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# International Child Health: State of the Art

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Many published articles and policies describe what should be state of the art in global child health, and there are dozens of large initiatives aimed at implementing these policies. We have knowledge of what should work, yet struggle to effectively implement that knowledge and improve child health outcomes in resource-poor settings, even at the most basic level of ensuring sufficient food and clean water for the world's children. This article highlights many smaller programs that are operational in the field, demonstrating excellence in global child health efforts, and may approach state of the art in actual implementation. The examples include a grass roots primary health care program, a home-based neonatal care program, kangaroo mother care, ready-to-use therapeutic food (RUTF), a vitamin A program, point-of-use water purification, disasters and children, a pain management program, and a developmental

disabilities program. This article also discusses the importance of strengthening human resources for health by, for example, training child health professionals in low resource countries. These programs show what can be done and could be replicated in other communities to improve child health, given a few committed individuals and modest resources. Ultimately, truly state of the art health care for children must be defined locally and championed by each state or nation. Nevertheless, there are overarching components and supports that are the responsibility of the global community, particularly those needed to assure that the basic human rights of children, including health, are met throughout the world.

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**W**e were asked by the editors of *Current Problems in Pediatric and Adolescent Health Care* to prepare an article on "The State of the Art of International Child Health." While we were intrigued by the assignment, we also recognized the paradox inherent in the title. For many decades, the international development community has emphasized sustainability, cost-effectiveness, and doing the best we can with limited resources. These precepts have been regularly challenged by advocates of social justice, who question the ethics of accepting a different standard of care for the developing world than for the western world. From Alma-Ata (1978) to the Millennium Development Goals (2000) to the voice of workers in the field, the world community is continually challenged to take on greater shared responsibility for the health and well-being of all people.<sup>1-4</sup> We

faced a conundrum when given the title for this article. The term state of the art is defined as the highest level of development achieved at a particular time. Its earliest documented use was in 1910 as "in the present state of the art this is all that can be done."<sup>5</sup> When applied to global child health, is state of the art the best child health care we currently provide in poor settings? Is this "all that can be done?" When asked in this way, it is clear that it is not.

Having worked in global child health for many decades, we recognize that there is a difference between state of the art policy and practice in the field. In many areas we have sufficient data and knowledge, yet practical transfer of that knowledge to widespread implementation and improved child health outcomes has not happened. We continue to struggle as a world community to effectively implement the most basic "state of the art" interventions for children: food, clothing, clean water, shelter, primary health care, education, and some measure of love and affection. The importance of addressing the global health needs of children cannot be overemphasized. Insult, injury, and deprivation in utero and through the first 5 years of life can have devastating long-term effects<sup>6</sup> that ultimately affect not just the individual harmed, but undermine

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long-term social, economic, and political stability on a global scale.

There are many published articles and policies that reflect what should be state of the art in global child health. There are dozens of large initiatives aimed at implementing these policies (eg, Integrated Management of Childhood Illness; the Global Fund to Fight AIDS, Tuberculosis, and Malaria; the Global Polio Eradication Initiative; the Measles Initiative; the Nothing but Nets Campaign, etc). In this article, we have chosen to highlight many smaller programs that are operational in the field, demonstrate excellence, and may approach state of the art in their actual implementation. It is not an exhaustive or all-inclusive list. We have also chosen to highlight some programs that address a critical need but generally receive less attention in global child efforts, such as alleviation of childhood pain and suffering. We hope these examples may inspire creativity and an increased effort to elevate child health to a truly state of the art level on a global scale.

## Overview of Global Child Health

Child health, as defined by the World Health Organization (WHO), is the complete physical, mental, and social well-being of a child, not merely the absence of disease.<sup>7</sup> Despite the evolution and advances in pediatric medicine and global health initiatives, sustainable improvements in the health status of children have not been consistent. The major causes of morbidity and mortality in children are the same as they were 35 years ago. In 1973, Professor David Morley wrote a book, *Paediatric Priorities in the Developing World*. In chapter one he noted that nutritional deficiencies and infectious diseases were the major problems of children in less developed countries.<sup>8</sup> The situation is much the same today. Over recent decades disease-specific initiatives have resulted in fragmented delivery systems rather than a coordinated effort to meet the health needs of the child and mother.<sup>9</sup> Less than 50% of children and mothers in the developing world are receiving child survival interventions,<sup>10</sup> nor have improvements in health status been equitable. The gap among countries regarding child mortality is not closing.<sup>11</sup> Geographic location of birth, environmental hazards, socioeconomic status, parental education, and gender are just some of the mitigating factors contributing to gross disparities in child health.

Ninety percent of infants born in 2008 were born in a developing country. An average of 100 times more is spent on the health care of a child in a developed country than on a child in a developing country. The estimated global shortage of 4.3 million health workers, including a shortage of one million in Africa that carries 24% of the global burden of disease,<sup>12</sup> compounds the challenge of providing health care. These statistics are expected to worsen with the decline and continuing exodus of skilled health care workforce from developing countries.

Twenty percent of the population in developing countries is under the age of 5. More than 9.8 million children under the age of 5 died in 2007 of preventable diseases, including 4 million in the first month of life.<sup>13</sup> The number one cause of death is inadequate neonatal health care, including problems such as asphyxia, preterm delivery, sepsis, and tetanus. Infectious and parasitic diseases are the second most frequent cause of mortality in children who live in developing countries. Infectious diseases and the frequently accompanying malnutrition, in contrast, are not major threats to the average western child due to national infrastructures that provide for immunizations, better nutrition, better environmental conditions, and access to sanitation, clean water, and medical care.

Significant adversity impairs early brain development, especially in the first 3 years of life; thus barriers to education achievement emerge at a very young age in children. Young children require a balanced approach to social, cognitive, and language development. Whether young children experience stress from physical deprivation such as lack of food or from psychological deprivation such as living in an orphanage, they are at risk for adult physical and mental impairment. All too often the physical and mental problems of adults are not viewed in the context of the adversity they experienced in utero or in early life. There is now much research, including “hard” physiological data, to demonstrate the links between early adversity and impairment of brain architecture, immune status, cardiovascular and metabolic functions.<sup>14</sup> Reducing such early adversity should be the highest priority for every government of every country.

The Millennium Development Goals developed in 2000 are 8 goals with target indicators and dates that world leaders agreed on as a vision for the future. These goals were developed in response to the failure to meet existing targets previously established in 1990 for the year 2000. The goals are considered a mutually reinforcing

ing framework in which health is central.<sup>15</sup> Unfortunately, there remains a large disparity in progress in meeting the goals to reduce maternal and child mortality by 2015. While there has been some progress in Northern Africa, eastern Asia, Latin America, and the Caribbean due to economic growth and improved access to health care, many countries, especially those in sub-Saharan Africa, remain far from meeting the Millennium Development Goals.<sup>16</sup> The UN Millennium Project final report regarding the reasons for failure to meet the Millennium Development Goals mentions poor governance, extreme poverty especially in countries with adverse geographic conditions, poverty pockets that are excluded from infrastructure and economic benefits afforded mainly to the more affluent sectors of society, and policy neglect.<sup>16</sup> Poverty remains one of the determinants of child health and eradication of extreme poverty and hunger is the first Millennium Development Goal. Poor children, especially those in developing countries, are more likely to be low birth weight due to poor maternal nutrition, to be exposed to health risks, have less resistance to disease due to undernutrition, and have less access to skilled preventive intervention or medical care.<sup>17</sup>

The well-being of children is intricately linked to the functioning of social supports and the family unit. It is well documented that the health and survival of the child is dependent on the health of the mother. Over 3 million of the greater than 9 million deaths in children occur in the first month of life. Inadequate reproductive health contributes to high maternal mortality in many developing countries. While there exist challenges to accurately determine global maternal mortality rates, in 2005 there were an estimated 400 maternal deaths per 100,000 live births. Most of these occurred in Africa where the maternal mortality rate is estimated at 900 maternal deaths per 100,000 live births and has barely changed since 1990.<sup>18</sup>

*Current Problems in Pediatric and Adolescent Health Care* recently published a comprehensive overview of global child health issues.<sup>19</sup> We also refer readers to the excellent 2003 *Lancet Child Survival Series*, available through the WHO web site.<sup>20</sup> We provide a brief overview of global child health issues and focus most of this article on specific examples of child health programs that approach state of the art in the field, some of which may be well-known, and others that are relatively unknown but merit broader recognition. We have completed extensive literature searches to identify programs that have been successful in the field over at least several years and have consulted with

many global child health specialists with personal knowledge of these programs. This confirms the common knowledge that programs may not be the same in the field as they are in controlled research trials and that they change over time. The programs described below demonstrate excellence in the areas of primary health care, food/malnutrition, water and sanitation, disasters/conflict, relief of pain and suffering, cognitive/developmental disabilities, and the strengthening of human resources for child health. We will conclude by reflecting on some of the common variables or “lessons learned” from these programs.

