rotavirus vaccine remains largely unavailable. In 2009 WHO recommended introducing rotavirus vaccine into all national immunization programmes, and in September 2011 the GAVI Alliance approved funding to support rollout of the rotavirus vaccine in 16 developing countries (figure 3.3). By 2015 the GAVI Alliance and its partners plan to support more than 40 of the world’s poorest countries in rolling out the rotavirus vaccine.

Measles and pertussis vaccines

Pneumonia is a serious complication of both measles and pertussis (or whooping cough) and is the most common cause of death associated with these illnesses. An effective vaccine against measles and pertussis (DTP3) has been available for decades and has been included in national immunization programmes worldwide since the 1980s.

There has been substantial progress in reducing mortality due to measles and pertussis over the past few decades. Worldwide mortality due to measles declined from an estimated 535,300 deaths in 2000 to 139,300 in 2010 – a reduction of 74 per cent. Pertussis remains endemic...
An estimated 50 million pertussis cases occur each year, most of them in developing countries. In 2008 pertussis caused approximately 200,000 deaths among children under age 5, mostly among infants.\(^5\)

Although coverage of measles and DTP3 vaccines is high globally (85 per cent for both in 2010), it varies across and within countries – with the poorest and most vulnerable children most often left unvaccinated (figures 3.4 and 3.5).

**Clean home environment: water, sanitation, hygiene and other home factors**

A clean home environment is critical for reducing transmission of pathogens that cause pneumonia or diarrhoea. Access to safe water and to adequate sanitation is necessary to prevent diarrhoea. Improving home and personal hygiene helps prevent both pneumonia and diarrhoea. Other home environment factors, such as household air pollution and overcrowding, also raise the risk of childhood pneumonia.

**Water, sanitation and hygiene**

Nearly 90 per cent of deaths due to diarrhoea worldwide have been attributed to unsafe water,
inadequate sanitation and poor hygiene. Water, sanitation and hygiene programmes include several interventions: promoting safe disposal of human excreta, encouraging hand washing with soap, increasing access to safe water, improving water quality and advancing household water treatment and safe storage. All these interrelated elements are important for preventing diarrhoea (figure 3.6).

**Safe water**

A recent WHO and UNICEF report announced that, as of 2010, the Millennium Development Goal target on safe drinking water has been met, a stunning success. Since 1990 more than 2 billion people have gained access to an improved drinking water source, but many rural households still lack these services. Some 783 million people do not have access to an improved drinking water source, 83 per cent of them in rural areas. In addition to the urban-rural gap, there are substantial differences between the richest and poorest households. For example, although access to an improved drinking water source is widespread, the poorest households often miss out (figure 3.7).

**Basic sanitation**

The problem is even greater for sanitation: 2.5 billion people (37 per cent of the world’s population) do not have access to basic sanitation, almost three-quarters of them in rural areas. And 90 per cent of people who practice open defecation, the riskiest sanitation practice, live in rural areas (figure 3.8).

Among the 1.1 billion people who still practice open defecation, 83 per cent of them live in 10 mostly poor and populous countries (figure 3.9). South Asia is home to around 60 per cent of all people practicing open defecation. Despite the progress in reducing the practice among better-off households across South Asia, nearly all people in the poorest 20 per cent of households still practice open defecation (figure 3.10).

---

**Figure 3.6** Water, sanitation and hygiene interventions are highly effective in reducing diarrhoea morbidity among children under age 5

<table>
<thead>
<tr>
<th>Source</th>
<th>5</th>
<th>21</th>
<th>27</th>
<th>29</th>
<th>34</th>
<th>37</th>
</tr>
</thead>
<tbody>
<tr>
<td>supply</td>
<td>Source water quality</td>
<td>Point-of-use water supply</td>
<td>Hygiene education</td>
<td>Point-of-use water quality</td>
<td>Sanitation</td>
<td>Hand washing with soap</td>
</tr>
</tbody>
</table>

Per cent reduction in diarrhoea morbidity, by intervention

- **Source water supply**: 5
- **Source water quality**: 21
- **Point-of-use water supply**: 21
- **Hygiene education**: 27
- **Point-of-use water quality**: 29
- **Sanitation**: 34
- **Hand washing with soap**: 37

- a. A more recent meta-analysis by the Child Health Epidemiology Reference Group in 2010 found a 42 per cent reduction in diarrhoea morbidity among children under age 5 who washed their hands with soap.


