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Survival and Health

CAROL M. WORTHMAN

Introduction
This may be the best moment to be a child in the history of humankind—if one goes by the global statistics for survival. Dramatic declines in infant and child mortality have fueled remarkable increases in life expectancy in the last half of the twentieth century. These advances have been hailed as triumphs of public health and international development policy. Between 1975 and 1995 alone, mortality for children ages 1 to 5 years decreased by 80% in Asia and North Africa, 78% in South/Central America, and 39% in sub-Saharan Africa; for all children under age 5 years, the corresponding declines were 60%, 63%, and 32% (Pelletier and Frongillo, 2003).

The more sobering news is that many young lives are still needlessly lost. Furthermore, disparities in child health actually are increasing within and among countries around the globe. In addition, there is more to well-being than mere survival, and expectations for child health have expanded to encompass reduced morbidity, healthy development, and the roots of adult function and well-being.

Fundamental improvements in the health status of children, which commenced in Western industrialized countries and swept the globe during the previous century, have had several effects on developmental science. First, such improvements abated the historically urgent concern with child survival among privileged, healthy postindustrial populations where most human development research is conducted. Second, unequal advances led to widening and persistent population disparities in child health and development that carry forward into adulthood and even into the next generation. Third, as with other branches of science and medicine, developmental science assumed a universalizing stance that overlooked the possible role of culture in confounding the generalizability of its findings.

This chapter aims to advance ongoing efforts by developmental science to engage with culture and cultural diversity; to integrate biology, cognition, and behavior; and to expand the scope of study and practice to an inclusive, comprehensive perspective that will better represent and serve the interests of the young. Its purpose, therefore, is to review current trends and insights regarding the status of child health from a comparative global perspective by considering evidence, ideas, and models of the roles of culture in differential child health.

Indices of Child Health
Child survival and health are particularly sensitive indicators of the overall welfare of a population. Indeed, they are widely recognized among policy, economic development, and health agencies and actors worldwide and, as such, carry weight for documenting needs, setting priorities, allocating resources, and evaluating progress at the international, national, and even regional
levels (de Onis and Blössner, 2003; Milman, Frongillo, de Onis, and Hwang, 2005; United Nations Children’s Fund [UNICEF], 2006; World Bank, 1993). Specifically, the key indicators of child welfare are early mortality and physical growth.

Identification of early mortality and child growth as key indicators has emerged from extensive evidence compiled by epidemiologists and human biologists over the last 60 years (Eveleth and Tanner, 1990; Frongillo, de Onis, and Hanson, 1997; Semba and Bloem, 2001). This work has established unequivocal links connecting poor conditions at the household and community level (e.g., poverty, marginal living conditions, lack of clean water and sanitation, inadequate or unsafe food), as well as inadequate infrastructure and programs at the regional and state level (e.g., sanitation, clean water, health care, economic opportunity, gender and structural inequality), with poor survival and growth among infants and children. In turn, growth and mortality indices of poor early health predict long-term health risk and reduced life expectancy (Crimmins and Finch, 2006).

Adequacy of response to emergent understandings of disparities in child health has varied. Indeed, one of the paradoxes of apparent global progress in child health and survival is the concurrent exacerbation of inequities in life chances for the young, within and between countries. Current status and trends in indices of child health, as well as progress on health disparities, are reviewed in the following sections.

**Early Mortality**

The premier challenge of infancy and early childhood is survival. Extensive demographic and epidemiological data collected by international agencies such as the World Health Organization (WHO; WHO, 2005), UNICEF (UNICEF, 2007), and World Bank (World Bank, 2004) clearly document the magnitude of this challenge. As shown in Figure 3.1, children under age 5 suffer far greater mortality rates than any other age group until late in life (age 60 and greater). Several major sources of mortality contribute to the survival challenge (Figure 3.2), primarily communicable diseases (e.g., infection, parasitic and infectious diseases) and insults from maternal conditions, perinatal conditions, and nutritional deficiencies. Birth and the postpartum transition are periods of greatest risk; 36% of deaths in children less than age 5 years in 2001 occurred among neonates within 1 month after birth, and 90% occurred before the age of 1 year.

(Black, Morris, and Bryce, 2003). Infections, preterm birth, and asphyxia account for most (86%) neonatal mortality worldwide, but the relative risk varies with infant mortality rates; the proportion of deaths in children under age 5 years (under-5 mortality) that occurs among neonates increases (24% to 56% of under-5 mortality) as national under-5 mortality rates decrease (Lawn, Wilczynska-Ketende, and Cousens, 2006). In affluent and poor countries, poverty is consistently associated with neonatal mortality, largely because of its influence on birth weight, access to care, and maternal health (Lawn, Cousens, and Zupan, 2005).

After the neonatal period, infections and parasitic and infectious diseases pose the greatest mortality risks (Figure 3.2). In particular, upper respiratory tract infections, diarrhea, and malaria account for nearly half (44%) of under-5 mortality (Brye, Boschi-Pinto, Shibuya, and Black, 2005). Behind these morbidities stands a powerful cofactor, malnutrition, which increases vulnerability to infection. Mildly to moderately malnourished young children ages 6 to 60 months are twice as likely to die during follow-up than their well-nourished peers, whereas severely malnourished children are nearly seven-fold more likely to die (Schroeder and Brown, 1994). Reciprocally, infections themselves promote malnutrition by reducing child appetite, eroding gut integrity and nutrient absorption, and claiming energy costs for the host’s response to illness (Campbell, Elia, and Lunn, 2003; Dantzer, 2001). The global impact of malnutrition is substantial and insidious; formal country-specific estimates attribute 42% to 57% of child mortality in children ages 6 to 60 months to potentiation by malnutrition, with the majority related not to frank deprivation but to mild-to-moderate malnutrition (Pelletier, Frongillo, Schroeder, and Habicht, 1994).

