Part 2 Newborn and Child Health

CHAPTER 5

Overview of Child Health

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Key learning objectives

- Describe the epidemiology of under-five mortality and compare developed to least-developed countries.
- Outline the underlying socioeconomic and geopolitical determinants of child health.
- Identify evidence-based, cost-effective interventions to decrease under-five mortality at different levels of care within a healthcare system.
- Describe the WHO Integrated Management of Childhood Illnesses (IMCI) guidelines and how they are implemented in developing countries.

Abstract

Each year, nearly 7 million children under 5 years old die worldwide, and most of these deaths are considered preventable. Beyond the neonatal period, during which approximately 40% of under-five deaths occur, diarrhea and pneumonia are the most commonly implicated diseases, and malnutrition contributes to a significant proportion of deaths. Disparities in child health persist both between and within countries and are associated with socioeconomic factors such as poverty, food insecurity, and lack of maternal education. Improvements in child health can be accomplished through implementation of essential evidence-based interventions such as immunizations, micronutrient supplementation, breastfeeding, and use of antibiotics. However, many children in low- and middle-income countries still do not receive these life-saving interventions. Strategies that integrate preventive and curative solutions have been developed to improve child health, starting at the community level up through the healthcare facility.

Key words: child health, child mortality, under-five mortality, newborn mortality, immunizations, vaccine-preventable diseases, health inequities, essential interventions, infections, social determinants of health

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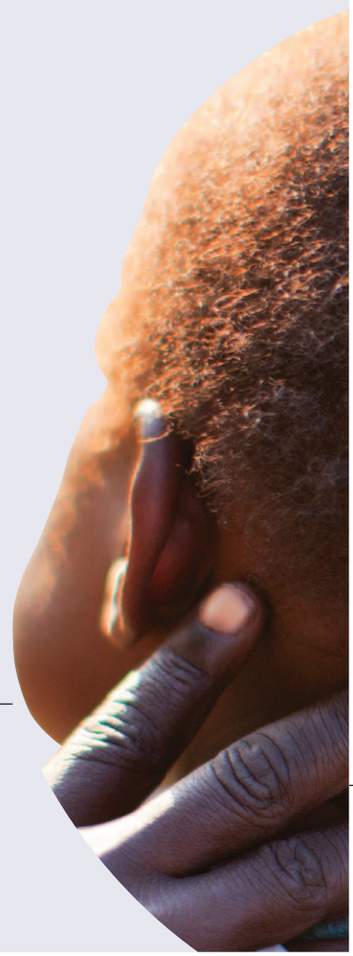

Introduction and epidemiology

In 2011, an estimated 7 million children under 5 years old died worldwide – far too many, but a dramatic improvement from an estimated 12 million in 1990 (UNICEF, 2012a). However, progress in reducing child mortality has not occurred evenly around the world (Figure 5.1). Most of the countries with high under-five mortality are in sub-Saharan Africa, where a child is 20 times more likely to die before his or her fifth birthday than in a developed country. Also concerning is that much of the progress in child health has been limited to improving survival outside the newborn period and, as a result, deaths within the first month of life account for a growing proportion of under-five mortality.

The vast majority of childhood deaths are caused by infections that are preventable, the most common of which are diarrhea and pneumonia (Figure 5.2). In contrast, in developed countries child deaths from infections are less common, and injuries and congenital malformations account for higher proportions of under-five deaths. In Africa, malaria and AIDS account for almost 20% of all under-five deaths (Liu *et al*., 2012). Undernutrition has been implicated in up to half of under-five deaths, due to the impact of inadequate caloric intake and micronutrient deficiencies on the immune system, and the toll recurrent illnesses take on the child's ability to take in and absorb adequate calories and nutrients.

Child health should not be assessed based on mortality rates alone. Children surviving illness are often left with disability, burdening their families and decreasing future economic productivity. Neonatal disorders, recurrent infections, nutritional deficiencies, and neglected tropical diseases are leading causes of disability in children younger than 5 years old, while injuries, musculoskeletal disorders, chronic respiratory disease, and mental health problems contribute more in older children (Vos *et al*., 2012).

Socioeconomic determinants of child health in developing countries: roots of health inequities

> This unequal distribution of health-damaging experiences is not in any sense a "natural" phenomenon but is the result of a toxic combination of poor social policies and programmes, unfair economic arrangements, and bad politics.
>
> *Closing the Gap Report* (WHO, 2008)

While life expectancy and overall health are gradually improving for many people around the world, there remain populations for whom this progress is not occurring equitably. Such disparities in health are reflected not only by differences in child mortality rates between countries, but also by differences between different populations within the same country. In Bolivia, for example, the infant mortality rate is greater than 100 per 1000 live births among children born to mothers with no education, while it is 40 per 1000 among children born to mothers with at least secondary education (WHO, 2008). Similarly, the child mortality rate in Nigeria is 87 per 1000 births for children in the highest wealth quintile, while it is 219 per 1000 for children living in the lowest quintile (UN Inter-Agency Group for Child Mortality Estimation, 2011). The socioeconomic factors that underlie health disparities are significant and reflect a family's risk for disease and malnutrition as well as access to a safe living environment and quality health services.

In response to increasing concern about these persisting and widening inequities, the World Health Organization (WHO) established the Commission on Social Determinants of Health (CSDH). The Commission's final report, launched in 2008, called for increasing the investment in training of health practitioners, policy-makers, and the public about the social determinants of health. The report made the appeal for countries to strengthen governmental social protection policies with emphasis on early child development, education, and empowerment of girls and women.