---

**Figure 3.7** Use of an improved drinking water source is widespread, but the poorest households often miss out

Share of population using an improved drinking water source, by household wealth quintile and region, 2004–2009 (per cent)

- **Richest 20%**
- **Poorest 20%**

a. Excludes China.

b. Unweighted average of 10 countries in the region with available data.

c. Available data cover 51 per cent of the region’s population and exclude Algeria and Turkey.

d. Available data cover 59 per cent of the region’s population and exclude the Russian Federation.

Note: The asset index used to classify households into wealth quintiles has not been adjusted for the drinking water variable that is part of the index.

Source: UNICEF global databases 2012, based on 80 Multiple Indicator Cluster Surveys and Demographic and Health Surveys conducted between 2004 and 2009.
**Safe disposal of child faeces**

Safe disposal of child faeces is critical to reducing faecal-oral contamination that facilitates transmission of diarrhoea pathogens. A child’s using a toilet directly or rinsing a child’s stools into a toilet or latrine is considered safe disposal. Across regions safe disposal is much higher among urban than rural populations and among richer than poorer households (figure 3.11).

**Hand washing with soap**

Hand washing with water and soap is the most cost-effective health intervention for reducing the incidence of both pneumonia and diarrhoea in children under age 5.8 There is consistent evidence that hand washing with soap at critical times – including before eating, preparing food and feeding a child and after using the toilet – can substantially reduce the risk of diarrhoea.9

Monitoring correct hand washing behaviour at these critical times is challenging, and comparable national data on hand washing are scarce, but Multiple Indicator Cluster Surveys and Demographic and Health Surveys are increasingly collecting information using proxy or reliable indicators on the likelihood of correct hand washing.

---

**FIGURE 3.8 Most people without an improved water source or sanitation facility live in rural areas**

People without an improved sanitation facility, people practicing open defecation and people without an improved drinking water source, 2010 (millions)

- **Urban**
- **Rural**

- Without access to an improved sanitation facility: 1,795
- Practicing open defecation: 949
- Without access to an improved drinking water source: 653


**FIGURE 3.9 Worldwide, 1.1 billion people still practice open defecation—more than half live in India**

Distribution of global population practicing open defecation, by country, 2010 (millions)

- **India**: 626
- **Rest of the world**: 183
- **Burkina Faso**: 10
- **Niger**: 12
- **China**: 14
- **Nepal**: 15
- **Sudan**: 19
- **Nigeria**: 34
- **Ethiopia**: 38
- **Pakistan**: 40
- **Indonesia**: 63


**FIGURE 3.10 The poorest households in South Asia have barely benefited from improvements in sanitation**

Share of population using improved and unimproved sanitation facilities and practicing open defecation in Bangladesh, India and Nepal, by household wealth quintile (per cent)

- **Poorest 20%**: 17
- **Second 20%**: 23
- **Middle 20%**: 57
- **Fourth 20%**: 81
- **Richest 20%**: 100

Note: The analysis is based on population-weighted averages. Patterns in individual countries may vary from the regional pattern. The asset index used to classify households into wealth quintiles has not been adjusted for the sanitation variable, which is part of the index.

Initial results show large disparities in hand washing both across and within countries. For example, in Serbia a specific place for hand washing was observed in most households, even in the poorest ones, but in Malawi coverage is very low, even in the richest households. Cambodia has large disparities between the richest (85 per cent) and poorest (30 per cent) households (figure 3.12).

Research has found that rates of observed hand washing with water and soap are low across developing countries. In a recent overview based on local studies just 17 per cent of observed caregivers washed their hands with soap and water after using the toilet. The data further suggest, however, that greater proportions of people wash their hands without soap (45 per cent), indicating that at least a culture of hand washing exists. 10

Other home factors
Household air pollution, a well known risk factor for childhood pneumonia, places children at particular risk for several reasons: their lungs and immune systems are not fully developed, they breathe more in proportion to their body size and they often spend more time inside the home.11

Household air pollution in low-income countries is due mainly to use of solid fuels (such as wood, crop waste, animal dung and coal) for cooking or heating in poorly ventilated open fires and stoves. Today, around 3 billion people worldwide use solid fuels as their main cooking fuel, and the most recent estimates show that solid fuel use contributed to nearly 2 million premature deaths in 2004, nearly half of them due to childhood pneumonia.12

People in the poorest countries – particularly South Asian and sub-Saharan African countries, which have the most deaths due to pneumonia – often use solid fuel (map 3.1). Within these countries it is likely that a larger share of people use solid fuels in the poorest households or in rural areas than in better-off households or urban areas.