Once a child survives the first 5 years, the risk for mortality decreases dramatically as the immune system becomes more robust (McDade, 2005). Communicable diseases and infections remain the primary sources of mortality through childhood and adolescence, although injuries (accidental and intentional) increase during adolescence and into the 20s. Injury-related mortality peaks during late adolescence and young adulthood (ages 15 to 24 years). This pattern is pronounced among males, robust across societies, and persistent through time (Heuveline and Slap, 2002).

![Figure 3.2 Crude annual mortality rates by cause for age groups under 60 years. Communicable diseases include infection and parasitic and infectious disease. Insults comprise maternal conditions, perinatal conditions, and nutritional deficiencies. Noncommunicable diseases include diabetes, cancer, cardiovascular disease, and other organic and mental disorders. Injury involves intentional and unintentional physical harm. (Rates calculated from data in Mathers, C. D., Lopez, A. D., and Murray, C. J. L., The burden of disease and mortality by condition: Data, methods, and results for 2001, in A. D. Lopez, C. D. Mathers, M. Ezzati, D. T. Jamison, and C. J. L. Murray (Eds.), Global burden of disease and risk factors, World Bank/Oxford University Press, New York, 2006, Table 3C9, pp. 174–179.)](image-url)
Health Burden Among Children

Mortality profiles convey a picture of early vulnerability, but estimated burden of disease delineates a yet more compelling view by quantifying the actual human costs of early health challenges. During the 1990s, the Global Burden of Disease Study attempted to calculate burden as costs from the sources of morbidity and mortality in terms of their impact on well-being, or disability-adjusted life-years (DALYs) (Murray and Lopez, 1996). In this approach, early mortality is assigned a high cost in years of life lost, as are chronic conditions that impair well-being. Such an approach, therefore, weights the impact of early health risk, estimating that 28% of the total worldwide burden of disease is borne by young children (Figure 3.3). The burden is intensified by being narrowly concentrated in the first 5 years of life, rather than the 10- or 15-year age period over which the burden occurs in older groups.

Only much later in life (after age 60 years) do mortality rates exceed those in early childhood. A breakdown of the components of disease burden by source (Figure 3.4) reveals the toll levied

![Image 1](https://via.placeholder.com/150)

**Figure 3.3** Percentage of total worldwide disability-adjusted life-years (DALYs) borne by age groups under 60 years. (Proportions calculated from data in Mathers, C. D., Lopez, A. D., and Murray, C. J. L., The burden of disease and mortality by condition: Data, methods, and results for 2001, in A. D. Lopez, C. D. Mathers, M. Ezzati, D. T. Jamison, and C. J. L. Murray (Eds.), Global burden of disease and risk factors, World Bank/Oxford University Press, New York, 2006, Table 3C9, pp. 228-233.)

![Image 2](https://via.placeholder.com/150)

**Figure 3.4** Distribution of the burden of disease by source across age groups under 60 years. Burden is gauged in terms of disability-adjusted life-years (DALYs). (Based on data in Mathers, C. D., Lopez, A. D., and Murray, C. J. L., The burden of disease and mortality by condition: Data, methods, and results for 2001, in A. D. Lopez, C. D. Mathers, M. Ezzati, D. T. Jamison, and C. J. L. Murray (Eds.), Global burden of disease and risk factors, World Bank/Oxford University Press, New York, 2006, Table 3C9, pp. 228-233.)
by communicable diseases and insults upon children under age 5 years, largely as a result of the substantial mortality from these causes. The high burden stems from two sources. An early death represents the loss of an entire lifetime’s potential and thus poses a maximum burden from disease. Similarly, effects of illness or early insults (marginal malnutrition, low birth weight and other gestational conditions, or poor delivery care) on realization of developmental potential can impair lifetime cognitive capacity and resilience and also reduce health and life expectancy by increasing long-term risk for communicable and chronic diseases. For instance, a prospective study in the Philippines has linked number of infections in the first 6 months and growth in the first year to reduced immunocompetence (immunoglobulin E production and thymic function, respectively) in mid-adolescence at ages 14 to 15 years (McDade, 2005). Furthermore, a burgeoning literature documents the importance of gestational conditions for development and adult health, including links between low birth weight and later risk for depression in adolescent females (Costello, Worthman, Erkanli, and Angold, 2007) or cardiovascular disease in adult males (Barker, Eriksson, Forsén, and Osmond, 2002). The potentiating effects of early insult on later functional impairment and risk for ill health represent particularly insidious and persistent costs not only to individual quality of life, but also to human capital and the social burden of ill health.

By contrast, mid-childhood to mid-adolescence (ages 5 to 14 years) stands out as a period with the lightest burden of disease. Note that algorithms for estimation of burden in this period appear to place a low value on the impact of malnutrition (a component of insult) related to the understanding that most of the enduring effects from malnutrition, such as mortality or long-term health risk, are incurred early in life. Hence, evidence for both mortality and health burden describes a profile of early risk followed by a protected or buffered period of relative good health.