> Education and training on the social determinants of health for relevant professionals is vital (*Closing the Gap Report*, WHO, 2008).

Greater recognition that the underlying causes of childhood diseases have socioeconomic roots has led to an emphasis on training clinicians about the "upstream" determinants of health and community-based interventions, rather than focusing solely on hospital-based treatments. Physicians working in resource-constrained settings may look at approaches to address the underlying causes of poor health when faced with questions: Why does a 5-year-old girl return to the hospital with pneumonia just months after being discharged for dehydration from diarrhea? What are the factors in her home and community that place her at increased risk of dying from these common childhood infections?

The immediate, underlying, and basic structural causes of disease, malnutrition, and disability are outlined in Figure 5.3. Despite advances in preventive and curative interventions aimed at the more immediate causes of poor health, unless the

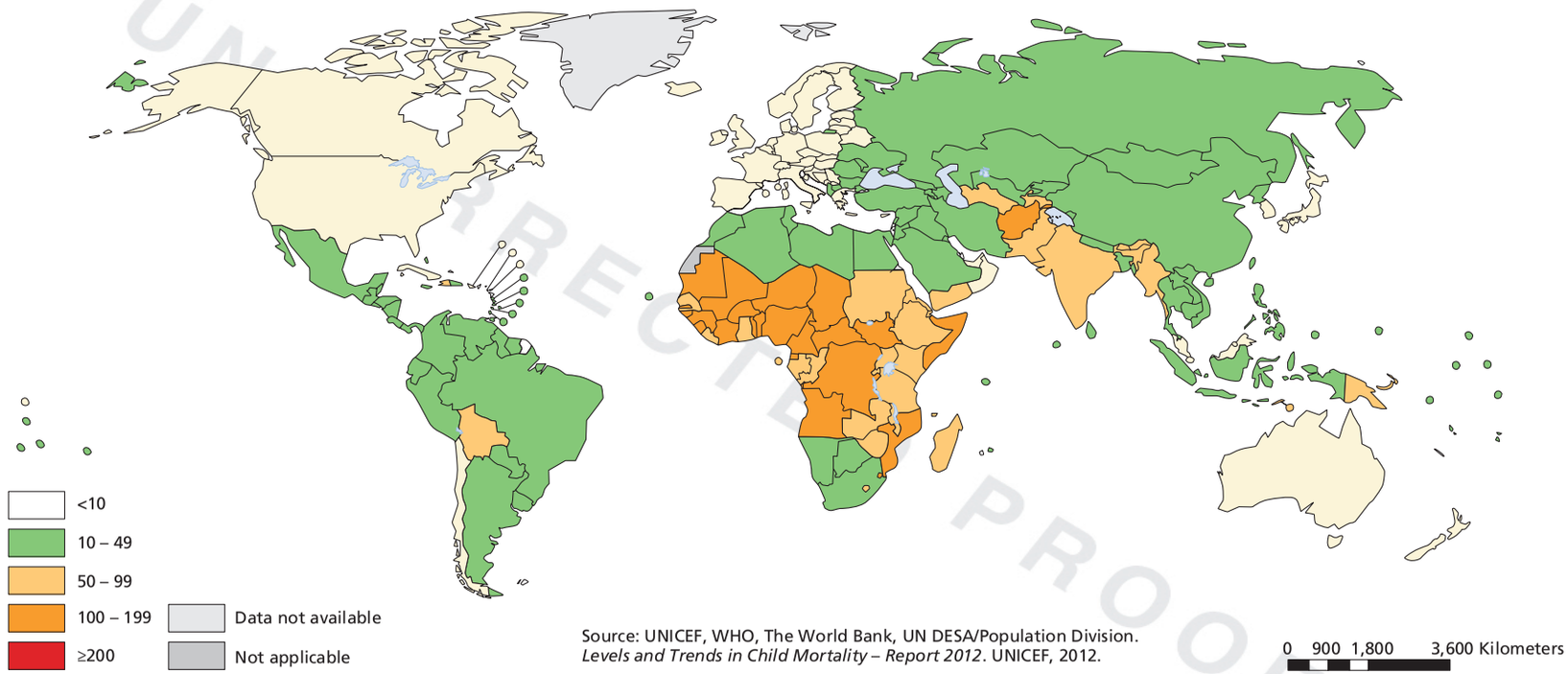

Figure 5.1 Under-five mortality rate (deaths per 1000 live births), 2011. *Source*: WHO (2012). Reproduced with permission of the World Health Organization.

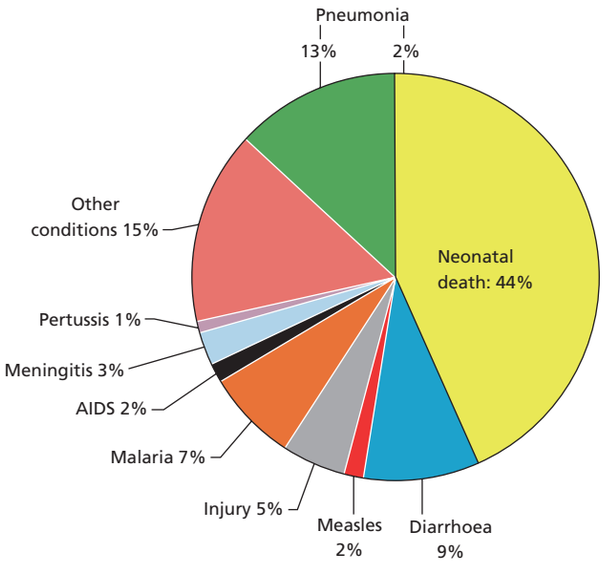

Figure 5.2 Causes of under-five and neonatal mortality worldwide in 2012. *Sources*: CHERG and WHO, Global Health Observatory http://www.who.int/gho/child_health/mortality/causes/en/ and Lawn *et al*. 2012. Reproduced with permission.

basic and underlying determinants of health are addressed, inequities in mortality and morbidity rates will persist.