Overcrowded homes are also associated with increased risk of childhood pneumonia13 because disease-causing pathogens can spread to more people faster. Such is the case in slum environments, which typically have poor sanitation and
Household air pollution from solid fuel use is concentrated in the poorest countries

Share of population using solid fuel as the main cooking fuel, 2010

- More than 95 per cent
- 81–95 per cent
- 51–80 per cent
- 5–50 per cent
- Less than 5 per cent
- No data

Note: This map is stylized and not to scale. It does not reflect a position by UNICEF on the legal status of any country or territory or the delimitation of any frontiers. The dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the Parties. The final boundary between the Republic of the Sudan and the Republic of South Sudan has not yet been determined. The final status of the Abyei area has not yet been determined. Data for Sudan refer to the country as it was constituted in 2010, before South Sudan seceded on 9 July 2011.

Source: WHO 2012b.
Undernutrition is also a consequence of repeated bouts of illness, diarrhoea in particular. This further worsens children’s nutritional status at the same time that they have higher nutritional needs. Stunting is a serious complication of repeated diarrhoea episodes in young children. Diarrhoea control – particularly in the first months of life – has been shown to reduce stunting prevalence among children.16

Undernutrition and infection interact to create a potentially lethal cycle of worsening illness and deteriorating nutritional status. Critical nutrition interventions to break this cycle include promoting optimal breastfeeding practices (early initiation, exclusive breastfeeding for the first six months of life and continued breastfeeding through age 2 and older), encouraging micronutrient supplementation (such as zinc and vitamin A) and reducing the incidence of low-birthweight newborns (caused by preterm delivery and restricted foetal growth) through interventions to improve maternal health and nutrition.

**Breastfeeding**

Infants who are exclusively breastfed for the first six months of life and who receive continued breastfeeding through age 2 and older develop fewer infections and suffer less severe illness than other home risk factors that aid transmission. Recent studies also suggest ambient particulate air pollution, often found in megacities, may increase the risk of acute lower respiratory infections.14

**Nutrition**

Maternal and child undernutrition is estimated to contribute to more than a third of child deaths.15 While all undernourished children are at higher risk of death, severely underweight, wasted and stunted children are at greatest risk. The number of moderately or mildly undernourished children is much larger, and many deaths occur among these children, who may otherwise appear healthy.

Undernourished children are at far greater risk of death and severe illness due to pneumonia and diarrhoea than are well nourished children (table 3.1). Undernutrition weakens the overall immune system, which needs adequate protein, energy, vitamins and minerals to function properly. For pneumonia, undernutrition also weakens the respiratory muscles needed to clear secretions in the respiratory tract. For diarrhoea, undernutrition places children at higher risk of more severe, frequent and prolonged illness.

Undernourished children are at higher risk of dying due to pneumonia or diarrhoea (table 3.1). Undernutrition weakens the overall immune system, which needs adequate protein, energy, vitamins and minerals to function properly. For pneumonia, undernutrition also weakens the respiratory muscles needed to clear secretions in the respiratory tract. For diarrhoea, undernutrition places children at higher risk of more severe, frequent and prolonged illness.

**Table 3.1**

<table>
<thead>
<tr>
<th>Level of undernutrition</th>
<th>Severe</th>
<th>Moderate</th>
<th>Mild</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Underweight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>9.5</td>
<td>3.4</td>
<td>2.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>6.4</td>
<td>1.3</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Stunting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>4.6</td>
<td>1.6</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>3.2</td>
<td>1.3</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Wasting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>6.3</td>
<td>2.9</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>8.7</td>
<td>4.2</td>
<td>1.6</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Note: Values are based on data for Bangladesh, Ghana, Guinea-Bissau, India, Nepal, Pakistan, the Philippines and Senegal.

a Severe refers to a level of undernutrition more than three standard deviations below the median WHO Child Growth Standard, moderate refers to a level of undernutrition two to three standard deviations below the median standard and mild refers to a level of undernutrition that is one to two standard deviations below the median standard.
b Measured as weight-for-age.
c Measured as height-for-age.
d Measured as weight-for-height.
Source: Black and others 2008.
those not breastfed. This is particularly true for pneumonia and diarrhoea (box 3.2).

The risk of increased morbidity and mortality due to pneumonia and diarrhoea is higher for infants who are not exclusively breastfed (figure 3.13). This effect may be larger among children in poor settings, for example, where maternal literacy or access to improved sanitation is low. However, nonbreastfed infants in industrialized countries also suffer more infectious illnesses than do breastfed infants.

Only 37 per cent of infants less than six months of age are exclusively breastfed in developing countries (figure 3.14). Across countries patterns of exclusive breastfeeding, unlike those of many other interventions, may not vary consistently by household wealth or urban-rural residence. Fewer than half of newborns in developing countries receive the benefits of initiating breastfeeding within the first hour of birth. Growing evidence points to the impact of early initiation of breastfeeding on neonatal mortality. To ensure appropriate breastfeeding practices among young children, it is necessary to start early.