Temporal Trends: The Global Effort for Child Survival

The heavy burden of disease borne by the very young has focused attention on improving child survival (Black et al., 2003). Worldwide efforts have achieved dramatic reductions in early mortality over the last 50 years, during which time the global under-5 mortality rate was halved, from 159 to 70 per 1,000 live births (Figure 3.5). Vaccination campaigns, oral rehydration therapy

![Figure 3.5](https://example.com/figure3_5.png)

**Figure 3.5** Changes in mortality rates per 1,000 live births among children under 5 years old. Trajectories are shown for global and regional figures. Numbers for 1999 are extrapolated estimates. (Data from Ahmad, O. B., Lopez, A. D., and Inoue, M., *Bulletin of the World Health Organization*, 78, 1175–1191, 2000.)
for diarrhea, widening health care access, and clean water and sanitation programs all have contributed to this effort. Nonetheless, several points of concern are apparent from the trends for 1955 to 1999 plotted in Figure 3.5 (Ahmad, Lopez, and Inoue, 2000). First, pre-existing mortality differences among world regions have not been reduced, much less eliminated, demonstrating that earlier visions for health equity remain unfulfilled (Stolnitz, 1965). Second, absolute and proportionate improvements during this period are distributed unequally among regions, such that rates of decline have been most dramatic in the eastern Mediterranean and most persistent in South and East Asia. By contrast, proportionate decreases have been greatest among developing countries of the Americas (76% reduction) and least in Africa (43% reduction). The low rate of change in developed nations relates to their low initial mortality and belies a 71% decrease in mortality rate in these privileged settings. Third, rates of decrease in mortality have decelerated markedly since the late 1980s. Such deceleration might reflect basement effects limiting survivorship, but the deceleration has been most pronounced and sustained in the two regions of highest mortality, namely Africa and South and East Asia. Mortality differentials have been related in part to the distribution of poverty; the poorest populations experience greater mortality than the richest populations (bottom versus top quintile), and more than three-fourths of this excess mortality is related to communicable disease (Heuveline, Guillot, and Gwatkin, 2002).

The diminishing returns on mortality reduction and the persistence and even exacerbation of inequities in early mortality risk have drawn increasing concern and renewed attention to factors with established relationships to early mortality trends (Ahmad et al., 2000). Such factors include fertility behavior (timing and spacing of births); nutrition (status markers, breastfeeding patterns, infant feeding); environmental risk (sanitation, clean water); health services use (by mother, for children); and socioeconomic status (poverty, social inequity). Indeed, comparative analyses of data from 56 countries collected between 1986 and 1998 show that maternal factors, child nutrition, environmental quality, and health care account for three-quarters of the variance in postneonatal mortality (Rutstein, 2000). Factors of increasing importance in specific regions include drug resistance of pathogens and parasites and prevalence of human immunodeficiency virus (HIV). These infectious risks apparently contribute to an actual reversal of mortality decline in regions of sub-Saharan Africa.

All of these mortality risk factors comprise behaviors and conditions strongly shaped by culture, including practices, goals/values, gender relations, and structures of status and power. Therefore, attention to underlying cultural conditions and change is needed to disentangle and explain the diversity of trends in child health. This theme is discussed after a review of global patterns and trends for the other major index of population welfare, namely child growth and nutritional status.

**Survival Is Not Enough: Child Nutrition and Physical Development**

Child growth and nutrition comprise the second set of sensitive indicators for the quality of conditions affecting human welfare (Frongillo et al., 1997). Child survival advocates sensibly emphasize that because death precludes further child development, averting mortality comes first; ensuring a future for all children remains an imperative (Lawn et al., 2005; WHO, 2005). Yet others press the need for measures to promote healthy development as essential for realizing the potential in each child’s future. Reports by the International Child Development Steering Group document the magnitude of lost human potential (Grantham-McGregor, Cheung, Cueto, Glewwe, Richter, and Strupp, 2007), highlight the primary causes of loss (Walker et al., 2007), and identify effective strategies for promoting healthy development (Engle et al., 2007). The reports link global child health to meeting developmental needs and, as such, represent a timely and salutary expansion of the vision for child health.
Before considering this expanded vision, classic morphometric indices of child growth and nutrition, global patterns and trends, and the relations of poor early nutrition with manifold aspects of child welfare in terms of development and human potential are discussed.

**Growth, Weight, and the Use of Growth Standards** Measures of height and weight are widely used to monitor child welfare for several reasons. Some are empirical. Growth acts as a mirror for society by closely reflecting both quality and inequality of environments (Lindgren et al., 1998). Poor growth and underweight reflect acute and cumulative effects of environments that are inadequate for nutrition and energy load; pathogen, parasite, and toxin exposures; and psychosocial stress (Ulijaszek, Johnston, and Preece, 1998). Hence, these anthropometric indices predict impaired future health and longevity. Other reasons are practical; the measures are rapid, noninvasive, simple, inexpensive, and portable. Height reflects cumulative skeletal growth from gestation onward. Rates of growth respond to nutritional state (growth takes energy and nutrients), and although growth acceleration (catch-up) does occur after an interval of restricted growth, even temporary decelerations during periods of very rapid growth such as infancy are difficult to make up entirely (Martorell, Khan, and Schroeder, 1994). Infections and illness also exact a toll on growth by impairing energy and nutrient availability (Bhutta, 2006). Thus, even minor insults exert cumulative effects on height that reflect the recurrence of stress or challenge to the child (Checkley et al., 2004). Weight, like height, is related to body size but also reflects body composition and tissue mass. Unlike height, weight can decrease as body mass is expended to meet energetic needs. Thus, weight represents both acute and previous nutrition and disease states. Among children whose growth has been stunted by mild to moderate malnutrition, body mass and proportions commonly are conserved, and weight for height may scarcely differ from that of chronically healthy, well-nourished peers.