Essential interventions

Estimates suggest that most of the 7 million annual deaths in children younger than five could be averted by increasing coverage of proven low-cost interventions (Table 5.1) (UN Inter-agency Group for Child Mortality Estimation, 2011). Childhood deaths from diarrheal illness and pneumonia can be prevented by simple measures such as vaccinations and exclusive breastfeeding until 6 months of age. Deaths related to undernutrition, which predisposes children to infectious diseases, may be prevented by proper infant and young child feeding practices, micronutrient supplementation, and community-based screening and management of malnutrition.

Vaccine-preventable diseases

An estimated 1.5 million under-five deaths each year are due to vaccine-preventable diseases (WHO, 2014). Top contributors are pneumococcus and rotavirus, followed by *Haemophilus influenzae* type B (Hib), measles, pertussis, and tetanus. The WHO Expanded Program on Immunization (EPI) has resulted in a dramatic reduction in deaths, illness, and disability from many of these diseases, as well as the near elimination of poliomyelitis. Recommendations for routine immunizations have continued to grow with the development of new vaccines that have demonstrated significant life-saving potential in industrialized countries (Table 5.2 and Box 5.1).

Vaccines are highly effective in improving child survival. However, rates of coverage are very low in many developing countries, and some life-saving vaccines are not available in many countries. In some cases, it takes years for immunizations introduced in developed countries to be made affordable and available to developing countries and to be incorporated into the national vaccine policy and infrastructure. In other cases, the vaccine is available but does not reach the child. In 2013, it was estimated that 21.8 million children did not receive all three recommended doses of DTP, and 16% of children did not receive a measles vaccine by their second birthday (WHO, 2014).

Reaching every child

Immunizations are not the only interventions that have failed to attain universal coverage. Oral rehydration therapy has been the evidence-based intervention of choice for dehydration from diarrheal illness since the 1970s (see Chapter 9). However, four decades later, fewer than half of children under five with diarrheal illness receive this treatment (UNICEF, 2012b). What impacts whether one child will receive a life-saving intervention while another will not? Characteristics of the healthcare system, social context, and political climate impact whether universal coverage can be reached for evidence-based essential interventions such as those in Table 5.1. Figure 5.5 shows the relationship and interplay of factors impacting coverage of an intervention that should be considered when it is discovered that children are not receiving the most basic, cost-efficient, and well-studied life-saving interventions.

Effective delivery strategies: integrated management of childhood illness

Weak health systems impede the ability of countries to deliver cost-effective interventions and life-saving health messages for children. Such systems are characterized by insufficient numbers of health workers, low-quality training and supervision, and poorly functioning supply chains. While efforts to support child health often focus on improving health service delivery at a single level such as the health facility, effective and lasting improvements can only be achieved with the integration of delivery at all levels, such as adequate referrals and follow-up between community, clinic, and health facility. Other important life-saving strategies include outreach services (e.g., mass immunization and Vitamin A campaigns) and community-based health promotion activities (Figure 5.6).