## Primary Health Care

In 1978, the Declaration of Alma-Ata defined primary health care as “essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and the country can afford to maintain at every stage of their development in the spirit of self-determination.”<sup>1</sup>

The Declaration of Alma-Ata placed primary health care in a broad social, political framework, recognizing that there are multiple determinants of health that cannot be easily separated. On a simplistic level, we may think of primary health care as relating to the provision of preventive and curative medical services, health promotion, and rehabilitation. In its broader context, primary health care intersects with education, agriculture, public works, industry, and all aspects of national and community development.<sup>1</sup> Hence primary health care efforts require an integrated, coordinated approach across sectors. The WHO reiterates that the ultimate goal of primary health care is better health for all. WHO identifies the following 5 key elements for achieving this goal:

- reducing exclusion and social disparities in health (universal coverage reforms);
- organizing health services around people’s needs and expectations (service delivery reforms);
- integrating health into all sectors (public policy reforms);
- pursuing collaborative models of policy dialogue (leadership reforms); and
- increasing stakeholder participation.<sup>21</sup>

One of the difficulties that the world community strug-

gles with is how to make primary health care policy operational in the field (ie, how to move resources away from conference rooms and into the villages). We ourselves have written policy reports that sit on shelves; much more heartening are the times we have actually worked hands-on in the field to implement primary health care programs. The descriptions below are examples of the latter, where often just a few committed individuals working “in the trenches” started with small ideas that resulted in tangible, positive outcomes. Some of these programs are more integrated than others, but they have all achieved some measure of success in improving access to primary health care for children in resource poor settings.

### *Lodoi Development Program*

The Lodoi Development Program is an excellent, well-integrated primary health care program in rural Uganda, which was established by Patrick and Helen Mutono in 2000.<sup>22</sup> It is named after Patrick’s father, Lodoi, who died suddenly because of lack of access to relatively basic medical interventions. At that time, Dr. Patrick Mutono was in the USA where he had completed his medical specialty training and was planning to continue his work there. The death of his father led Dr. Mutono to return to his rural village in Uganda, an area with no health services. He began curative and preventive programs concurrently. He planned and built the Kanginima Hospital with modern surgical facilities and primary care clinics. He established close relationships with surgical teams and dental teams from the USA who came as volunteers to provide services to the local community. Initially, Dr. Mutono provided much of the acute medical care himself; eventually the Ministry of Health of Uganda appointed him with full-time medical officers to live on site and provide both outpatient and inpatient services. As is true in the provision of medical services throughout the world, patients often used traditional or alternative treatments before coming to the Lodoi clinic and may have decided to come only after the traditional treatment failed. Dr. Mutono notes that patients rarely volunteer any information about their prior traditional treatment, but it is an important variable to consider when providing integrated primary care.

Together, the Mutonos established community outreach programs, including immunizations, de-worming, and health education. In collaboration with the local community, they established income-generating

activities such as fish farming, tree planting, and improvement of agricultural methods. A nursery starts trees from seeds and these are available to village citizens for a few cents apiece. Recognizing the health hazards from traditional cooking stoves, the Mutonos have organized the construction of smokeless stoves for most traditional houses. The Lodoi Development Program has mobilized funding and protected 200 water wells, increasing access to clean water from 30% to 95%. This has been associated with a major reduction in waterborne diseases. The Lodoi Development Program also established a microfinance institution called Savings and Credit Operations for the People. With small loans of approximately US\$50 to \$100, this program helps families and individuals to save and start small businesses.

Helen Mutono developed a model school program that taught the first 2 years of primary school in the local language and provided meals for students. Malnutrition has been a major problem for children in the area. The Mutonos addressed this via fish farms, improved farming practices, and education for families about nutrition for pregnant women and children under 5 years. They developed a food supplement for malnourished young children made from local grains and vegetables, including millet, sesame, soya, beans, peanuts, rice, and cassava.

The Mutonos have partnerships with the local and national government, churches, local community organizations, farmers groups, area hospitals, and clinics. They have developed a small tourist business to help fund all the health programs. They themselves live in a rented house and home school their own children.

When the Lodoi program began, 25% of child patients had diarrheal illnesses; this figure is now 5%. Recently, the Lodoi team made an outreach visit to a village 50 km away and outside of the Lodoi Development Program catchment area. Four children had died in that village in the past month alone. In contrast, deaths of children are now a rare event in the catchment area served by the Lodoi Development Program. The program is an excellent model that has improved child health outcomes in this rural Ugandan community and could be replicated in many countries.

### *Partners in Health*

Over 20 years ago, Dr. Paul Farmer and colleagues established the organization Partners in Health to provide health care to people living in the rural Central

Plateau of Haiti. Since that time, Partners in Health has expanded health care services to 6 other countries and supported dozens of other initiatives.<sup>23</sup> Partners in Health has championed the use of locally trained community health workers to extend health care services to hard-to-reach populations, usually in poor, rural, geographically isolated areas. They have harnessed the global funding available for human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) services to expand and strengthen primary health care services through an integrated, community-based approach. In Haiti, Partners in Health has demonstrated that integrated HIV/AIDS prevention and care services have a measurable and positive impact on primary health care, specifically in the areas of immunization, family planning, tuberculosis case finding and treatment, and health promotion.<sup>24</sup>

The organization's guiding principle is to "do whatever it takes" to provide health care to the world's poor. What this looks like in action is a long-term commitment to the communities in which they work, close collaboration with the local community and government to build infrastructure and influence policy, the training of hundreds of local villagers to serve as community health workers, developing a system for home visitation that extends health care services beyond the hospital/clinic and into the neighborhoods where people live, and integrating services so that every point of contact is an opportunity to address a broad range of patient needs from medical care to social services. This strategy has been effective in multiple settings at expanding access to basic primary health care, along with many other benefits for children such as early identification of children at risk for malnutrition, prevention and treatment of pediatric HIV/AIDS, and successful cure of multi-drug-resistant tuberculosis in children.<sup>25,26</sup>

### *SEARCH: A Home-based Neonatal Care Program*

The Society for Education, Action, and Research in Community Health (SEARCH) is a nongovernmental organization that was founded in India in 1985 by Drs. Abhay and Rani Bang. The mission of SEARCH is to work with marginalized communities to identify their health needs, develop community empowering models of health care to meet these health needs, to test these models by way of research studies, and then to make

this knowledge available to others via training and publications. SEARCH identifies health problems in marginalized communities by living among them, listening to them, and conducting epidemiologic studies.<sup>27</sup>

Recognizing that lack of access to neonatal health care, high levels of neonatal asphyxia, and neonatal mortality are major problems in developing countries, Drs. Abhay and Rani Bang initiated a field trial of home-based neonatal care in rural Gadchiroli, India and followed the cohort for 10 years.<sup>28</sup> The study compared 39 intervention villages with a population of 39,000 and 47 control villages with a population of 42,000. The intervention consisted of training village health workers to cooperate with traditional birth attendants and local health services to do the following:

1. Identify and maintain a list of pregnant women.
2. Organize group health education activities using audiovisuals and games.
3. Make two home visits during pregnancy and also visit the home on the second day after the delivery.
4. Attend deliveries with the traditional birth attendants.
5. Manage asphyxia if required.
6. Facilitate exclusive breastfeeding by mothers.
7. Inject vitamin K on the day of birth.
8. Provide warmth for the newborn.
9. Assess the newborn for high risks.
10. Make 8-10 home visits during the first year of life.
11. Provide weekly weighing for low birth weight or preterm infants and refer these infants for evaluation and treatment if needed.
12. Maintain vital statistics data records.<sup>29</sup>

Village health workers were taught about symptoms of newborn sepsis. If infants were diagnosed with sepsis, they received cotrimoxazole and gentamicin. The study followed neonatal mortality, stillbirth rates, perinatal mortality, postneonatal mortality, and infant mortality in the intervention and control areas. While the neonatal mortality rate increased in the control area from 58 to 64 (per 1000 live births), it declined from 62 to 25 in the area that received home-based neonatal care. In the intervention area the stillbirth rate decreased by 49%, the perinatal mortality rate decreased by 56%, and the infant mortality rate decreased by 57%. Also, the cause-specific neonatal mortality rate for sepsis decreased by 90%, for asphyxia by 53%, and

for prematurity by 38%. These gains were sustained over a 7-year period.