Growth standards are invaluable for assessing and comparing the nutritional status of children throughout the early years, but the choice of reference values is hotly debated (Butte, Garza, and de Onis, 2007; Roberfroid, Lerude, Perez-Cueto, and Kolsteren, 2006). The height and weight of children are moving targets that change over time, and rates of growth vary with age and stage of physical development. Therefore, anthropometric measures must be expressed in terms of height or weight for child age to derive comparable measures of status. But this approach requires norms (medians and distributions) of size for age, for which well-nourished healthy Western populations have been the source (most commonly, the United States National Center for Health Statistics [NCHS]). The logic behind the approach holds that, in principle, all child populations have the same distributions of growth potential reflected in optimal growth patterns that would be realized under nurturing, healthy conditions. Therefore, the same standards should apply for all populations. Although current thinking agrees with this logic for young children (WHO Multicentre Growth Reference Study Group, 2006), the presumption of cross-population universality of growth potential and the definition of optimal growth in school-age children and adolescents remain contested (Butte et al., 2007). The difficulties are further complicated by variation in the timing and pace of puberty and its association with environmental quality (Worthman, 1999a). Hence, WHO international growth standards apply to children through age 5 years (WHO, 2006b), and NCHS reference values for comparative purposes apply only to children through age 10 years.

With relative, standardized measures in hand, the status of an individual child is established vis-à-vis the reference and can be aggregated with children of other ages in the same sample for comparison with other groups. Weight-for-age or height-for-age less than two standard deviations below the reference median is classified as moderately malnourished, and weight-for-age or height-for-age three or more standard deviations below the median is considered severely malnourished (WHO, 1995). The next section discusses the use of anthropometric surveys.
Temporal Trends and Taking Stock

As late as 1980 and despite three decades of intensifying efforts toward global development and health promotion, roughly 40% of children in developing countries still manifested moderate to severe malnutrition (Pelletier and Frongillo, 2003). As Figures 3.6 and 3.7 show, global rates of moderate-to-severe malnutrition have declined according to both indices. But height and weight tell rather different stories about improvement and inequality. As with mortality rates, regional differences in the prevalence of stunting (height-for-age less than two standard deviations below median) are substantial (de Onis and Blössner, 2003; de Onis, Frongillo, and Blössner, 2000), being highest in Asia and lowest in the South America/Caribbean region. These differences were maintained as prevalence decreased throughout the last 25 years, during which the Africa region experienced little change. Consequently, height status of African children declined from being better than in developing countries overall to being the worst of any region.

Both globally and in developing countries, child nutrition has improved steadily over the last two decades and more; wasting (weight-for-age less than two standard deviations below median) declined by approximately 80% in the developing Americas and by nearly half in Asia, the region where the largest segment of human population resides. Despite this progress, current projections show that the Millennium Development goal set by international accord as a 50% reduction in under-5 undernutrition between 1990 and 2015 will not be achieved (de Onis, Blössner, Borghi, Frongillo, and Morris, 2004). Instead, only a 31% improvement is expected, largely as a result of deteriorating conditions in sub-Saharan Africa.

Juxtaposition of the temporal trends for both indicators (mortality and nutrition) suggests how gains have been achieved and reveals limitations that underlie both failures to meet...
expectations and widening global health inequalities. The greatest gains in mortality reduction were attained earlier and more rapidly than for malnutrition. Sharp mortality reductions could be realized by acute interventions such as immunization and oral rehydration therapy. As mortality reductions slowed, the importance of continued improvements in nutrition for consolidation and, arguably, future progress of mortality gains became apparent (Pelletier and Frongillo, 2003). Concurrently, the understanding of child welfare as a litmus test for society reasserted itself to suggest that a reconceptualization of goals and indices of human welfare is needed. This reorientation is motivated by recognition that the fabric not just of societies, but also of the international order is imbricated with human welfare (Ahmad et al., 2000; Claeson and Waldman, 2000). Related to a refigured vision of child health within the social fabric is a reconsideration of an adequate indicator for child welfare, a theme that is taken up in the following section.

**Toward Expanded Goals for Child Health: Realizing Developmental Potential**

Child mortality and disease burden represent “the tip of the iceberg” of lost human potential (Grantham-McGregor et al., 2007, p. 60). In many respects, the markers of child nutritional status derive significance from their representation of embodied capital or the extent to which a child’s potential is being supported and actuated under the conditions in which he or she is growing up. Embodied capital, in turn, fuels the future of societies as well as that of the children themselves. The number of children under age 5 years who fail to meet potential is estimated at 200 million (Grantham-McGregor et al., 2007).

In this inclusive view of child welfare, child psychosocial development comprises cognitive, socioemotional, and sensory-motor dimensions, all of which are affected by child health and nutrition. Child health and nutrition are, in turn, embedded in the material and social conditions of rearing. The estimation of 200 million children failing to meet potential is based on the performance of children with growth retardation (height-for-age less than two standard deviations below median) and absolute poverty (adjusted income under $1/day). Growth retardation and poverty were selected as indicators of poor child development because of their strong relations to deficient rearing conditions. Assessment of the impact of these indicators on school

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and cognitive performance reveals remarkably powerful effects. WHO and UNICEF data for 79 countries showed that attainment rates for the final grade of primary school drop by nearly 8% for every 10% increase in national prevalence of stunting. Data for 64 countries further indicate that for every 10% increase in poverty, school attainment rates drop by more than 6%. The prevalence of the risk factors is dauntingly high; nearly one-third of children in developing nations are stunted (Figure 3.7), and 37% live in absolute poverty (Gordon, Nancy, Pantazis, Pemberton, and Townsend, 2003).*

Poor early child health signals developmental risk that predicts diminished outcomes across the life course (Law, 2005). It also forms a link in the chain of intergenerational transmission for economic and health disparities. Environmental risks signaled by deficits in physical growth also impair cognitive and socioemotional development along with motor and other aspects of physical development. Even small differences in child growth have been linked to differences in school performance (reviewed in Grantham-McGregor et al., 2007).