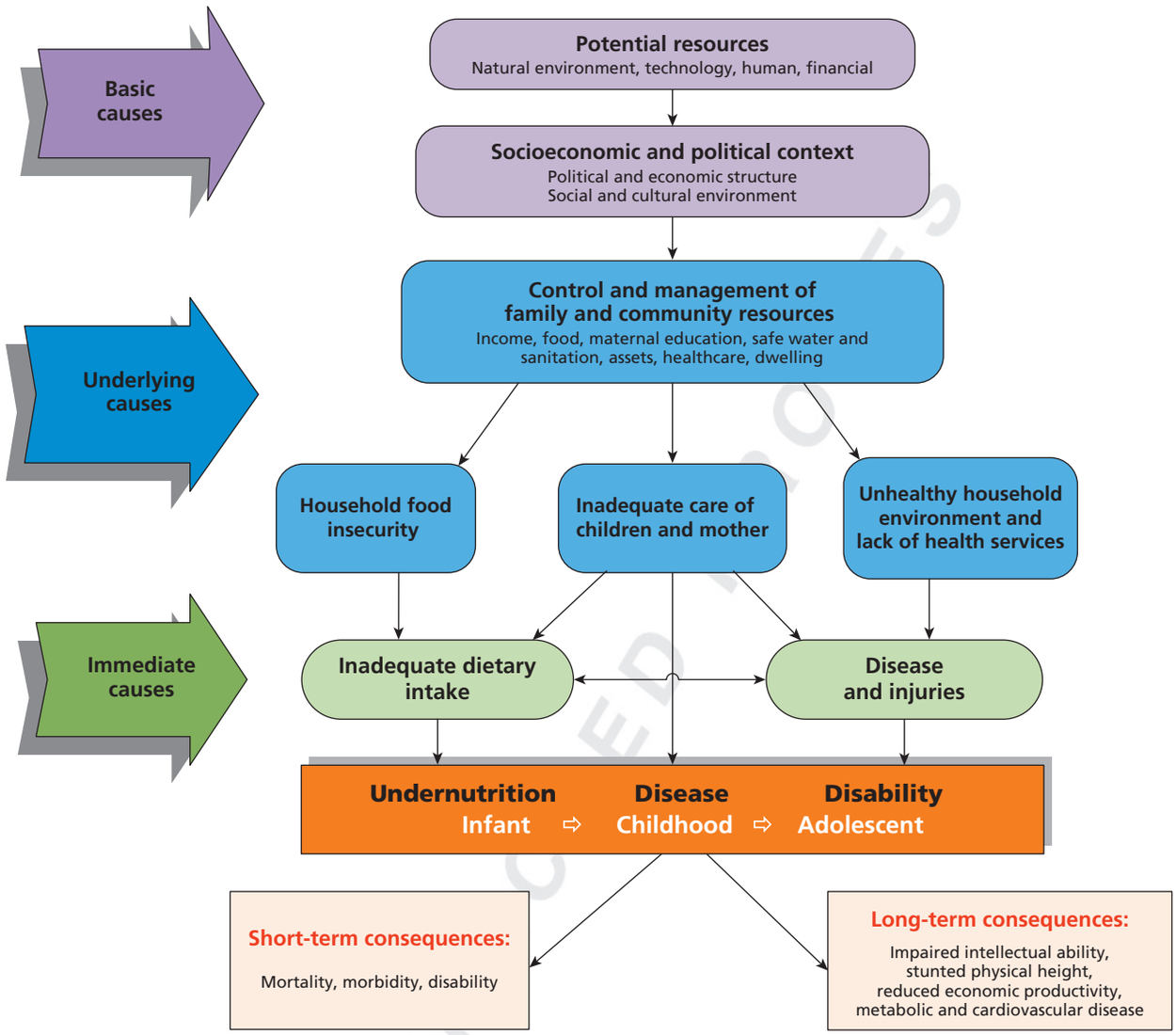

Figure 5.3 Framework of underlying socioeconomic determinants of health.

Community-based interventions are effective in extending healthcare delivery, are low cost, improve healthcare-seeking behavior, and can reduce infant and child mortality and morbidity (Lehmann & Sanders, 2007; Lewin *et al.*, 2010; McCord *et al.*, 2012). Community health workers (CHWs) are members of a community without formal medical training chosen to provide basic health and medical care to their community. CHWs may screen and manage mild to moderate cases of undernutrition, diarrheal disease and pneumonia, and refer serious cases in a timely manner to healthcare facilities. They may promote proper infant and young child feeding, as well as hand-hygiene practices to prevent disease.

The lack of integration of vertical programs that deliver individual interventions results in missed opportunities. Children may receive immunizations from one health worker at one encounter, but go somewhere else to obtain oral rehydration solution for diarrheal illness and yet elsewhere for treatment of malnutrition. Past programs focused on a single disease and set of interventions, while most children present with overlapping signs and symptoms to first-level health facilities with limited diagnostic tools such as laboratories or radiography.

Table 5.1 Essential interventions to improve child survival.

General preventive interventions		
• Early and exclusive breastfeeding through 6 months of age • Continued breastfeeding and complementary feeding from 6 months of age • Vitamin A supplementation from 6 to 59 months • Water, sanitation, and hygiene		
Disease-specific interventions		
Disease or condition	**Prevention**	**Treatment**
Birth asphyxia	Maternal intrapartum care and monitoring Skilled delivery	Newborn resuscitation
Newborn infections	Maternal tetanus vaccination Antibiotics for premature rupture of membranes Clean delivery Clean cord care	Antibiotics Case management of sepsis, meningitis, and pneumonia
Complications related to prematurity	Antenatal steroids Intermittent preventive treatment for malaria	Thermal care (kangaroo mother care) Feeding support for small and preterm newborns Surfactant administration Continuous positive airway pressure (CPAP) Treatment of jaundice
Diarrhea/dehydration	Rotavirus vaccination	Oral rehydration solution Zinc supplementation Continued feeding
HIV	Prevention of mother-to-child transmission	Highly active antiretroviral therapy (HAART)
Malaria	Insecticide-treated bednets	Antimalarials
Measles	Measles vaccination	Vitamin A supplementation
Meningitis	Meningococcal/Hib/pneumococcal vaccination	Antibiotics Case management
Pneumonia	Hib/pneumococcal vaccination	Antibiotics Case management
Tetanus	Tetanus vaccination Clean delivery	

Hib, *Haemophilus influenzae* B.
Source: Jones *et al*. (2003) and Partnership for Maternal, Newborn and Child Health (2011).

Box 5.1 Child health cards

Children in most countries will have an immunization or child health card (Figure 5.4), such as the WHO's "Road to Health" card that their guardian carries with them. This is the best way to check a child's immunization history. These cards may also serve as a portable medical record, charting growth, medical visits, and treatment of HIV in some locations.