In the baseline years of the study, trained traditional birth attendants used mouth-to-mouth resuscitation for newborns. During the intervention years, they used tube-mask (1996-1999) and bag-mask (1999-2003). Asphyxia-specific mortality was reduced 12% by use of mouth-to-mouth resuscitation, 27% by use of the tube-mask, and 67% by use of the bag-mask. The estimated equipment cost was US\$13 per averted death.<sup>30</sup> Notably, this longitudinal study demonstrated that low birth weight and preterm neonates can be managed at home by mothers and trained village health workers.<sup>31</sup> This successful program in 39 villages continues at present (Bang AT, personal communication, 2009) and is supported by the Society for Education, Action, and Research in Community Health.

### Kangaroo Mother Care

Sometimes the worst aspects of “high-tech” medicine reach low resource countries. This has been particularly true of neonatal intensive care where incubators to keep preterm infants warm, ventilators to assist respiration, and intravenous feeding to provide nutrition can be hazardous. This results in separation of mother and baby, failure to initiate breastfeeding, and nosocomial infections. There are some neonatal units where, to avoid infection, maternal visiting is forbidden and others where none of the incubators function correctly with overcrowding, overheating, and cross-infection (Brady J, personal communication, 2009). Furthermore, assisted ventilation without serial blood gas measurements has not improved survival, and intravenous feeding often results in bacterial and fungal infections.

Beginning in 1978 in Bogotá, Colombia, Drs. Rey and Martinez, frustrated by their lack of incubators, high incidence of cross-infections, and abandonment of premature infants, tried a novel technique.<sup>32</sup> Instead of incubator care, they placed preterm infants close to their mothers in a “skin-to-skin” position, held between the mother’s breasts for 24 hours a day.<sup>32,33</sup> This so-called “Kangaroo Mother Care” provides temperature control, breastfeeding on demand, and protection from nosocomial infection. Their original data suggested that mortality of low birth weight infants 1000-1500 g could be reduced from 70% to 10%.<sup>34</sup> However, their results may well have been due to selection of cases for skin-to-skin care as randomized

well-controlled trials have not shown any difference in mortality.<sup>35</sup> However, a Cochrane Systematic Analysis showed that infants treated with kangaroo mother care demonstrate significant improvement in daily weight gain at discharge, head circumference at 6 and 12 months, and exclusive breastfeeding at discharge with reduction in severe infection and lower respiratory tract infection during the first 6 months of life.<sup>35,36</sup> Since 1978, neonatal nurseries in many countries have initiated kangaroo mother care programs.<sup>37,38</sup> We believe it is an excellent and effective intervention for improving neonatal outcomes in the developing world.

### Food/Malnutrition

*Susan was abandoned in an orphanage at about three months of age. Although she was healthy and had normal weight on arrival in the orphanage, she soon became ill with pneumonia and chronic diarrhea. She lost weight and weighed only 5 kg at the time of her adoption at age 8 months. She was noted to be “floppy” and could not sit. Subsequently she gained weight and height rapidly and was at the 50th percentile by 24 months. Both receptive and expressive language acquisition were slow. Gross- and fine-motor skills were normal for age by two years. When she entered school, she learned to read normally but had serious math disabilities and auditory processing handicaps. She had significant difficulty in self-modulation. As she grew older, her problems in executive function became more apparent and she had problems completing assignments at school and tasks at home. She completed high school with learning assistance. She entered a community college and dropped out after a few weeks. She underwent a one week evaluation for vocational potential and skills. Despite a normal IQ, she was judged to be “noncompetitively employable.”*

Malnutrition weakens the immune system and makes children more vulnerable to disease, effects which are believed to be reversible with refeeding. However, malnutrition and its associated micronutrient deficiencies result in serious, irreversible poor outcomes as well.<sup>39-41</sup> Early malnutrition is the leading cause of cognitive impairment, usually manifested by problems with attention, learning, and executive function. A recent report estimated that more than 200 million children under 5 years are cognitively impaired be-

cause of early malnutrition.<sup>42</sup> Efforts to prevent early malnutrition should be at the top of the list for all child health programs.<sup>43</sup> A truly state of the art program should identify children at risk of malnutrition and intervene before irreversible cognitive impairment occurs; this has been difficult to implement in practice. This is also a policy issue in that funding can be procured to treat the “disease” (eg, acute malnutrition) but not to prevent it (eg, provide food supplementation to all children and families at risk).

Key preventive strategies for malnutrition include attention to the nutritional status of pregnant women from the beginning of gestation; priority distribution of food, vitamins, and micronutrients to pregnant women and children; growth monitoring from birth until age 3 years; and rapid refeeding interventions when there is evidence of growth faltering. Communicating with government leaders and policymakers about the irreversible and serious long-term effects of malnutrition in children is needed to generate political will for effective preventive nutrition programs for children.

### *Ready-to-Use Therapeutic Food and Project Peanut Butter*

An example of a relatively new nutritional intervention is the outpatient use of ready-to-use therapeutic food (RUTF)<sup>44</sup> for acute and chronic malnutrition. Clinical research over the past decade has documented that RUTF given on an outpatient basis is the preferred treatment for the majority of young children who are severely malnourished. The rapidity and success of recovery is much better than that seen with the inpatient milk-based treatments that were used for many years. In 2007, the United Nations Standing Committee on Nutrition, the WHO, and the United Nations Children’s Fund (UNICEF) issued a joint statement establishing community-based treatment protocols with RUTF as the most effective method by which to treat severely malnourished children.<sup>45</sup> RUTF has a similar nutrient composition as F100, which is the therapeutic diet traditionally used by hospitals to treat malnutrition. However, because ready-to-use therapeutic food is not water-based, it can be used without refrigeration for months and requires no cooking. RUTF is relatively inexpensive; the average child in Malawi required 6 weeks of treatment for a total cost of US\$15.<sup>46,47</sup>

In 2000, Dr. Mark Manary began Project Peanut Butter in Malawi.<sup>48</sup> At that time Malawi had a 70%

rate of malnutrition in children under 5 years. Dr. Manary experimented with a mixture of ground roasted peanuts, powdered milk, vegetable oil, vitamins, sugar, and minerals; initially he made this in his own local kitchen. This food supplement was then brought to rural villages for nutritional therapy in the home. He trained teams of medical personnel to examine children, record anthropometric information, and then provide two weeks of the RUTF for malnourished children. The teams returned every two weeks to reassess the children and then to give an additional two week ration of RUTF, if needed. Eighty percent of the children receiving RUTF recovered in 6-8 weeks. The average recovery rate is now 95%.

Project Peanut Butter expanded its production and distribution to 15 sites by 2005. It has emphasized the teaching of local health staff to recognize signs of early malnutrition to allow for earlier intervention. The preparation of RUTF in Malawi involves special care to minimize the amount of air and moisture in the mix, thus preventing bacterial multiplication. In Malawi an independent food technologist determined that the locally produced RUTF had no significant microbial contamination or aflatoxin levels.

This innovative treatment for malnourished children represents a dramatic change. Most children with severe malnutrition can be treated successfully in their homes without the risks of nosocomial infection or the psychological stresses associated with hospitalization. Families are not as burdened with the significant problems of transportation to the hospital and/or loss of income. As a result, they may be more likely and able to seek intervention at an earlier stage of malnutrition. RUTF is currently distributed primarily to children with severe acute malnutrition. Extending its use to children who are chronically malnourished, less severely malnourished, and undernourished or “at risk” has great potential as an effective, low-cost intervention strategy for preventing the serious long-term consequences of early childhood malnutrition.