For the purposes of this discussion, child development is taken to comprise physical development and health interacting dynamically with psychosocial development and well-being. This expanded view of both child health as including psychosocial development and child development as including physical development and health integrates the two worlds of human development and public health. It also raises the bar for defining what constitutes “developmental potential.”

Culture and Child Health

Thus far, this chapter has surveyed the global record of progress and disparity in child health, the intimate ties between child health and culturally mediated conditions, and the emergence of an expanded developmental framework for child health. To meet the challenges of this expanded view, the following sections discuss concepts and models that have integrated culture to yield novel, practical insights into established and emergent health issues.

The Developmental Niche

The developmental niche, or the cultural organization of the environment in which the child grows up, is a powerful concept that links culture and human development (Super and Harkness, 2002). The niche is composed of the culturally constituted conditions (settings, experiences, resources, and challenges) under which development occurs (Valsiner, 1997). Cultural determinants of developmental niche include beliefs (e.g., parental beliefs about child development, health and illness, appropriate parenting, family relationships, proper behavior) and values (e.g., relative value of daughters versus sons, or relationships versus self, or religious versus pragmatic goals) that, in turn, inform social “goods” and priorities. Culture also includes practices, from those that define large-scale social structure, political economy, and living conditions to personal and domestic ones in daily life (e.g., cooking, hygiene, childcare) (Goodnow, Miller, and Kessel, 1995). From rituals to routines, practices both shape the settings in which children grow up and place children in specific settings. Most importantly, culture encompasses models of how the world is and works, along with context- and goal-contingent scripts for appropriate thought, action, and feeling (Shore, 1996). Thus, for example, parents hold models of family function, child development, and gender that are mapped to multiple scripts, as for mealtimes and child feeding, authority and minding, or task allocation and performance expectations.

* The criterion used for this estimate is severe deprivation of two of more basic human needs (e.g., food, safe water, shelter, sanitation). Poverty is difficult to both define and assess. Income/net resources take many forms, and consumption power can determine the leverage of available resources (Deaton, 2001). Then, relative rather than absolute deprivation accounts for some outcomes (Wilkinson, 1996).
Enacting cultural models and scripts through practices also exerts cumulative macrosocietal effects on social structure, political and material economy, degrees of inequity, and other circumstances that inform the range of possibilities and challenges afforded children and their families. Such effects also shape the characteristics of parents who themselves have grown up in the culture. These moderating factors influence the developmental niche of any specific child as well as the range of niches children experience in a particular society. Social marginalization or poverty impairs parental ability to enact cultural models and scripts for their children's welfare by, for instance, reducing their capacity to access prenatal and pediatric care, realize culturally appropriate hygienic practices, or regulate daily schedules and provide desirable opportunities to children (Grantham-McGregor et al., 2007).

The impact of moderating factors on the developmental niche and hence on child health can be both subtle and powerful. Consider this example regarding effects of household water storage and sanitation on child growth in an informal housing settlement (pueblos jovenes) near Lima, Peru (Checkley et al., 2004). Small water containers are stored uncovered inside the home and thus exposed to fecal contamination; large containers are kept outside, covered, and therefore less exposed. By age 24 months, children in households with small water containers had 28% more diarrheal episodes and were 0.8 cm shorter than were those in homes with medium or large storage containers. Moreover, a small water container plus lack of sewage and water connections in the home accounted for 40% of the average 2.5-cm height deficit in this population relative to the WHO/NCHS reference values for 24-month-olds. Hence, small within-community differences in household practices and access to infrastructure strongly contributed to child stunting.

The Developmental Niche and Child Health: Models and Exemplars

Therefore, as modeled in Figure 3.8, the developmental niche is the locus of action for determinants of child development and health. Pathways to differential well-being within and between cultures must operate through the niche. Culture shapes the developmental niche through models and scripts that orchestrate parental ethnotheories, practices, settings, and routines that make up the daily life of the child (Figure 3.8, top and middle). But the child also enters as an actor whose characteristics (biology/genetics, function, temperament, and abilities) and behaviors dynamically shape the niche and its effects on health and development (Figure 3.8, middle, bottom).
bottom, and right). For instance, in many societies, child gender systematically colors the developmental niche by eliciting distinctive, elaborated cultural models and scripts for parenting and socialization that can lead to quite different survival and health prospects for boys and girls (Worthman, 1996). Additionally, child abilities and temperament interact with expectations for emotion regulation, appropriate demeanor, and task performance to modify parental affections, quality of care, and provision of opportunities. For instance, Masai babies whose mothers rated them difficult were more likely to survive during a subsequent drought, presumably because they claimed more care (deVries, 1984). By contrast, destitute mothers in favelas of northeast Brazil may respond to infant symptoms of severe malnutrition by withdrawing care, although these mothers, too, saw demanding children as fighters ready for life’s hardships (Schepers-Hughes, 1992).

