaking News MDG-4 revised report July 1 2015**

- The global under-five mortality rate has declined by more than half, dropping from 90 to 43 deaths per 1,000 live births between 1990 and 2015.
- Despite population growth in the developing regions, the number of deaths of children under five has declined from 12.7 million in 1990 to almost 6 million in 2015 globally.
- Since the early 1990s, the rate of reduction of under-five mortality has more than tripled globally.
- In sub-Saharan Africa, the annual rate of reduction of under-five mortality was over five times faster during 2005–2013 than it was during 1990–1995.
- Measles vaccination helped prevent nearly 15.6 million deaths between 2000 and 2013. The number of globally reported measles cases declined by 67 per cent for the same period.
- About 84 per cent of children worldwide received at least one dose of measles containing vaccine in 2013, up from 73 per cent in 2000.

### **Breaking news Feb. 2016**

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- Measles vaccination helped prevent nearly 15.6 million deaths between 2000 and 2013.
- About 84 percent of children worldwide received at least one dose of measles-containing vaccine in 2013.
- Every day in 2015, 16,000 children under five continue to die, mostly from preventable causes. Child survival must remain the focus of the post-2015 development agenda.