### *Barbados National Nutrition Program*

Prior to refeeding, a malnourished child is likely to have experienced some irreversible effects of malnutrition.<sup>39,49,50</sup> For nearly 40 years, Dr. Janina Galler has followed a cohort of persons in Barbados who were malnourished during their first year of life. Subjects in her study had only one relatively short period of malnutrition in the first year of life and afterward received weekly visits until they were in

grade school to ensure that they did not experience further malnutrition. Nonetheless, about 65% manifested evidence of cognitive impairment, especially by ages 10 or 11, when higher order cognitive functioning is required.<sup>41,49,50</sup>

Previously malnourished children should be followed closely for at least 10 years with respect to the likelihood that they will manifest learning and behavioral problems over time. They should receive careful developmental assessments yearly. Ideally, early appropriate interventions should be available whenever learning problems are identified. Often, the expertise does not exist to do this, particularly in areas at greatest risk for early childhood malnutrition. Prevention of malnutrition in pregnant women and in children under age 3 years is the only practical solution. This has been demonstrated as feasible in an excellent nutrition program implemented in Barbados. In response to the compelling data that came out of the follow-up studies of malnourished infants, the Barbados Ministry of Health began providing food supplements to pregnant women, encouraged breastfeeding, and provided food supplements for infants and toddlers. There was a rapid reduction in early malnutrition.<sup>51</sup> Preventive nutrition programs continue to be implemented in Barbados in their polyclinics, communities, and schools.<sup>52</sup>

### *Nepal National Vitamin A Program*

More than 250 million of the world's children suffer from vitamin A deficiency. In Nepal, for example, vitamin A deficiency caused deaths and permanent blindness in many children. An excellent model program to address this serious problem was developed and implemented in 1993 by Dr. Ram Shrestha.<sup>53</sup> The vitamin A program in Nepal requires intensive social mobilization and service delivery over a period of 2-7 days every 6 months. Community volunteers play a vital role in program implementation. They are not paid but receive an allowance for attending training sessions and a travel allowance during vitamin A distribution days.

The Nepal National Vitamin A Program began in 1993 in 8 of the country's 75 districts; the coverage is now nationwide. Average coverage in program districts has exceeded 80% since 1997 and approached 100% in April 2001. The program has been funded by the Nepalese Government, the United States Agency for International Development, and UNICEF. The United States Agency for International Development

and UNICEF have provided technical assistance for procurement of supplies, logistical support, monitoring, and evaluation. It costs US\$1.25 to deliver 2 vitamin A capsules to each participant. It is estimated that the reduction of diarrheal disease and measles reduced the need for Ministry of Health services and saves the government of Nepal US\$1.5 million per year.<sup>54</sup>

## **Water and Sanitation**

If safe water and good sanitation were available to all people in the world, there would be a dramatic reduction in infectious diseases. In western countries it was the provision of safe water and sanitation to the general population that led to the initial dramatic improvements in public health. Lack of access to clean water and sanitation is one of the greatest limiting factors to improving health outcomes for children in developing countries.

Many communities have increased their water supply using piped water, deep wells, protected springs, or rain water collection, but this does not guarantee that the water is safe from contamination. Despite many programs to improve water, there continues to be a cholera crisis in Africa.<sup>55</sup> More than 600 million children in the world do not have regular access to safe water, and more than one billion children lack adequate sanitation in their homes and environments. As a result, they experience high levels of morbidity and mortality due to waterborne diseases and chemical contaminants such as herbicides. The problem of safe and sufficient water is a major issue for children. The absolute minimal amount of drinking and cooking water needed for survival of a young child is approximately 2-3 liters per day. However, minimal requirements for bathing, cleaning, and drinking are 20 liters, and much more is required for washing clothes and flushing toilets.

Discouragingly, little headway has been made in establishing reliable public works infrastructure for the provision of large amounts of safe drinking water over the long-term in developing countries, particularly in areas that experience water shortages due to large populations, falling water tables, and/or droughts. However, there are some point-of-use programs that result in safe water for children and their families in their homes, even in areas with chronic water shortages, which are practical and can be replicated. We

will describe one such program in Zambia.<sup>56-59</sup> Use of water disinfectants at point-of-use in homes removes external sources of pathogens. There is still the possibility that water may stand too long after disinfection and become recontaminated within the home but, overall, water treatment at point-of-use has greater potential to ensure safety of water at the time it is drunk.

### *Point-of-Use Water Purification in Zambia*

Prior to 1998 there were no community water disinfection programs in Zambia. A decade ago a group of safe water researchers compared the techniques of motivational interviewing, social marketing, and standard health education in encouraging Zambians to institute point-of-use household water disinfection and safe storage of water. The results of the trial indicated that motivational interviewing was quite promising in increasing the appropriate use of water disinfectants.<sup>60</sup> A follow-up study demonstrated that there was high compliance in households, that the risk of diarrhea was 48% less in the households using disinfectant than in the houses not using it, and that the percentage of homes storing water safely increased from 41.5% to 89.2%.<sup>61</sup>

Since that time, the use of water disinfection in Zambian homes has increased dramatically with a concurrent reduction of waterborne diseases. However, it is recognized that Zambians purchase and use more of the disinfectant solutions during times that they perceive more risk from contaminated water (eg, during the rainy season when cholera epidemics occur). It is still difficult to increase uptake of the disinfectant solutions during other times of the year (eg, the dry season). Point-of-use water purification is not effective without quality controls assuring that the correct chlorine concentration is present in the disinfectant solution. Private companies in Zambia now make the disinfectant solutions using hypochlorite generators. The companies are required to follow manufacturing guidelines and are periodically inspected, which has increased the likelihood that the correct concentration of chlorine is maintained (Quick R, personal communication, 2009).

### **Disasters/Conflict**

*Annie was 3 years old when her family's home was destroyed during Hurricane Andrew. Her parents now*

*recall the period when they stayed in temporary housing provided by the American Red Cross. Annie seemed frightened all the time and usually clung to her parents. She was not playful as she had always been. She often awakened screaming and she regressed in her development. They said that she slowly improved and was playful and cheerful again except in one area. She became frightened whenever it rained. Before going outside she would scan the sky. If she saw any signs of rain, she refused to go out and would cry. Annie is now 20 years old. She has done well in school and is in college. She describes a feeling of panic whenever it rains and is now planning to seek psychotherapy for this problem.*

We started this section with an example from a North American disaster to highlight the significant and lifelong effects that disasters can have on children, even when a high level of resources and excellent infrastructure are in place. Although Annie had supportive parents and most aspects of her life resumed normalcy, she had long-lasting psychological trauma from her early experience of a natural disaster. When disasters occur in developing countries, there is usually a paucity of resources and infrastructure to mitigate the effects on children. Compared to adults, children are especially vulnerable during disasters, whether they are natural or man-made.

Humanitarian emergencies are increasing worldwide; every week there is at least one large crisis that requires external assistance. There were 321 disasters in 2008, which killed 236,000 people and affected 211 million people, of whom half were children.<sup>62</sup> Many children in the developing world are or will be exposed to disasters, which may or may not include exposure to armed conflict. On any given day during the past decade there have been at least 15 million children displaced from their homes because of disasters. Morbidity and mortality in disasters is greatest for children under age 5 years. In disaster situations children are at special risk for trauma from loss of family members, physical injuries, infectious diseases, malnutrition, and both acute and long-term psychological illness.<sup>63</sup> The events during disasters that are most likely to have long-term negative psychological effects on children include death or physical injury to a family member, loss of home and possessions, relocations, and parental dislocation or dysfunction. Although figures vary depending on the nature and duration of a disaster, 20-40% of children will have long-term

psychological problems related to the experience of a disaster.<sup>64,65</sup>

Until recently there was insufficient recognition that children have special needs and require special care and attention when they are involved in a disaster. These relate to physiological differences, such as the fact that children become dehydrated more quickly than adults, and behavioral differences including the neuropsychological immaturity of children. Fortunately, logistical systems for dealing with disasters have improved a great deal over the past generation and most children and families will be rapidly provided clean water, food, clothing, and some type of shelter. Implementing effective sanitation systems is more complicated but can be achieved after a few weeks in most areas for persons displaced because of disasters. In many western countries there are detailed plans for how hospitals and other institutions might cope with a sudden huge influx of children because of a disaster. However, these programs generally do not include immediate interventions to mitigate or reduce the likelihood of acute and long-term psychological disorders.<sup>66</sup>

To achieve state of the art prevention and interventions for children in disasters, it is essential to increase training about the special needs of children in disasters for persons likely to be involved as general relief workers, first responders, teachers, and all child health professionals. Training courses that focus on children have slowly evolved over the past 15 years. Such courses are most effective if they use problem-based learning approaches. Important topics include child development and how the age and stage of a child or adolescent affects his/her perceptions about a disaster, special considerations for children who are without adult parent figures, nutritional needs, immunization needs, environmental hazards, humanitarian law as it relates to children, the media in disasters and children, school issues, safety issues for children, housing considerations for children, symptoms of distress at various ages, ethical issues and children, and information about various relief agencies and how they relate to the needs of children. It is also important to address the personal issues of relief workers, including how they can recognize their own problems and cope with stress.