Low birthweight
In low-income countries low birthweight due to preterm delivery or restricted foetal growth results largely from poor maternal health and nutrition. Low birthweight places newborns at higher risk of dying during the early months and years of life, particularly due to infections such as diarrhoea and pneumonia. More than three-quarters of the 19 million low-birthweight newborns in developing countries are born in the poorest regions, South Asia (55 per cent) and sub-Saharan Africa (22 per cent). India alone is home to 40 per cent of low-birthweight newborns (figure 3.15).

Micronutrient supplementation
Micronutrients, including zinc and vitamin A, are critical for normal growth and development.

---

**Box 3.2 The importance of improved breastfeeding practices for child survival**

> Given the compelling evidence of the impact of exclusive breastfeeding on pneumonia and diarrhoea in the first six months of life, greater commitment to large-scale implementation of a comprehensive package of evidence-based interventions to protect, promote and support improved breastfeeding practices is urgently needed. The package includes professional support by skilled health providers and counselors, improvement of maternity breastfeeding practices, lay and peer support, community-based counseling and promotion, communication through multiple channels, support for maternity care practices and enforcement of the Code of Marketing of Breastmilk Substitutes.

> The growing number of countries that have recorded substantial increases in exclusive breastfeeding did so by implementing the full package of interventions at scale, tailored to the local context and the specific barriers to optimal breastfeeding. As the 2015 deadline for achieving the Millennium Development Goals nears, all countries must accelerate efforts to reach every infant with effective programmes to improve breastfeeding, in order to realize its full potential to reduce mortality due to pneumonia and diarrhoea and thereby overall child mortality.

> Source: UNICEF 2012.

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in young children, but micronutrient malnutrition remains a challenge. Zinc deficiency places children at greater risk of illness and death due to pneumonia and diarrhoea, particularly children in low-income countries. Evidence shows that zinc is beneficial in managing acute or persistent diarrhoea in children ages 6–59 months, showing clinically important reductions in illness duration and severity. Preventive zinc supplementation has been shown to reduce the incidence of diarrhoea, and research has also demonstrated that zinc supplementation reduces the incidence of acute lower respiratory infection among children under age 5. Several studies show that preventive zinc supplementation reduces by 18 per cent deaths among children ages 12–48 months.

Similarly, some research indicates that vitamin A supplementation reduces all-cause and diarrhoea-related mortality among children ages 6–59 months. Vitamin A given in therapy of measles has been shown to reduce children’s risk of measles-associated pneumonia. Recent data show sustained high coverage of the recommended two doses of vitamin A in the least developed countries since 2005 (figure 3.16).

Co-morbidities

The poorest and most-deprived children often suffer multiple illnesses or conditions at the same time, and such co-morbidities may substantially increase their risk of death and severe illness. Yet little is known about the magnitude of childhood co-morbidities in low-income countries.

Recent studies indicate that symptoms of pneumonia and diarrhoea are highly correlated in children and are more often observed together in the same child than are other combinations of disease symptoms. Pneumonia and diarrhoea share risk factors – notably poverty, undernutrition and poor home environments – and may be viewed as endpoints in this long cascade of factors. Evidence also suggests that diarrhoea itself may raise the risk of developing pneumonia.

Other conditions or illnesses may also raise the risk of pneumonia or diarrhoea. Poor nutritional status, as discussed, is an important underlying risk factor that often interacts with infections to create a potentially lethal cycle of worsening illness and deteriorating nutritional status. Malaria infection, too, may interact with other illnesses to increase susceptibility
or severity of either disease, including pneumonia\textsuperscript{28} and diarrhoea.\textsuperscript{29} HIV places a child at high risk of pneumonia or diarrhoea and more severe and chronic forms of the diseases.\textsuperscript{30} Similarly, pneumonia is commonly due to an opportunistic infection among HIV-positive children caused by common pneumonia pathogens such as \textit{S. pneumoniae} and, in young infants, \textit{P. jiroveci}.