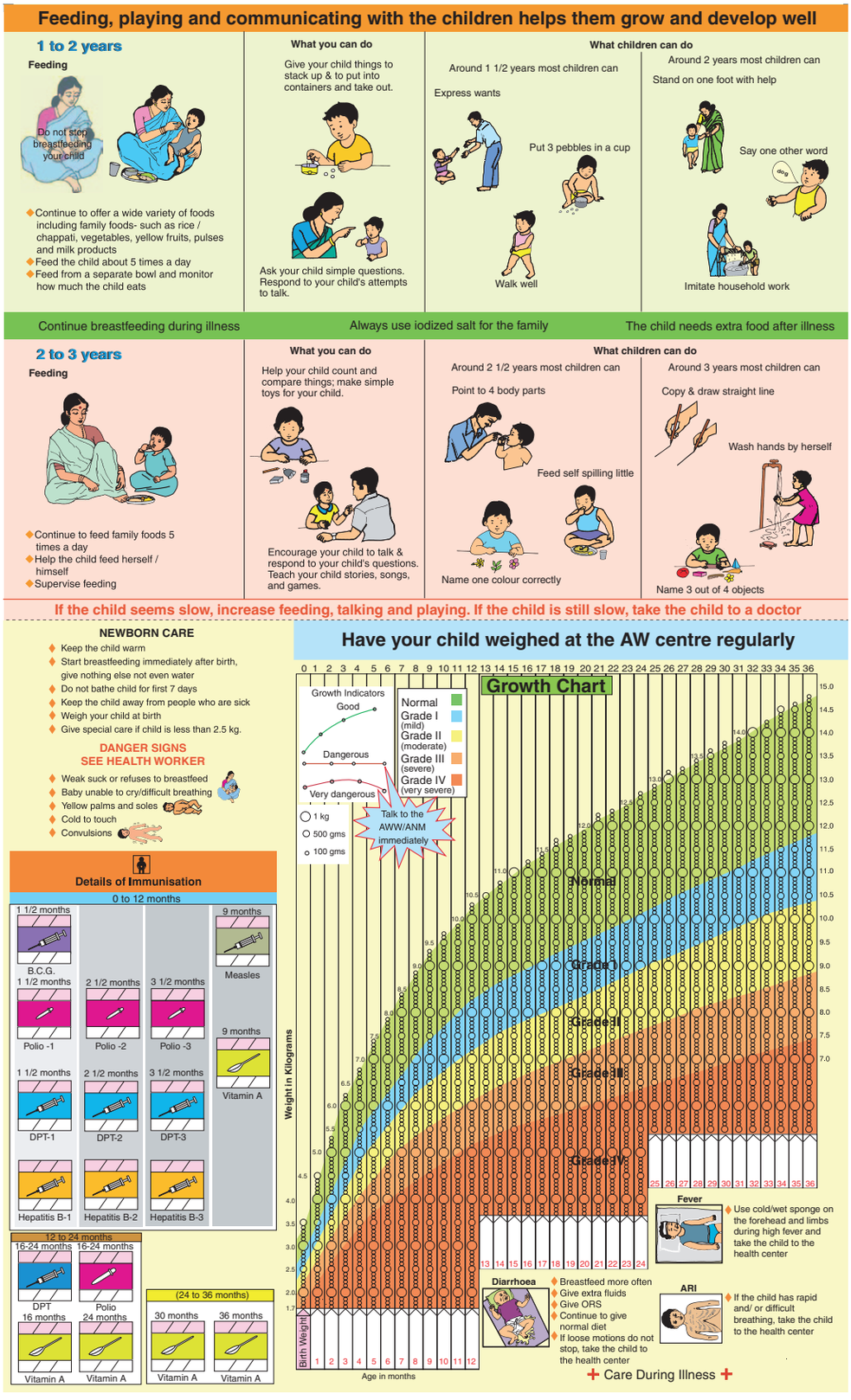

Figure 5.4 An example of a child health card. Adapted from a card produced by the Ministry of Health and Child Welfare (Zimbabwe).

Table 5.2 Routine immunizations recommended by the World Health Organization as of 2014.

Vaccine	Birth	6 weeks	10 weeks	14 weeks	9–12 months	Booster	Considerations
BCG (Bacillus Calmette–Guérin)	✓						Prevents severe tuberculosis (TB) and TB meningitis Only recommended in TB-endemic countries Contraindicated in HIV-positive children
DTP (diphtheria, tetanus, and pertussis)		✓	✓	✓		Yes	Whole cell pertussis vaccine still used in many countries "DTP3" (receiving all three doses in the primary series) is a commonly used marker of vaccination coverage
Hepatitis B	✓	✓	✓	✓			Birth dose recommended for prevention of perinatal transmission Premature newborns <2 kg may not respond well Three doses needed for immunity, but can receive four if necessary when combined with other routine vaccinations
OPV (oral polio vaccine)		✓	✓	✓			OPV is used in many developing countries due to low cost, ease of administration, and resulting herd immunity An additional birth dose is recommended only in highest-risk countries As of 2014, the WHO recommends that *all* children get at least one dose of inactivated polio vaccine (IPV), which can be given at earliest 14 weeks when maternal antibodies wane. A different schedule exists for IPV (inactivated polio vaccine), which creates less herd immunity and is only recommended in low-risk countries
Hib (*Haemophilus influenzae* B)		✓	✓	✓			Important cause of pneumonia and meningitis especially among children <2 years
Measles					*Option 1* 9 months *Option 2* 12 months	*Option 1* 15–18 months *Option 2* 15 months to 4 years	All children should get two doses of measles vaccine High-transmission/high-mortality countries should start at 9 months to decrease mortality
Pneumococcus (PCV10 or 13)		✓	✓*	✓		* Yes, if not given at 10 weeks	Important cause of pneumonia, sepsis, and meningitis
Rotavirus		✓	✓	✓			Need for third dose depends on vaccine brand Rotavirus kills >400,000 children annually In 2011, only implemented in 31 countries
Rubella					9–12 months with measles vaccine		Goal is to prevent congenital rubella syndrome (CRS) More than 80% coverage is needed to avoid increasing risk for CRS by continued presence of unimmunized pregnant women who were not exposed as children