Training should include information about psychological triage, using the PsyStart program.<sup>67</sup> This important approach to triage is based on what has happened to the child (eg, saw a dead person, lost a

parent, lost a house) rather than on a psychological assessment. If a child has a high PsyStart score, he or she is at greater risk for acute and long-term psychological problems. This child should be evaluated by a child mental health professional. Following a disaster, it is important to arrange for resumption of school as soon as possible. Sometimes schools must be organized in tents or nonschool buildings for a period. Teachers can be trained to recognize children with evidence of trauma who may require individual treatment.

### *Return to Happiness Program*

A helpful therapeutic program developed by UNICEF for children who have experienced disasters is the "Return to Happiness" program, which has been used successfully in many countries following both natural and man-made disasters. This program does not require a large number of child mental health professionals. Rather child health professionals train teachers and other appropriate community leaders to supervise children in a special assessment program. Each child moves through many mini programs, including drawing areas, play areas, and music areas. Children are provided with "psychosocial backpacks," which include items such as toys, musical instruments, balls, paper, crayons, and books. As the child moves through the carousel and the various mini programs, there are adult mental health professionals who observe and provide special attention to children who show symptoms of trauma. If such children require mental health treatment, arrangements are made to provide this for them.<sup>68</sup>

### *Response to the Asian Tsunami Disaster in 2004*

In March 2001 a workshop on "Management of Disasters: Focus on Children and Families" was held in Khon Kaen, Thailand and included participants from Thailand, Indonesia, the Lao People's Democratic Republic, and the Socialist Republic of Vietnam. The Asian tsunami occurred on the morning of December 26, 2004 and devastated coastal areas of Indonesia, Thailand, Myanmar, Sri Lanka, India, and the Maldives. In the southern coastal area of Thailand, 1215 Thai children were orphaned. The tsunami destroyed 4806 homes, 315 hotels, 4365 fishing boats, and thousands of acres of agricultural land, beach, and coral reefs. Thai children experienced physical trauma

from exposure to the wave and psychological trauma both from personally experiencing the disaster and/or from watching television footage and hearing radio accounts of the tsunami. Studies of Thai children two months after the tsunami found the prevalence of posttraumatic stress symptoms was 13% among displaced children, 11% among children in affected villages, and 6% among children from unaffected villages.<sup>69</sup>

Upon hearing about the tsunami, child health professionals from Khon Kaen, Thailand, who had trained in the special needs of children in disasters, left immediately for the Ranong Province of southern Thailand, remained there for weeks to provide acute care and assistance, and made dozens of return trips to provide follow-up for affected children up to the present. Under the direction of Dr. Srivieng Pairojkul, the team identified vulnerable children in the affected areas and developed psychosocial programs for them. Dr. Pairojkul organized psychosocial “first aid” programs with the objectives to (1) help children cope with the trauma; (2) potentiate resilience; and (3) identify children at risk and therefore in need of close observation and support or referral. Coordinating with several organizations, Dr. Pairojkul implemented the psychosocial first aid programs in 6 provinces that had been devastated by the tsunami. The programs involved families, teachers, trained youth workers, and community leaders. Identification of especially vulnerable children was done using a modified version of the “Return to Happiness” program, followed by evaluation of children by child psychiatrists and psychologists. Teachers were trained to identify psychological symptoms in children and were also provided personal counseling related to their own stress and anxiety.

Immediately after the schools were reopened (two weeks after the tsunami), a 3-day intervention program designed by health professionals from Khon Kaen University was piloted in 6 schools in Ranong and one school in Phang Nga province. Based on data from the pilot study, the program was quickly adapted and launched in 96 schools in 4 provinces of the tsunami-affected areas between January and March 2005. This larger effort was accomplished with coordination between the following 4 organizations: (1) Khon Kaen University; (2) Prince of Songkla; (3) Walailuk University; and (4) the Center for Protection of Children’s Rights. Six-hour training sessions were con-

ducted for the volunteers before they implemented the program.

The program included three modules intended to build trust between the volunteers and the children, as well as peer support among the children themselves. Each group had 8-10 members including both severely and mildly affected children from the same classroom. Activities involved discussion of exposure and disaster-related events, and expression of emotional concerns of the affected children. The volunteers who facilitated the groups helped the children to cope with their emotions and strengthen their self-image to instill a sense of hope. For example, module three included “building a tree of happiness” together. The children helped build a tree in the community, where their hopes and dreams were written/drawn on the leaves, flowers, and fruits of the tree representing the return of the ideal. Between each module, activities were conducted and games played. The games emphasized working together and gave the message that by uniting as a group, the children could overcome obstacles and achieve success.

Most children demonstrated general fearfulness. Many children clung to their parents and were afraid to go to school. Fear of the sea was manifested in children who had played along the beach and who previously swam well. Children were worried about returning to their homes near the sea. During a therapeutic art session, children were asked to make a picture of the ideal home. All the homes drawn by the children were several stories tall and stood on a hill with no ocean in sight, so that they could see and be safe from the next tidal wave.

Large numbers of children had lost a parent or siblings. In each class in Phang Nga province, two to three children were dead or missing, and two to three children had lost a family member. Some children expressed anger toward the sea because the waves had taken family members. Children whose parents’ bodies still had not been found were in a more intense state of grief-angst. Some children felt guilty that they were not able to save their parents most of the children in Phang-Nga had suffered loss of their home and all or some of their school. Many children expressed sadness at home, but felt much better at school, where they had friends and activities. Some schools were used as temporary accommodation for volunteers. Home life was depressing because some families were still trying to find missing persons and some were

going through the process of registering damaged items.

Although most schools had reopened within 2 weeks of the disaster, only 50%-60% of the pupils attended and sometimes there were no teaching activities. Many teachers were themselves victims and survivors. They felt sad and depressed by their own losses but were trying to console and help their students. Most children had close relationships with their teachers. When asked to draw what they loved most, some children drew their school.

The psychological first aid programs were evaluated by the children, teachers, and volunteer facilitators. All together, 220 volunteers helped conduct the program in the 4 provinces. They included 80 psychiatric or pediatric nurses, 127 nursing students, 3 pediatricians, 5 psychiatrists or psychologists, and 5 social workers. The evaluations found that children had fewer fears and were coping better at the conclusion of the activities. All the children stated that they enjoyed participating in the activities, that the activities made them feel better, and that they wanted to join the program again. In qualitative group interviews, most of the teachers observed that the program had helped the children's recovery. The teachers recommended that a follow-up program be conducted at intervals over the coming months; hence, Dr. Pairojkul and colleagues arranged for repeat programs in most schools (Pairojkul S, Siripul P, personal communication, 2007).

Dr. Pairojkul and colleagues also established One Stop Crisis Centers in the tsunami-affected areas. Counselors in these centers collaborated with area child protection workers, hospital social service departments, and personnel working in the shelters that had been established for orphaned children. UNICEF coordinated with the child protection committees of each affected province and new child protection guidelines were created. Although many organizations from outside Thailand came to assist children in the acute phase post-tsunami, most left within a few months. Dr. Pairojkul and colleagues continued their commitment to the children and their families with ongoing visits, phone calls, and monitoring up to the present time. Although the programs were designed specifically to respond to the needs of children in a terrible disaster, they have also led to improved child protection programs over the long-term in the affected Thai provinces.

## Women's Refugee Commission Programs

*Rose was 9 years old and living in Liberia when war broke out.<sup>70</sup> The first Liberian Civil War lasted from 1989 to 1996. Rose was separated from her mother and spent 7 years fleeing from the civil war and living as a refugee along with her father, a sister, and 2 brothers, until her resettlement in New York City at age 16. During the time that she was a refugee she witnessed many horrible events such as her brother being tortured by soldiers. One night they found shelter in an abandoned house; when they awakened in the morning, they found a family of dead bodies in pools of blood lying around the house. Rose's family scavenged for food scraps and sometimes drank discolored sewage water. They were often ill. They eventually escaped Monrovia in a cargo container in a ship headed for Ghana. The trip took 3 days; when they arrived and food was finally available, her father told her to eat a small amount and slowly. They were in a refugee camp in Ghana for 6 years; the food rations were always insufficient. While at school in the fourth grade in Ghana, Rose was sexually attacked by a teacher. She never felt safe enough to report this attack.*

*Rose arrived in New York at age 16 and was reunited with her mother. She attended a public high school in Brooklyn where she tried to keep her previous refugee life a secret. In the refugee camp she had learned to dance. Dancing helped her therapeutically. As a high school senior, Rose choreographed a dance that was a depiction of war. Based on her dancing ability, she won a prize and a full university scholarship. Rose is now sharing dance as a therapeutic outlet for troubled youths. She has developed a dance studio and after-school program serving children and teenagers from other Liberian refugee families.*

The Women's Refugee Commission was established in 1989 to improve the lives and protect the rights of refugee and displaced women, children, and young people.<sup>71</sup> The Women's Refugee Commission identifies and highlights the stories of refugee girls resettled in the USA, such as Rose, to bring attention to the millions of refugee girls still struggling to survive while displaced within their own countries or in refugee camps.<sup>70</sup> Women's Refugee Commission volunteers have repeatedly documented the special hazards faced by women and children who are displaced by man-made disasters. They have focused many of

their efforts on refugee girls, who are rarely featured in the coverage of armed conflict but are often targeted. Girls are usually powerless and more vulnerable to forced marriage, sexual slavery, and other forms of gender-based violence. Even United Nations peacekeepers have been found guilty of abusing girls in several countries, including East Timor, Bosnia, Herzegovina, Chad, and Nepal.