WHO guidelines recommend that all children born to mothers living with HIV start cotrimoxazole prophylaxis between ages 4 and 6 weeks and continue until breastfeeding has terminated and HIV serostatus is known to be negative.\textsuperscript{31} This intervention increases survival chances, but in 2010 only 23 per cent (19–24 per cent) of HIV-exposed infants in reporting low- and middle-income countries received it. Countries in East and Southern Africa have shown the most progress and account for most of the increase in coverage in 2010.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure3.16}
\caption{Least developed countries lead the way in coverage of vitamin A supplementation}
\end{figure}

\begin{table}
\centering
\begin{tabular}{|c|c|c|c|c|}
\hline
Year & Least developed countries & Developing countries & Least developed countries & Developing countries \\
\hline
2010 & 100 & 75 & 50 & 25 \\
\hline
2009 & 100 & 75 & 50 & 25 \\
\hline
2008 & 100 & 75 & 50 & 25 \\
\hline
2007 & 100 & 75 & 50 & 25 \\
\hline
2006 & 100 & 75 & 50 & 25 \\
\hline
2005 & 100 & 75 & 50 & 25 \\
\hline
\end{tabular}
\caption{Share of children ages 6–59 months who received two doses of vitamin A supplements during a calendar year (per cent)}
\end{table}

\begin{itemize}
\item Note: Analysis is based on estimates from 43 developing countries, including 26 least developed countries, with available data for all years during the trend period. The decrease in 2010 for developing countries was due mostly to a decrease in India (from 66 per cent in 2009 to 34 per cent in 2010).
\item Source: UNICEF global databases 2012.
\end{itemize}
In the poorest communities with the sickest children, caregivers often provide medicines at home or seek care outside the formal health sector. For pneumonia or diarrhoea symptoms, this could result in inappropriate treatment and delayed care seeking. Extending the reach of the health system through community case management strategies is an urgent priority (box 4.1).

Community case management
A recent UNICEF survey of sub-Saharan African countries showed that while most had a policy promoting community case management of pneumonia and diarrhoea, far fewer actually implemented such strategies at a scale to reach children most in need (figures 4.1 and 4.2).

The private sector also demands attention. In many high-mortality countries a large proportion of care for childhood illnesses, particularly diarrhoea, is sought from private retailers such as pharmacies and drug shops. In addition to the risk of unregulated distribution of drugs through the private market, more expensive and ineffective treatments such as antibiotics...
and antimotility agents for diarrhoea (rather
than oral rehydration salts and zinc) are often
provided.

**Treatment for suspected pneumonia**

Once children develop pneumonia, prompt
and effective treatment saves lives. In low-
income settings chest radiology, blood tests
and sputum samples for culture are largely
unavailable to confirm the pneumonia diagno-
sis, identify the disease-causing pathogen and
determine illness severity. Without these tools,
pneumonia is classified and treated based on
symptoms and physical examinations accord-
ing to WHO and UNICEF Integrated Manage-
ment of Childhood Illness guidelines. Based
on these guidelines, pneumonia is classified
by a rapid respiratory rate counted by a health
worker. Children with pneumonia classified
this way should receive a full course of effec-
tive antibiotics because most severe cases have
a bacterial cause.\(^1\) WHO recommends amoxi-
cillin provided twice daily for three days (in
settings with low HIV prevalence) or five days
(in settings with high HIV prevalence) as the
most effective antibiotic treatment of child-
hood pneumonia. Pulse oximetry can improve
the diagnostic specificity for pneumonia. Oxy-
gen systems, injectable antibiotics and other
supportive measures are also needed in health

---

**FIGURE 4.1 Most African countries have a community
case management policy, but fewer
implement programmes on a scale to
reach the children most in need**

Number of countries in sub-Saharan Africa with community case
management policies, a community health worker treatment policy,
Ministry of Health community case management implementation and
Ministry of Health community case management implementation at scale
for diarrhoea or pneumonia, 2010

<table>
<thead>
<tr>
<th></th>
<th>Pneumonia</th>
<th>Diarrhoea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community case management</td>
<td>28</td>
<td>34</td>
</tr>
<tr>
<td>policies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community health worker</td>
<td>24</td>
<td>33</td>
</tr>
<tr>
<td>treatment policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ministry of Health</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td>community case management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>implementation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ministry of Health</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>community case management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>implementation at scale(^a)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Data reflect responses from 40 of 44 (91 per cent) UNICEF country
offices in sub-Saharan Africa (see annex 2).

Source: UNICEF 2011b.
facilities for children with severe acute respiratory syndromes.

**Fast or difficult breathing: signs to seek immediate care**

Caregivers play an important role in recognizing the symptoms of pneumonia and immediately seeking appropriate care for sick children. Even though pneumonia continues to be the leading killer of children globally, only 43 per cent of caregivers across countries with data report fast or difficult breathing (key symptoms of pneumonia) as signs to seek immediate care for the child (figure 4.3). Available data indicate little difference between caregivers in rural and urban areas or in the poorest and richest households.

**Seeking appropriate care for suspected childhood pneumonia**

An early step in managing childhood pneumonia is for caregivers to seek appropriate care so that it can be classified and treated based on WHO and UNICEF Integrated Management of Childhood Illness guidelines. As reported here, appropriate care generally includes public or private
in rural areas or the poorest households are far less likely to be taken to appropriate care than are children in urban areas or better-off households (figures 4.6 and 4.7).