Cultural and social expectations also determine what caregivers monitor about the child and how they respond to what they see. Amele mothers of coastal New Guinea, for example, regard infant development in nonlinear terms including reversible behavioral-motor states to which infant feeding must be adjusted; an infant who was crawling and therefore fed stage-appropriate semisolids one day may be feverish, limp, and listless and therefore restricted to breast milk appropriate to their state the next day (Worthman, Jenkins, Stallings, and Lai, 1994). Similarly, Peruvian mothers encourage eating more when their infants show poor appetite during bouts of diarrhea but become more passive when infants eagerly accept food during recuperation (Bentley, Stallings, Fukumoto, and Elder, 1991).

An inclusive conception relating culture to child health ultimately must encompass all levels of a society and even the world order, from the political, economic, and social organizational, down to the domestic and personal. Nevertheless, such comprehensive accounts often lack specificity about how differential child health is produced and what those differences mean in terms of capacities, experiences, or welfare. Focus on the developmental niche draws culture out of the social ether and pulls it down to the ground by translating culture into the proximal dynamics of child development. Linking the global to the local, or macrostructural to microprocessual levels of analysis, remains more challenging. The moderators included in the developmental niche model (Figure 3.8, left) introduce these factors as constraints on dynamics operating in the niche. Hence, the distribution of sewage disposal and clean water, and access to schools, food, and medicines that condition the developmental niche of any child are shaped by values, availability and allocation of resources, and sociopolitical realities within and among nations.

The apparent and immediate needs of children and families prompt public health and policy to emphasize determinants of child welfare at the maternal, household, or community level (Engle et al., 2007). Yet the urgency of obvious need can deflect attention from larger determinants of inequity, poverty, and other challenges (Farmer, 2003). Hence, research and policy regarding child health, in particular, and social epidemiology, in general, continually struggle to formulate models of equivalent specificity and power at all levels of analysis. Nevertheless, frameworks that address all levels tend to be descriptive rather than predictive (Krieger, 2004; Mosley and Chen, 1984), whereas those with greater analytic purchase tend to offer more narrow specificity that makes a subset of relevant levels operational (Super and Harkness, 2002; Worthman, 1999b).

In view of these complexities, the following sections illustrate the insights generated by integrative, culturally informed analysis of human development and health in two domains, namely child feeding and transgenerational effects.

**Child Feeding** Humans are unique among mammals for systematic food sharing and provisioning of the young beyond weaning and into the adult period. This arrangement seems effective; infant mortality is much lower in humans than in other primates (Lancaster, 2000), and the
infant feeding practices implemented by recent and contemporary preindustrial societies meet current global recommendations (Sellen, 2001). The downside of such unusual levels of nurturance and juvenile dependency surfaces where the cultural configurations and social arrangements for provisioning are inadequate or disrupted. Although global rates of acute and chronic hunger have declined, food insecurity remains common (Coates, Frongillo, Rogers, Webb, Wilde, and Houser, 2006) and increasingly is seen as related to perturbations in production, distribution, and consumption systems rooted in social, political, and economic disparities and crises (Baro and Deubel, 2006). Social macrostructure, inequalities, and instabilities shape food availability and household livelihood security (Frankenberger, 2003). These, in turn, affect child well-being. For example, dietary diversity is associated with child nutritional status (Arimond and Ruel, 2004), but diversity is reduced by poverty and market dependency.

The relation between feeding and survival is strongest in infancy; therefore, infant feeding practices have been intensively studied and targeted in interventions to improve child survival and growth (Labbok, Clark, and Goldman, 2004). Effects of early feeding ramify throughout life. Breastfed infants have less frequent infectious illness and higher survival (Jones, Steketee, Black, Bhutta, Morris, and Bellagio Child Survival Study Group, 2003) and, as adults, have lower risk of type 2 diabetes (Owen, Martin, Whincup, Smith, and Cook, 2006) and premenopausal breast cancer (Martin, Middleton, Gunnell, Owen, and Smith, 2005). Extensive evidence indicates that optimal infant feeding is defined by convergent ecological, maternal, cultural, and economic factors (McDade and Worthman, 1998). As such, infant feeding vividly illustrates both the roles of culture in child health and the feasibility of deriving a grounded model of those roles as a basis for intervention and policy. Exclusive breastfeeding provides ideal nutrition and developmental support as well as protection against pathogens causing early mortality (Labbok et al., 2004). Nevertheless, after 6 months, breast milk no longer meets infant needs. Supplementation becomes necessary but increases risk from pathogens and nutritional insufficiency. Infant needs and risks and caregiver intent and capacity for optimal feeding are influenced by household and community conditions. Hence, pathogen burden affecting mortality risk for the infant and maternal nutrition and workload affecting maternal health burden represent potentially opposing pressures—to delay or accelerate supplementation, respectively.

Figure 3.9 tracks how prevailing sociocultural factors determine the timing, pattern, quality, and quantity of infant feeding by influencing on-the-ground pressures on caregivers—usually mothers—around specific feeding behaviors comprising continuing exclusive breastfeeding,
supplementing, or weaning. Benefits and supports for breastfeeding, such as cultural views of maternal roles or infant development, weigh against constraints on breastfeeding, such as maternal workload and marital demands. For example, breastfeeding and supplementation patterns have been associated with mother–child transmission of HIV (Hartmann, Berlin, and Howett, 2006), but workload, illness, or partner pressure may erode maternal ability to maintain an exclusive breast- or bottle-feeding regimen to minimize transmission risk. Local forces are, in turn, shaped by macro-level factors (ideology, physical and social ecology, and political economy) related to conditions of life, prevailing values and knowledge, and access to resources and social capital. Poverty and social marginalization demonstrably affect infant feeding (Schepet-Hughes, 1992; Stallings, Worthman, Panter-Brick, and Coates, 1996), but the influence of macro–micro linkages often operate circuitously. For instance, household technologies of food storage and processing affect the nutritional value and safety of complementary foods fed to infants (Mensah and Tomkins, 2003).