In many developing countries, girls are responsible for tasks such as fetching firewood and water. In refugee camp areas, collecting firewood has become a dangerous occupation for girls. For example, in North Darfur, girls might travel 6 or more miles to find a tree for firewood and then become prime targets for sexual assault. The Women's Refugee Commission has developed programs to address the dangers of firewood seeking, which include provision of alternative cooking fuels in humanitarian settings.<sup>72</sup> They have also developed programs to provide education for displaced girls, such as in refugee camps in Chad, where many refugee girls were enrolled in school for the first time.<sup>73</sup>

In northern Uganda, the Women's Commission helps support the Straight Talk Foundation's Gulu Youth Centre, which is an excellent program for girls and adolescents. This program was developed for young people who have been displaced by the Conflict in northern Uganda. Many of the youth had been captured and forced to be soldiers or sexual slaves. The Gulu Youth Centre provides culturally appropriate youth-friendly services, involving the local community. It provides recreation such as volleyball, entertainment with music and dancing, health education, mental health, and medical treatment.

The Women's Refugee Commission supports similar youth centers on the Thai Myanmar border. Since 2003, the Women's Refugee Commission has supported 2 adolescent reproductive health networks made up of 17 community-based organizations on the Thai-Myanmar border. The network model of collaboration among community-based organizations supports capacity building, communication, coordination, and credibility. Local communities are empowered to address concerns of young people. Each peer educator is trained in a shared curriculum to become a trainer of trainers in sexual and reproductive health, including reproductive health rights, family planning, sexually transmitted diseases including HIV/AIDS. Workshops that include the distribution of contraceptive supplies have been provided to Burmese adolescents who live

in factories or refugee camps along the Thai-Myanmar border, along the Chinese border, or in villages within Myanmar. Some of these adolescents attend migrant schools. Local nongovernmental organizations in the network also undertake media and communications activities such as adolescent reproductive health radio campaigns and development of teaching resources. One of the networks established a youth center in Mae Sot, Thailand. Excellent guidelines for adolescent reproductive health services have been developed by the Women's Refugee Commission.<sup>74</sup>

## Pain and Suffering

*Daravane is a 6-year-old Lao girl who has hemoglobinopathy (a combination of thalassemia and hemoglobin E). Not only is her disease associated with chronic pain, but she requires blood transfusions several times a year. She receives no medication for either her chronic pain or the diagnostic and treatment procedures. As a result she is terrified of clinics and hospitals and their staff. She often has nightmares about receiving blood transfusions and screams in terror when she is en route to the clinic where she receives transfusions.*

Children in all areas of the world experience pain, which may be related to injuries, to dental or medical procedures, or to specific acute and chronic illnesses such as otitis media or HIV/AIDS. For the 90% of children born into the developing world, adequate pain treatment is rarely available. As a result, there are untold numbers of children and the adults they have become who have posttraumatic stress symptoms related to the pain they experienced from illness, injuries, burns, and diagnostic and/or treatment procedures.

Pain that is not optimally treated has deleterious effects on the immune system, wound healing, tumor growth, and gastrointestinal functioning. These physiological effects, reflecting severe stress, may continue for years or a lifetime. Pain impacts many aspects of both the individual and his or her family through its influence on physical functioning, mood, sleep, interpersonal relationships, social activities, and ability to work or attend school. For these reasons, health care workers must assess both the pain characteristics and the impact of pain on the whole person to not treat pain exclusively from a biomedical perspective. For example, information on the extent of school and social

activities missed gives insight into how well the child and family are coping with pain and may suggest the need for psychological interventions to assist with this. Some children may report that they feel sad, angry, or hopeless or that they are never going to feel better, and parents may relate that the child is more moody, irritable, or withdrawn. It is helpful to ask what the child and family would be doing or what would be different for them if the child no longer had pain. Some children cannot imagine life to be any different without pain.

Pain has both sensory and affective components. A child's perception about pain is not simply and directly related to the level of tissue damage, but also to the child's previous experiences, expectations, and perceptions about health providers, which impact the affective aspects of pain. Pharmacologic treatment is often needed for management of the sensory aspects of pain and nonpharmacologic strategies are needed to manage the emotional aspects of pain.

The following ideal guidelines for pediatric pain management take into account both the sensory and the affective aspects of pain in children<sup>74-77</sup>:

1. Choose an appropriate pain assessment tool, based on the child's developmental stage, to compare pain and discomfort levels over time. A series of faces ranging from sad to happy are appropriate for preschool children. Some type of visual analog scale is useful for older children.
2. When selecting both pharmacologic and nonpharmacologic pain management interventions, consider the child's age, developmental stage, past experience with pain, fears, likes, and interests.
3. Use only medications with which you are familiar.
4. Calculate dosages of pain medications carefully, according to the weight of the child.
5. Assess the potential side effects of medications, as well as their interactions with other drugs and/or nutrition. Be aware of the likelihood of concomitant traditional/herbal medication use and their potential interactions with allopathic pain medications.
6. Carefully monitor children receiving sedation with respect to pulse, blood pressure, oxygen saturation, and respirations.
7. Learn and practice some verbal and nonverbal communication strategies, appropriate to various developmental stages, which may help in either an

acute or a chronic pain situation. These include (a) saying something positive about some aspect of the child's physical state; (b) giving a message that the child can be helpful or can master some aspect of the situation; (c) using a distraction technique; (d) using language that implies things will get better and will change and that the child will not always be in pain.

When pain medications are not available, there are many nonpharmacologic strategies that can mitigate not only the affective aspects of pain but also the sensory aspects of pain.<sup>78</sup> These include use of sugar or a sugar-solution on the tongue of infants, distraction with stories, games, or music, blowing out a pretend candle, self-hypnosis or guided imagery, virtual reality games, relaxation exercises, biofeedback, massage, acupuncture, and acupressure.

There are serious long-term mental and physical effects from failure to provide treatment to children in pain. This is a topic that receives little attention, yet represents a great unmet need for children in developing countries. All health units should develop pain assessment methods and intervention plans for children in pain. When pharmacologic agents are lacking, nonpharmacologic measures should be available to help children cope with pain. Pain assessment and management can be done successfully with low-tech tools throughout the world, as is demonstrated in the excellent example from Thailand described below.

### *Pediatric Cancer Pain Management in Northeast Thailand*

Khon Kaen is the capital of Khon Kaen Province in northeast Thailand, the poorest province in the country. Children are referred from throughout the largely rural province to Srinagarind Hospital at Khon Kaen University for treatment of complex problems such as cancer. Prior to 2003, children with cancer were subjected to outpatient procedures such as bone marrow aspiration or chemotherapy without local anesthesia or sedation or psychological preparation. The hospital had insufficient numbers of anesthesiologists to be available to monitor sedating medications in the outpatient areas. Few families could afford to pay for a Hickman indwelling catheter; therefore, each child had to endure a new intravenous cannula placement each time chemotherapy was required. In the University Hospital, liquid narcotics were occasionally available to children with chronic pain associated with

cancer, but oral narcotic preparations were rarely available at rural health stations. Many children manifested symptoms of posttraumatic stress disorder after experiencing painful procedures at the hospital.