Data from a subset of countries with comparable data for around 2000 and 2010 indicate that progress in appropriate careseeking for suspected childhood pneumonia has been limited. In developing countries appropriate careseeking rose from 54 per cent at the start of the decade to 61 per cent by decade’s end (figure 4.8). Sub-Saharan Africa showed the most progress, although it still has the lowest level of appropriate careseeking.

Boys and girls are about equally likely to receive appropriate care for suspected pneumonia. Across developing countries 62 per cent of boys and 59 per cent of girls are taken to appropriate care (figure 4.5), although South Asia and Middle East and North Africa show a slightly wider gender gap. Children with suspected pneumonia in rural areas or the poorest households are far less likely to be taken to appropriate care than are children in urban areas or better-off households (figures 4.6 and 4.7).

While progress in appropriate careseeking for suspected pneumonia was similar for boys and girls over the past decade, in every region progress was greater among rural children than among urban children (figure 4.9). Between 2000 and 2010 appropriate careseeking remained at 65 per cent in urban areas,

### Figure 4.4
Most children with suspected pneumonia in developing countries are taken to an appropriate healthcare provider or facility

<table>
<thead>
<tr>
<th>Region</th>
<th>Share of children under age 5 with suspected pneumonia taken to an appropriate healthcare provider or facility, by region, 2006–2011 (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>48</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>55</td>
</tr>
<tr>
<td>South Asia</td>
<td>66</td>
</tr>
<tr>
<td>East Asia and Pacific</td>
<td>67</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>69</td>
</tr>
<tr>
<td>Developing countries</td>
<td>60</td>
</tr>
</tbody>
</table>

a. Excludes China.

Note: Estimates are based on a subset of 77 countries with available data for 2006–2011, covering 84 per cent of the under-five population in developing countries (excluding China, for which comparable data are not available) and at least 50 per cent of the under-five population in each region. Data coverage was insufficient to calculate the regional average for CEE/CIS and industrialized countries.

Source: UNICEF global databases 2012, based on Multiple Indicator Cluster Surveys, Demographic and Health Surveys and other national surveys.

### Figure 4.5
Boys and girls with suspected pneumonia are taken to an appropriate healthcare provider or facility at similar rates

<table>
<thead>
<tr>
<th>Region</th>
<th>Share of children under age 5 with suspected pneumonia taken to an appropriate healthcare provider or facility, by gender and region, 2006–2011 (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>Boys: 77, Girls: 59</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>Boys: 70, Girls: 68</td>
</tr>
<tr>
<td>South Asia</td>
<td>Boys: 74, Girls: 69</td>
</tr>
<tr>
<td>East Asia and Pacific</td>
<td>Boys: 81, Girls: 77</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>Boys: 80, Girls: 80</td>
</tr>
<tr>
<td>Developing countries</td>
<td>Boys: 80, Girls: 79</td>
</tr>
</tbody>
</table>

a. Excludes China.

Note: Estimates are based on a subset of 70 countries with available data for 2006–2011, covering 80 per cent of the under-five population in developing countries (excluding China, for which comparable data are not available) and at least 50 per cent of the under-five population in each region. Data coverage was insufficient to calculate the regional average for CEE/CIS, Latin America and the Caribbean, and industrialized countries.

Source: UNICEF global databases 2012, based on Multiple Indicator Cluster Surveys, Demographic and Health Surveys and other national surveys.
However, questions on antibiotic use among children with suspected pneumonia were added to national surveys (such as Multiple Indicator Cluster Surveys and Demographic and Health Surveys) around 2005, and a wealth of new data has become available over the past few years. Less than a third of children with suspected pneumonia received antibiotics in developing countries, with South Asia averaging 18 per cent (figure 4.10). Importantly, not all children with suspected pneumonia should receive antibiotics, only those classified as having pneumonia (based on a rapid respiratory rate counted by a health worker), according to WHO and UNICEF Integrated Management of Childhood Illness guidelines (see annex 2). And not all children so classified have true pneumonia, but in settings without adequate diagnostic tools, the guidelines provide a common standard by which health workers can classify bacterial pneumonia illness in need of presumptive antibiotic treatment.
Every region has shown progress in appropriate careseeking for suspected childhood pneumonia over the past decade

Share of children under age 5 with suspected pneumonia taken to an appropriate healthcare provider or facility, by region, around 2000 and around 2010 (per cent)

- Sub-Saharan Africa
- East Asia and Pacific
- South Asia
- Middle East and North Africa
- Developing countries