**Intergenerational Effects**

Explanations for parent effects on child health and survival have long focused on socioeconomic conditions of childrearing, particularly on income, parental education, and residence. An important insight gained by this work is the importance of women’s education for reducing child mortality independent of the effects of paternal education, residence, or occupation (LeVine, LeVine, and Schnell, 2001; UNICEF, 2007). The effects of women’s education extend to the community level; in India, for instance, the proportion of educated women at the district level predicts child immunization rates for the district (Parashar, 2005). Hence, child welfare reflects not only culturally determined gender norms, but also social stratification and living conditions that affect both parents’ own developmental histories and consequent capacities and their priorities and resources for parenting as adults.

Recent epidemiological work has revealed another direct route for transmission of intergenerational effects, namely during gestation. Evidence that fetal conditions, indexed by low birth weight, have early and enduring effects on the child’s health has directed attention to gestational environment and maternal welfare. Formative observations identified relationships of low birth weight with risk for cardiovascular disease and metabolic dysfunction in adulthood (Barker, 1991). The resultant thrifty phenotype hypothesis proposed that poor fetal nutrition induces alterations in regulatory mechanisms that facilitate coping with challenging postnatal conditions including poor nutrition and high activity but predispose to chronic disease within a “mismatching” postnatal environment of overnutrition and low activity (Hales and Barker, 1992).

Subsequent research has established relationships and mediating mechanisms between maternal conditions (diet, nutrition, stress, and activity levels) and child function as well as health from infancy onward (Gluckman and Hanson, 2004; Kajantie, Osmond, Barker, Forsén, Phillips, and Eriksson, 2005). Many factors influence fetal nutrition beyond maternal nutrition, including maternal behaviors (smoking or physical activity), maternal conditions (hyperglycemia or hypertension), maternal stress (low social support or distress), composition of maternal diet (high protein or low micronutrient intake), or vagaries of placentation (Harding, 2001; Perkins, Pivarnik, Paneth, and Stein, 2007). Context plays significant roles not only in producing gestational conditions that affect fetal development, but also in determining the postnatal health consequences of fetal outcomes (Leon, 2004; Worthman and Kuzara, 2005). For example, persons exposed during gestation to the 1944 to 1945 famine in Holland exhibit increased obesity, reduced glucose tolerance, higher blood pressure and risk for hypertension, and likelihood of mortality in middle age (Kyle and Pichard, 2006; Stein, Zybert, van der Pal-de Bruin, and Lumey, 2006). Conversely, undernourished offspring of Guatemalan mothers supplemented in pregnancy grew faster as children and had greater glucose tolerance as young adults compared with unsupplemented controls (Conlisk, Barnhart, Martorell, Grajeda, and Stein, 2004; Stein
et al., 2004). Such effects can carry forward across generations; gestational and postnatal conditions that alter physiological regulation and increase sensitivity to stressors potentiate subsequent stress in pregnancy with consequent transmission of the phenotypes of vulnerability to the next generation (Drake and Walker, 2004). Via the uterine pathway, the treatment of girls and women may translate into well-being of their offspring—daughters and sons.

Fetal programming and environmental mismatch may underlie the emerging worldwide epidemics of obesity and secondary, or acquired, type 2 diabetes that became apparent by the 1990s (Zimmet, Alberti, and Shaw, 2001). Initially, the trends to increasing prevalence of non-communicable diseases were seen as afflictions of affluence (Armelagos, Brown, and Turner, 2005). But the global epidemic also afflicts developing and transitional economies, including their less affluent sectors, and coincident over- and undernutrition within households or communities is increasing (Monteiro, Moura, Conde, and Popkin, 2004). The trends first manifested in adults now are appearing in children and adolescents. Onset of type 2 diabetes historically has occurred later in life, but high prevalence in adults has been associated with its novel appearance among the young; child-onset type 2 diabetes was seen earliest in countries having the world’s highest adult rates of the disorder (Pinas-Hamel and Zeitler, 2005). Ironically, diseases of affluence began disproportionately to burden the disadvantaged just as improved life circumstances were achieved (Leon and Walt, 2001). Thus, adolescents from disadvantaged minorities in the United States, Canada, and New Zealand have disproportionally high rates of secondary diabetes (Pinas-Hamel and Zeitler, 2005).

Other likely complementary explanations for these epidemiological trends also command supporting evidence (Davey Smith, Sterne, Tynelius, and Rasmussen, 2004; Dowse and Zimmet, 1993; Neel, 1962; Sniderman, Bhopal, Prabhakaran, Sarrafzadeh, and Tchernof, 2007; Spiegel, Knutson, Leproult, Tasali, and Van Cauter, 2005). During this period of very rapidly shifting epidemiological and scientific landscapes, final conclusions must await events. Nevertheless, the consensus is that changes in diet, activity, and daily experiences and stressors play a role in the emergence of chronic diseases and that such diseases have a developmental course that begins early on and is affected by conditions throughout life.

Behind these causal conditions is cultural change, on local and global levels. Therefore, now more than ever, culture has assumed a major place in our understanding of human development and health. From this point, this chapter turns to a final consideration of cultural factors in the epidemiology of early life.