Several pediatric faculty in Khon Kaen had been trained in developmental behavioral pediatrics in the USA and had studied nonpharmacological pain management. In 2003 and 2004, they arranged 3 training sessions for 68 child health professionals working in the hospital. The training curricula included guidelines for pain assessment in children; these guidelines were introduced into every pediatric ward, including the intensive care units. In 2005, the Department of Pediatrics of Khon Kaen University organized a national workshop on "Pediatric Pain Management" with 80 child health professionals attending from throughout Thailand. Since then, Dalhousie University in Canada and Khon Kaen University in a collaborative effort have conducted several studies to assess parental attitudes, beliefs, and experiences concerning child pain and pain management and the prevalence of pediatric pain in hospitals throughout northeast Thailand. These studies documented that 81% of pediatric patients suffered moderate to severe pain and received little or no pharmacologic pain treatment. Because of these findings, the Khon Kaen pediatric pain management team established guidelines for the management of pain in children throughout the province. These guidelines have now been implemented, including education for all health care workers, commitment to respond quickly to patients when they report pain, accountability for pain management by child health professionals, and continuing evaluation to improve the quality of pain management.

Every child newly diagnosed with cancer now meets with a member of the pain management team. The team member explains plans and procedures to the child and his/her family. The child is offered training in self-hypnosis and biofeedback and most patients accept this. The training is similar to well-known meditative techniques in Thailand and, therefore, is well received. In one example, an 8-year-old girl with leukemia learned to use relaxation techniques before diagnostic procedures and/or treatments. She focused on imagining herself in her mother's kitchen and imagined the good food that her mother was preparing for her. She remained relaxed and comfortable throughout the procedures (Boonyawat K, personal communication, 2007).

## Cognitive Impairment and Developmental Disabilities

The ongoing epidemic of cognitive impairment has resulted in an estimated 700 million persons under age 18 with impaired thinking ability in one or more areas.<sup>79</sup> While there is recognition of the importance of identifying the cause and type of cognitive impairment in a given child and many early child development programs for children who are developmentally disabled, there are insufficient efforts and programs to prevent this devastating problem. We recognize that this is not just true in developing countries, but that many western countries have also failed to adequately address prevention of cognitive impairment and developmental disabilities.

The term cognitive impairment includes learning disabilities with normal overall intelligence, attention deficits, problems with executive function (difficulty in making good judgments or implementing a plan), and mental retardation. While the cause of cognitive impairment may be difficult to ascertain in some children, the most common causes are well known. They include prenatal malnutrition, malnutrition in the first 3 years of life, iron deficiency in the first years of life, iodine deficiency, damage to the developing brain from infections such as meningitis or severe malaria, toxins such as lead or mercury, use of harmful drugs or alcohol during pregnancy, physical trauma to the brain, and various genetic conditions such as Down syndrome. Poor growth during the fetal period and/or stunting in the first 2 years of life can lead to irreversible brain damage that limits the ability to complete schooling, to maintain employment, and to support the next generation.

Deficits in executive function, organization, and/or attention are often not recognized in the progress of a child until higher order intellectual functions are required in school (ie, ages 11-13 years). Children who did well while "learning to read" no longer do well when they are "reading to learn" and when learning requires integration of multiple intellectual skills. Most causes of cognitive impairment can be prevented and prevention programs are much more practical and less expensive than programs to help children who are already impaired.

Ideally, every state or country should assess the primary causes of cognitive impairment among their population and target prevention for those causes. Examples of prevention strategies that may be indi-

cated are provision of supplemental food for pregnant women; food supplementation for children under 5 years; salt iodization programs; iron supplementation via fortified porridge; infant and toddler developmental stimulation; policy/laws to require use of helmets by all children on bicycles or motorcycles; education programs about drug and alcohol use during pregnancy; immunization programs to prevent meningitis; prevention of exposure to environmental lead; and malaria prevention. Good prevention programs should include careful and regular evaluation of pregnant women, infants, and toddlers. If prevention strategies in specific areas are not working (eg, iron fortification), the programs need to be corrected and then re-evaluated frequently until they are achieving the desired effects.

### *Ummeed Program in India*

There are over 35 million children in India with developmental disabilities such as cerebral palsy, mental retardation, autism, spina bifida, and visual and hearing impairments. In the city of Mumbai there are more than 650,000 children with developmental disabilities, most whom live in slums. Sixty percent of Mumbai's population lives in slums. Most have very limited access to basic health care and rehabilitation services for disabilities are rarely available. Dr. Vibha Krishnamurthy, a developmental behavioral pediatric specialist, developed the Ummeed organization in 1998 to address the problems of developmental disabilities in Mumbai.<sup>80</sup> Ummeed means "hope" in Hindi and in Urdu. Ummeed defines a developmental disability as "a severe and chronic disability of a person which: is attributable to a mental or physical impairment or a combination of mental and physical impairment; is manifested before the person attains age 22 and is likely to continue indefinitely; results in substantial functional limitations in three or more of the following areas of major life activity (self-care, receptive and expressive language, learning, mobility, self-direction, capacity for independent living, economic self-sufficiency); reflects the person's need for a combination and sequence of special, interdisciplinary, or generic care, treatment, or other services which are lifelong or of an extended duration and individually planned and coordinated."

Ummeed is committed to helping children of all sections of society, irrespective of financial considerations. An Ummeed team of professionals provides diagnostic and follow-up care, training of profession-

als such as physicians, teachers, and parents, and has substantial programs to build community awareness and to advocate for the special needs of developmentally disabled children and adults. Professionals work together as an interdisciplinary team to review and compare findings and to arrive at joint decisions with the family on care and management of a given child. This is the only program in India that provides this type of integrated care for developmental disabilities. In general, a family's first contact at Ummeed is with 1 of 3 developmental pediatricians who provide the initial assessment and make other referrals for various other assessments, depending on the individual needs and requirements of the child. The services provided by Ummeed include occupational therapy, speech and language therapy, physiotherapy, educational assessments, IQ assessments, developmental behavioral pediatric assessments, and counseling. Ummeed also offers an early intervention center for very young children.

Efforts of Ummeed to build community awareness include provision of educational programs for professionals and parents, articles in the popular press, and professional publications. Advocacy programs include numerous activities in the community such as special interest groups for autism and provision of expertise for rehabilitation programs.

Ummeed has provided direct services to 4500 children and indirect services to tens of thousands more through outreach programs which include training programs for teachers in schools with on-site mentoring and supervision. Volunteers with expertise in special education, management, and speech therapy from the USA and the UK have helped to strengthen the clinical, management, and teaching expertise of the team. Dr. Ilgi Ertem, a developmental behavioral pediatrician from Turkey, volunteers her expertise in monitoring and evaluating the Ummeed programs. Funding for logistical needs and activities are raised locally.

The families, most of whom are very poor, are very reliable with respect to keeping follow-up appointments. Many will travel more than an hour each way to receive services at Ummeed. Ummeed has a long waiting list for services. Ummeed works closely with the Latika Roy Foundation in Dehradun, North India that provides rehabilitation services for disabled children at a grass roots level in an extremely resource-poor area. This program, despite the difficulty in recruiting specialized professionals to such a poor area, has demonstrated amazing skills in training and in using local resources. Ummeed staff visit the Latika

Roy Foundation and they share information, including practical interventions that work.

In addition to providing direct service, Ummeed has decided to expand its work as a resource center for schools and nongovernmental organizations so that they can replicate Ummeed programs. Ummeed is a unique, excellent program and a model for developmental disabilities programs in resource-poor areas. Dr. Krishnamurthy and her colleagues recognize that many of the children who are developmentally disabled have conditions that could have been prevented. Therefore, their work includes efforts to increase the knowledge of the public and government about how developmental disabilities can be prevented.

## Strengthening Human Resources for Child Health

One of the great challenges in improving child health and health care overall in low-resource countries is the severe shortage of human resources for health. Human resources for health refer to all individuals engaged primarily in the improvement of health for populations.<sup>81</sup> They are crucial to the functioning of any health system. The shortage in human resources for health is a multifactorial problem involving not just a profound lack in numbers, but also distribution of health care workers, their composition, training, migration issues, economics, socio-demographics, and cultural and geographic factors.<sup>82</sup> While there is ongoing research to address the significant challenge of strengthening human resource capacity and management in the health sector, it remains an open question as to how best to implement the knowledge we have into practice.<sup>83</sup>

There has been a recent increase in efforts by global health organizations to understand and establish best practices for strengthening human resources for health. The WHO has established an online free access journal for this purpose.<sup>84</sup> The United States Agency for International Development hosts an online global resource center devoted to the topic.<sup>85</sup> In 2005, the Millennium Project Task Force for Maternal and Child Health called for the strengthening of health systems and made specific recommendations for developing the maternal child health workforce:

The health workforce must be developed according to the goals of the health system, with the rights and livelihoods of health care workers addressed.

- These principles must also inform strategies to address brain drain, low morale, and loss of productivity due to illness and

death (often from HIV/AIDS), factors that are limiting the ability of governments to provide their populations with access to good-quality health care.