2000  | 2010
---|---
Sub-Saharan Africa | 38 | 50
East Asia and Pacific | 59 | 65
South Asia | 61 | 65
Middle East and North Africa | 64 | 69
Developing countries | 54 | 60

Note: Estimates are based on a subset of 63 countries with available data, covering 71 per cent of the under-five population in developing countries in 2000 and 73 per cent in 2010 (excluding China, for which comparable data are not available) and at least 50 per cent of the under-five population in each region. Data coverage was insufficient to calculate the regional average for CEE/CIS, Latin America and the Caribbean, and industrialized countries. Source: UNICEF global databases 2012, based on Multiple Indicator Cluster Surveys, Demographic and Health Surveys and other national surveys.

Narrowing the rural-urban gap in careseeking for suspected childhood pneumonia over the past decade

Share of children under age 5 with suspected pneumonia taken to an appropriate healthcare provider or facility, by residence and region, around 2000 and around 2010 (per cent)

- Urban
- Rural

2000  | 2010
---|---
Sub-Saharan Africa
East Asia and Pacific
South Asia
Developing countries

---|---|---|---|---|---|---|---
Sub-Saharan Africa | 29 | 35 | 61 | 65 | 64 | 69 | 54 | 60

Note: Estimates are based on a subset of 46 countries with available data, covering 55 per cent of the urban under-five population and 76 per cent of the rural under-five population in developing countries in 2010 (excluding China, for which comparable data are not available) and at least 50 per cent of the under-five population in each region. Data coverage was insufficient to calculate the regional average for CEE/CIS, Latin America and the Caribbean, Middle East and North Africa, and industrialized countries. Source: UNICEF global databases 2012, based on Multiple Indicator Cluster Surveys, Demographic and Health Surveys and other national surveys.
Interpreting data on antibiotic use is difficult for the reasons outlined above and in annex 2. When measuring this indicator, it is possible that data underestimate the true level of treatment because it is likely that children who do not have pneumonia are included in the denominator. At the same time, it is possible that some of those children with symptoms may receive antibiotics despite not needing them. Identifying the actual antibiotic provided for suspected pneumonia to determine if treatment conforms with the standard treatment guideline in the country is problematic.

While boys and girls with suspected pneumonia are almost equally likely to receive antibiotics, gaps exist between children in rural and urban areas. Across developing regions children with suspected pneumonia in urban areas are 1.4 times more likely to receive antibiotics than are children in rural areas (figure 4.11).

Information on disparities by household wealth is limited, but nearly all low-income countries with available data show a wide gap in antibiotic use for suspected childhood pneumonia between the poorest and richest wealth quintiles (figure 4.12).

**Diarrhoea treatment**

In 2004 UNICEF and WHO published a joint statement with the latest diarrhoea treatment recommendations for low-income countries, promoting oral rehydration therapy with solutions made of low-osmolarity oral rehydration salts (ORS), continued feeding and zinc treatment for children with acute diarrhoea (box 4.2). This section assesses coverage of the treatment recommended to prevent dehydration (oral rehydration therapy with continued feeding) as well as its components: solutions made of ORS, recommended homemade fluids, increased fluids, continued feeding and zinc treatment.

**Recommended treatment package: oral rehydration therapy with continued feeding**

Across developing countries 39 per cent of children with diarrhoea receive the recommended
FIGURE 4.12  . . . as are the poorest children

Share of children under age 5 with suspected pneumonia receiving antibiotics, by household wealth quintile, low-income countries, 2006–2011 (per cent)

Note: Subnational estimates are often bracketed by large confidence intervals, so results should be interpreted with caution. Low-income group is based on the World Bank July 2011 classification (see http://data.worldbank.org/about/country-classifications/country-and-lending-groups#Low_income).

Source: UNICEF global databases 2012, based on Multiple Indicator Cluster Surveys, Demographic and Health Surveys and other national surveys.
Since the 1970s oral rehydration therapy has been the cornerstone of treatment programmes to prevent life-threatening dehydration associated with diarrhoea. Fluid replacement should begin at home and be administered by the caregiver at the onset of diarrhoea. Solutions made of oral rehydration salts (ORS) is the ‘gold standard’ of oral rehydration therapy, and a new formulation developed in the early 2000s (low-osmolarity ORS) has improved overall outcomes. ORS is available in smaller packet sizes (200 grams) and assorted flavours to facilitate use among children. UNICEF and WHO recommend that all children receive solutions made of low-osmolarity ORS to prevent and treat dehydration due to diarrhoea.