6-, 10-, and 14-week schedule based on WHO recommendation to start at 6 weeks for many routine immunizations, with minimum 4 weeks between subsequent doses.
Source: adapted from WHO recommendations for routine immunization: summary tables. Available at http://www.who.int/immunization/policy/immunization_tables/en/

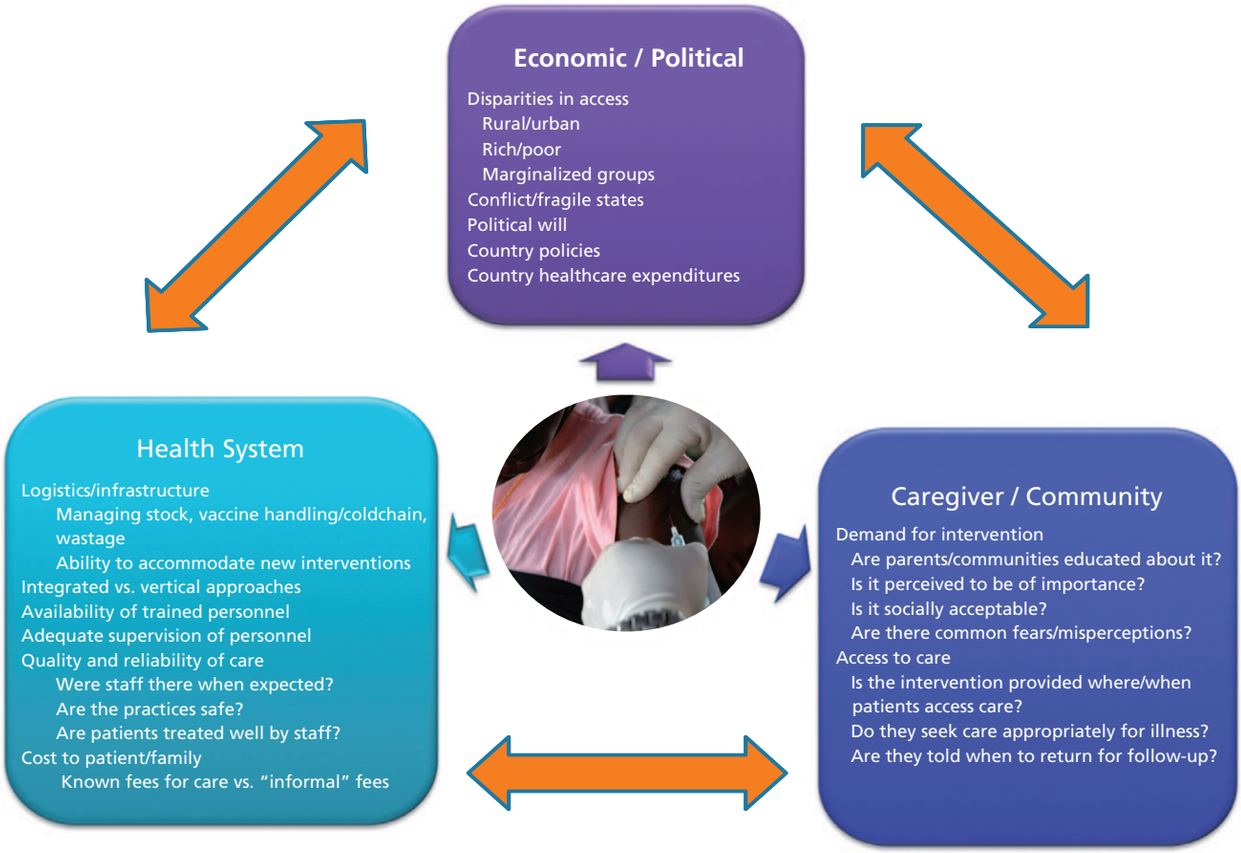

Figure 5.5 Factors influencing coverage of interventions.

The Integrated Management of Childhood Illnesses (IMCI) is an approach to reduce child death, illness, and disability and to promote improved growth and development. IMCI includes both preventive and curative elements with guidelines that are implemented by families and communities as well as by providers at health facilities. One key component of IMCI is to train CHWs to identify signs of common childhood illness and to decide when a child needs referral to a health facility. IMCI trains CHWs to instruct parents on home management of ill children including oral rehydration solution and zinc for diarrhea, antimalarial medicine for febrile children who test positive for malaria, and antibiotics for children with signs of pneumonia. CHWs can schedule follow-up visits for ill children. They also promote use of bednets, hand-washing, and proper infant and young child feeding.

While IMCI guidelines are useful tools proven to reduce under-five mortality (Figure 5.7), the resources for CHW training and supervision, supply of medications, and referral are often limited or completely absent (Goga & Muhe, 2011). More efforts are needed to integrate delivery of services between all levels of care while empowering communities to identify and manage childhood illnesses properly (Box 5.2).