Cultural Factors and Global Trends in Child Health

If child survival and growth are sensitive indicators of environmental quality, then advances in child health must draw on culture change. Global interventions that leveraged improvements in child survival, health, and nutrition also have involved culture change regarding social values, ideas, practices, and structures of power and authority. For instance, global achievement of high rates of child vaccination has relied on parental acceptance (Streefland, Chowdhury, and Ramos-Jimenez, 1999), political and media support (Gangarosa et al., 1998), and shared understandings of risk (Hacking, 1990), alongside reallocation of resources as well as organizational and logistical capacities required to implement and maintain immunization programs. Beliefs and values remain important even when material, technical, and logistical constraints are relaxed; in the United States where vaccination rates had slumped, completion of childhood immunization was attributable to “positive immunization-related beliefs and attitudes” among mothers (Gore et al., 1999).

Indeed, an analysis to explain differential reductions in growth stunting using the WHO Global Database on Child Growth found that both starting conditions and change in multiple domains were necessary to account for just two-thirds of national differences in stunting
reduction among children under 4 years old (Milman et al., 2005). These factors comprised initial and change in immunization rate, initial and change in safe water rate, initial female literacy rate, initial government consumption, initial income distribution, and initial proportion of the economy devoted to agriculture. Accordingly, biomedicine and public health have begun to engage seriously with the role of culture in health, including critical analysis of the cultural context of customary medical, public health, and policy practices themselves.

Movements such as social medicine and ethnopediatrics have emerged to inform pediatric research, practice, and even popular childcare manuals on such disparate topics as feeding (McDade and Worthman, 1998), sleep (Jenni and O’Connor, 2005), and parenting in general (Small, 1998). “Pediatricians need to recognize the cultural environment in which children live and be knowledgeable about how cultural beliefs and values of both families and physicians interact with the needs and biological characteristics of individual children” (Jenni 2005, p. 204). Important as it is, individual-level action is demonstrably insufficient to secure child welfare. Rather, household, community, national, and international conditions influence the developmental niche and shape the welfare of any given child. Concurrently, social epidemiology has been launched to unravel the roles of psychosocial factors such as social capital, inequality, and perceived status or insecurity in paving the pathways to differential well-being based on a multilevel framework stretching from the molecular to the macrostructural (Adler, 2002; Krieger, 2004).

Conclusion

Views of child health and its relation to the social order are undergoing a paradigm shift related to forces of globalization and widespread culture change with corresponding struggles for local and global welfare (Worthman and Kohrt, 2005). The shift is precipitated by diminishing gains and even reversals in advancing child survival and health that are rooted in the limitations of current policies and their informing paradigms. Concerted public practice and research around the world during the last half century have taught us that not only psychosocial factors, but also physical development and health of the young are closely tied to the fabric of society. We are still learning how to bring these lessons most effectively to bear for securing the physical and psychobehavioral health of young people. The social sciences currently are grappling with this problem by engaging sources of human diversity (Part 2 of this book), characterizing the roles of culture and context (Part 1 of this book), and formulating multilevel models that span the individual to societal to global.

This discussion commenced by characterizing the exceptional burden of mortality and ill health borne by children, particularly during the early years. The burden remains substantial despite dramatic improvements in child survival from the latter part of the twentieth century to the present. Child health indicators also improved during this period, although not as rapidly as did survival. More worrisome are persistent or even widening disparities in child health within and among countries. Public and scientific constituencies agree that child survival and health denote the welfare and functioning of the population as a whole. This insight has had two consequences. First, indices of child health (particularly survival, growth, and weight) not only guide national and international policy with regard to public health, but also act as a litmus test for the performance of governments, agencies, and societies as a whole. Second, these indices have propelled an engagement with the sociocultural factors that drive child health.

If the survival and development of the young rely on the package of care and ambient conditions from conception onward, then improvements in child health must entail improvements in these conditions. Early efforts in this direction focused on proximal levels, particularly the mother and child, household, and local community. The concept of a developmental niche permits integration of cultural factors into the analysis of the determinants that form the
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particular envelope of care and experiences a child encounters. The model has been expanded to include both sociostructural and biological levels and has proven to be an effective tool for guiding new work to discover key factors and dynamics in child health and development (Richter, 2004; Weisner, 1998). Flexible integrative models are required for an effective and comprehensive global approach to child health because the nature and importance of these factors and dynamics vary within and across societies. A model for a basic element of care, child feeding, was discussed to show the feasibility for integration of structural down to biological levels of analysis in a biocultural model for determinants of infant feeding and its health consequences.

The shock waves from upheavals in thought and practice regarding human welfare and child health in particular will continue to reverberate for some time. Developmental and health sciences are transforming themselves in the process. The current move to define child health in terms of physical as well as psychosocial development and well-being orients social goals and policies around a realization of child developmental potential. The value of this integrated approach to child health is compellingly illustrated by the recognition of fetal programming and environmental mismatch as potentially powerful forces in shaping health across the life span and into the next generation. Social conditions that cause physical and mental hardship have been found to translate into adjusted functional capacities of offspring that, if confronted with a mismatching postnatal environment during current conditions of culture change and globalization, can lead to impaired development and health.

The cutting edge of current evidence for integrative cultural-contextual analysis has carved deep into outmoded distinctions between mind and body, individual and society, personal and political, and qualitative and quantitative analysis. Attention to child health and the use of developmental analysis have helped both to unravel these distinctions and to build new science and practice toward promotion of human equity, realized potential, and well-being.

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