When ORS is not available, other fluids could help prevent dehydration, although they are not as effective in treating children who are already dehydrated. Such fluids (which many countries have designated as ‘recommended homemade fluids’) can be prepared at home using readily available and low-cost ingredients, such as sugar-salt solutions and cereal-based drinks. Breastmilk is also an excellent rehydration fluid and should be given to children still breastfeeding along with ORS.

In addition to fluid replacement, children with diarrhoea should continue to be fed during the episode. Food intake supports fluid absorption from the gut into the bloodstream to prevent dehydration and helps maintain nutritional status and ability to fight infection. Children should also simultaneously receive zinc treatment, a recently added and important component of the treatment recommendations. Zinc reduces the duration and severity of diarrhoea episodes, stool volume and the need for advanced medical care. Strategies for scaling up zinc treatment have also been associated with greater uptake of ORS and reduced demand from caregivers for other less effective drugs, such as antibiotics and anti-diarrhoeal medications, which should not be routinely administered.


Data for analysing trends in coverage with the recommended treatment package are limited due to changes in data collection methods over time. However, coverage in sub-Saharan Africa since 2000 shows modest progress for the region as a whole as well as for the gap across population groups within the region (figure 4.14).

Solutions made of oral rehydration salts, including low-osmolarity ORS

One of the first steps to increase coverage of ORS is to increase availability through manufacturing and procurement. Although information from private manufacturers is not readily available, UNICEF remains one of the largest international procurers of ORS, obtaining close to 600 million packets since 2000, including the low-osmolarity formula starting in 2004 (figure 4.15).
Manufacturers remain slow to shift their productions to the new formula; the pace of progress needs to quickly increase.

Recognizing the need to further boost use of ORS, flavoured versions have been included in the list of priority medicines for mothers and children developed by WHO, UNICEF and the United Nations Population Fund in 2011. UNICEF established the first long-term agreement for flavoured ORS with an African company in December 2011 and is working with manufacturers to increase the number of sources in the range of packet sizes recommended in the essential medicines list for children.

Only around a third of children with diarrhoea in developing countries receive ORS. Every region has coverage of about 40 per cent or less. Sub-Saharan Africa and Middle East and North Africa have the lowest, 30 per cent (figure 4.16). In every region boys and girls are equally likely to receive ORS to treat diarrhoea, while children in rural areas are less likely to receive them than are their urban peers (figure 4.17).
In the poorest countries the poorest children – those often at greatest risk of diarrhoea – are much less likely to receive ORS to treat diarrhoea than are the richest children (figure 4.18).

Data from a subset of countries with comparable data for around 2000 and 2010 show little progress in use of ORS to treat childhood diarrhoea (figure 4.19). Only sub-Saharan Africa showed any improvement – from 24 per cent to 30 per cent – although coverage is still too low. Despite this progress, the rural-urban gap in use of ORS did not narrow in sub-Saharan Africa or any other region during this time (figure 4.20).

**Recommended homemade fluids, increased fluids and continued feeding**

Household survey data on the use of recommended homemade fluids for childhood diarrhoea are limited and not assessed in this section (see annex 2). However, across developing countries less than a quarter of children with diarrhoea drink more fluids of any type, and all regions had levels of 32 per cent or less. Most children continue to be fed during the illness, receiving more, the same or somewhat less food than usual, but nearly a third in developing countries receive much less food or none at all during...
illness, despite the importance of continued food intake to support fluid absorption, maintain nutritional status and boost ability to fight infection (figure 4.21).

**Zinc treatment**

The 2004 WHO and UNICEF joint statement recommended zinc treatment for 10–14 days, in addition to low-osmolarity ORS, as an adjunct therapy that reduces the duration and severity of a diarrhoea episode and the likelihood of subsequent infections in the two to three months following treatment.\(^5\) This recommendation came after scientific consensus and recognition that zinc and low-osmolarity ORS were critical for reducing mortality due to diarrhoea.

Despite the evidence of benefit, widespread introduction of zinc for diarrhoea treatment has been limited. Many countries have changed diarrhoea management policies to include zinc and low-osmolarity ORS, but there is a gap between policy change and effective programme implementation, leaving few children appropriately treated.\(^6\)

Limited information is available on the prevalence of zinc treatment for childhood diarrhoea. Questions on zinc use were only recently added to household surveys, and to date, data are available for just 24 countries worldwide. The limited data indicate low use of zinc to treat childhood diarrhoea (table 4.1).

UNICEF and its partners are working closely with manufacturers to increase zinc availability. UNICEF is the largest buyer of zinc tablets, accounting for over 80 per cent of international procurement. UNICEF’s zinc procurement began in 2006 and has increased substantially since (figure 4.22). Despite this progress, global zinc supply is dismally low compared with global need.