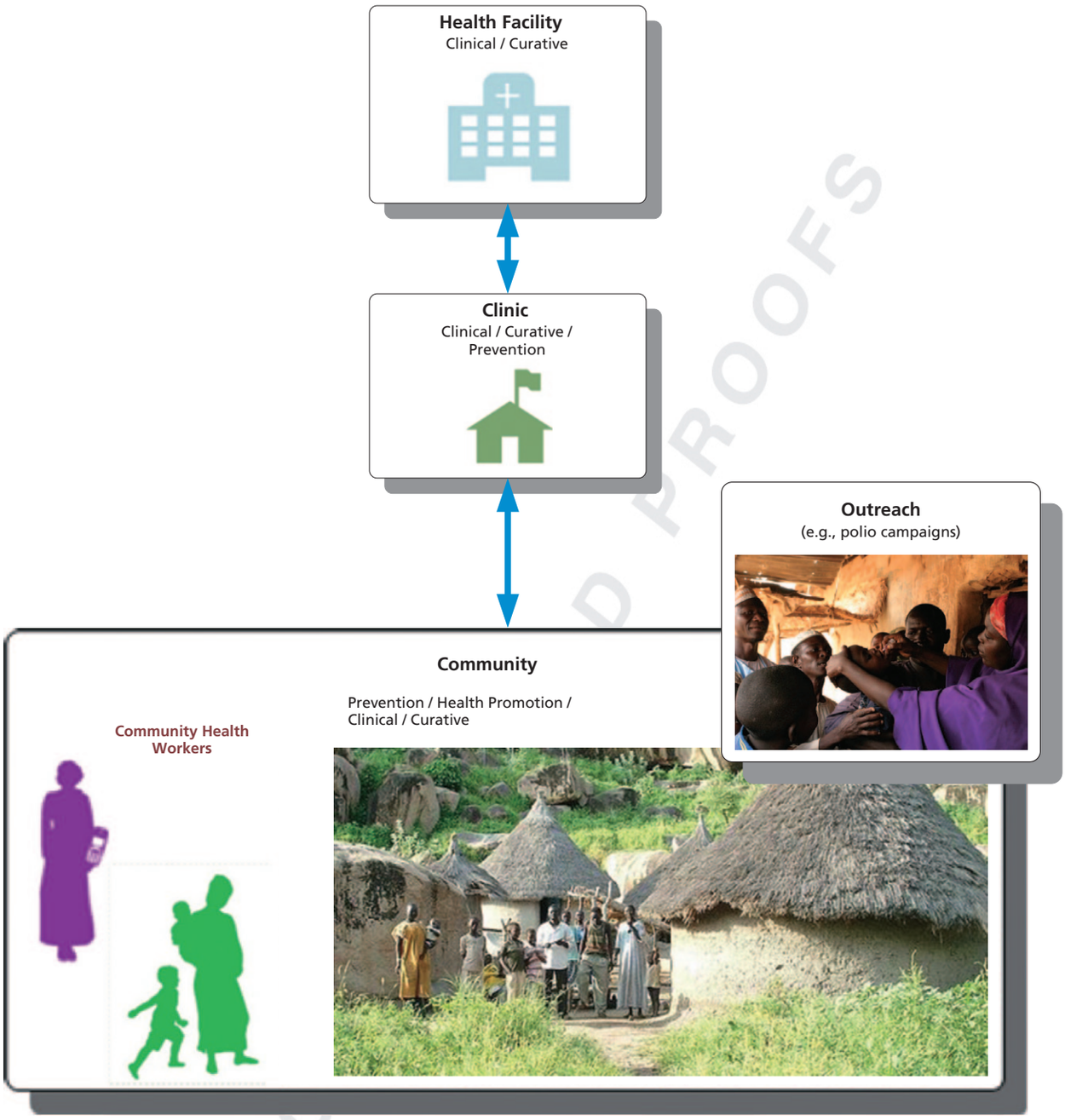

Figure 5.6 Health services delivery systems.

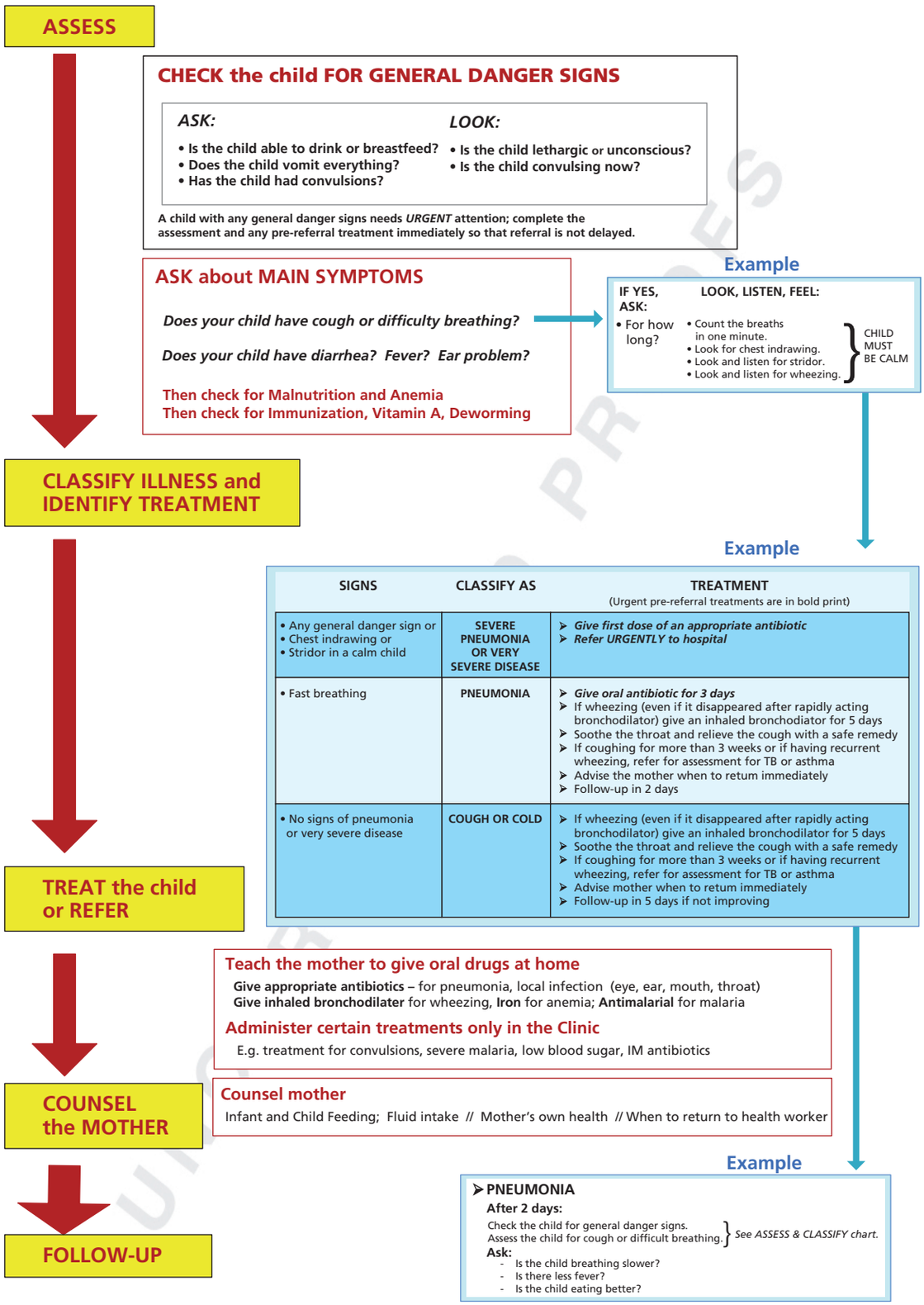

Figure 5.7 Respiratory illness flowchart: an example of how the algorithms in the WHO's Integrated Management of Childhood Illnesses can be applied.

Box 5.2 Case study: the interrelationship between disease, nutrition, and socioeconomic context

You are working with local healthcare staff at a hospital serving an impoverished district. You admit a 3-year-old girl for pneumonia and severe acute malnutrition. Despite a high case fatality rate for such children in the hospital, this child improves and is able to be discharged home. You note statistics that show a high mortality rate for children after being discharged, and you reflect on your training that emphasizes the importance of proper discharge instructions. You also want to ensure that you have comprehensively addressed all medical issues before discharge since you know that she will not receive any primary care follow-up. You consider the following questions.

Identification of other infections and disease prevention
- Has this child been screened for HIV? What is HIV prevalence in the area where you are working?
- Has this child's immunization status been checked and updated?

Prevention of malnutrition and other illnesses
- Has the mother received any nutritional counseling?
- Has the child received routine Vitamin A supplementation?
- Is she anemic? Has she received antihelminthic treatment?
- How will this child's undernourished state impact her risk of infection when she returns to the community?

Follow-up plan
- What is the follow-up plan for this child, who is responsible for implementing this plan, what are the challenges, and how will follow-up be monitored?

Socioeconomic determinants of health and disease
- What is the socioeconomic context to which this child will return, and how does that place her at risk for mortality upon her return as she continues her convalescence at home?
- What have been the direct and indirect costs of this hospitalization on the family? What are the mechanisms and resources for the family to recover from the financial impact of this hospital admission?

Home visit

You accompany a CHW to visit the child in her community after discharge. It is a 20-minute drive and 30-minute walk into the rural community. On arrival at the home, you observe that the side of the house serves as an open latrine. You observe that the mother is working much of the day harvesting a corn crop, with little supervision of the girl and her two siblings at home.

- What are the factors in her community and in her social situation that might influence how the mother accesses care when one of her children is sick?
- How could this child's condition have been initially addressed in the community to prevent her from becoming so severely ill that it warranted her being admitted?
- What are the risk factors for this girl's other young siblings to also fall ill?
- What role might a traditional healer play in providing ongoing care for infants and children in the community? What are the potential benefits and risks of this role?
- What is the role that CHWs can play in providing appropriate nutrition and disease counseling to parents, as well as in identifying and treating illnesses within the community? How might CHWs be supported in the community to carry out this role?
- What other social services and community resources are available to strengthen the families' ability to keep their children healthy? Are there micro-loan programs, kitchen gardening activities, etc.?

Additional resources

- UNICEF. Monitoring the situation of children and women. Available at www.childinfo.org
- UNICEF. State of the World's Children annual report. Available at http://www.unicef.org/sowc/
- Countdown to 2015. Maternal, newborn, and child survival. Available at http://www.countdown2015mnch.org/
- World Health Organization. Child health. Available at http://www.who.int/topics/child_health/en/
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