- Effective management and operational systems that seek to improve quality and increase trust in the health system should accompany the development of the health workforce.
- Medium- to long-term plans for building a cadre of skilled birth attendants—the health workers key to reducing maternal deaths—must form an explicit part of all health workforce plans.
- “Scope of profession” regulations and practice must be changed to empower midlevel providers, including skilled birth attendants, to perform life-saving procedures safely and effectively.<sup>86</sup>

There are many underlying variables that complicate the development of effective approaches for strengthening health workforce capacity in resource-poor settings. Dual practice is one such variable. The concept refers to coping strategies used by health care workers as they try to meet their own survival needs in the face of inadequate public servant salaries and arduous working conditions. Some of the coping strategies used are combining low-salaried public sector work with private fee-for-service patient care, absenteeism, under-the-table payments, and misappropriation of drugs and supplies. The negative effects of dual practice are significant and reflect more than a simple problem of individual ethics. Dual practice is a complex human response to an overall system failure. The response in and of itself changes the system and reinforces dysfunction. Yet, in some respects the system functions better than expected, in that some health workers continue to engage in public service despite minimal financial rewards and difficult working conditions. This suggests that factors such as social responsibility, self-realization, professional satisfaction, and prestige still play a significant role in motivating health workers. Straightforward solutions, such as increasing public sector salaries or regulating the private health sector, are not sufficient or realistic on their own to resolve the complex system problems. Other ideas include incentives, improved working conditions, professional value systems, peer pressure, pressure from users, recruitment practices, and pressure on donors.<sup>87</sup>

One approach to increasing workforce capacity that has received increased attention in recent years is task shifting, where health care tasks that have historically been performed by more highly trained professionals are delegated to those with less training in an effort to increase human resources for health. Task shifting has been most notably used to rapidly increase the provision of HIV/AIDS care in resource-poor settings, but it

is also considered an important part of a more broad-based solution to deliver health care services to the poor.<sup>88</sup> Task shifting is not a new concept in that community health workers have been a mainstay of public health efforts through history. It is new in the extent to which it is being applied, both in the complexity of health care tasks being delegated and in the large numbers of community health care workers being mobilized. The Partners in Health program described previously is an excellent example of how task-shifting can be used to extend primary health care services to the poor.<sup>25,26</sup>

The issue of health care worker training and competence as part of strengthening human resource capacity has particular implications for children. Beyond the overall shortage of human resources for health in developing countries, there is a notable lack of health care workers who are well trained in the specific needs of children. Health care for children is different from that of adults, not just in relation to prevention, diagnosis, and treatment, but also in the critical context of healthy growth and development for the child. The training of qualified child health care workers is a major hurdle for less developed countries, and for the organizations trying to assist them. Western training of health care professionals from developing countries is hugely expensive, may focus on skills that have little relevance for the home country population, and often leads to brain drain. Ideally, health policy and health care for children should be developed and provided by well-trained child health professionals who are from the same country as the children. They have the advantages of language, culture, and knowledge of local health problems. We describe below an excellent program that focuses on increasing human resources for child health through the training of general pediatricians in the Lao People's Democratic Republic. On the other end of the spectrum, we then highlight the creative and longstanding Child-to-Child program, which has been used throughout the world to train children to teach other children using child-friendly public health messages.

### *National University of Laos: Pediatric Residency Training Program*

The Lao People's Democratic Republic is a landlocked country in southeast Asia with high rates of child morbidity and mortality. Infant mortality was 59 and under fives mortality was 75 in 2006. In 2007,

only 50% of children had been immunized against DPT.<sup>89</sup> Infant mortality was 104 in 1995. Under fives mortality was 107 in 2000.<sup>89</sup> In 1990, there were only 3 Lao pediatricians, all western trained, in a country with 3 million children. The leader of this small group of pediatricians, Dr. Phonethep Pholsena, asked for assistance to start a pediatric residency training program in the Lao People's Democratic Republic. He envisioned a training program that would follow international standards of pediatric training, and he believed that the graduates of such a program would remain in the Lao People's Democratic Republic, would spread throughout the country, and would become advocates on behalf of children in their communities, promoting both high-quality preventive and curative care.

Health Frontiers, an American all-volunteer outreach of health professionals, agreed to assist Dr. Pholsena and his colleagues to plan and implement a comprehensive 3-year residency training program in pediatrics. The planning and preparation of a detailed curriculum took about 6 years and was adopted by the National University of Laos as a diploma program. The pediatric training program began in 1997. Since then, many American volunteer child health professionals have spent a year or more in the Lao People's Democratic Republic to help Lao colleagues establish the first viable postgraduate medical education program in the country's history. The program has local ownership, local leadership, and strong regional support from Khon Kaen University in northeast Thailand, which provides tuition-free training rotations for the Lao pediatric residents and additional subspecialty training for the graduates. Volunteer faculty from universities in the USA, Canada, and Australia have made dozens of short-term teaching visits to the Lao People's Democratic Republic to provide additional support to the training program.<sup>90</sup>

As of mid-2009, 48 pediatricians have graduated from the Lao pediatric residency program, with 6 or more pediatricians projected to graduate annually. There are now Lao pediatric graduates working in all 16 Lao provinces and the capital of Vientiane. The training program has grown to include continuing medical education and subspecialty training opportunities in nearby countries. Lao pediatricians are active in developing national and local health policy for children, in providing pediatric care and teaching in rural provinces, and in community advocacy efforts, including radio public health broadcasts on behalf of

children. The pediatric program laid the groundwork for starting a general internal medicine residency training program in the Lao People's Democratic Republic, which has had a similar positive impact on strengthening human resources for health in the Lao People's Democratic Republic.<sup>91</sup>

### *Child-to-Child Program*

The Child-to-Child program was developed by Professors David Morley and Hugh Hawes at the London Institute of Child Health in 1978. The concept of teaching children about health, how to care for family members, and how to teach family members has now been adapted in more than 70 countries. Originally, Professors Morley and Hawes focused on what individual children could do to make a difference to the health of younger children. They developed single messages associated with activities for teaching and emphasizing the messages.<sup>92</sup> Some of the early Child-to-Child messages are as follows:

- Children who have diarrhea and lose too much water and salt may die. Rehydration will put back the liquid they lose.
- Children learn to talk by hearing others talk to them. Talk to babies as much as possible.
- The kitchen or cooking area is the most dangerous part of the house for babies. Smoke from cooking fires harms their lungs. Keep them away from the fire and cooking pots. Do not put poisons like paraffin in soft drink bottles and keep bottles away from children.
- Treat burns immediately with cold water.
- Cars kill. Teach little children road safety.
- Regular and right brushing saves teeth and gums. Teach smaller children to use brushes or sticks.
- Wrapping patients with fever in blankets can kill them. Keep children sick with fever cool but not cold.
- Little children's feces are even more full of germs than adult ones. Wash hands after touching them. Teach little children to wash hands.
- Befriend and play with children whose families have HIV/AIDS and visit their families. You cannot catch HIV/AIDS this way.
- Flies spread disease onto food. Keep food covered from them.
- Ensure water is as clean as possible. Keep hands away from it at the water source. Cover the water pots and jugs. Water stored in clear plastic drinks

bottles and kept in the sun or strong daylight for 6 or more hours is safe to drink.

- Small children need to be fed often, at least 4 times a day. Otherwise they may not get enough food to grow well.

The original basic messages continue to be used and are fully explained in activity sheets in the Child-to-Child resource book.<sup>93</sup> Over the past 30 years the Child-to-Child program has been linked to many school and community programs. For example, a new category was developed in Albania to address environmental protection.<sup>94</sup> This includes an environmental education curriculum for grades 1 to 5 that is both teacher- and child-friendly, builds the capacity of teachers and key community members to teach children, and supports concrete child-led actions in the community to improve the local environment. Another new Child-to-Child program focuses on children reading to younger children about topics such as injuries, dirty water, flies, and worms.

The Child-to-Child programs have been successful for 30 years and their teaching materials are available free of charge to anyone who wishes to use them.<sup>95</sup> Associated with Child-to-Child is Teaching Aids at Low Cost founded by Dr. Morley in 1965. Child-to-Child teaching resources may be obtained through Teaching Aids at Low Cost, which currently supplies more than 10,000 health workers with low cost health textbooks, videos, CDs, and weight charts.<sup>96</sup>

### **Conclusion**

When we contemplate state of the art health care for children in resource poor settings, we must start by humbly admitting that the world community has failed to guarantee even the most basic needs of children. We also know however that some good things are being accomplished in local communities by individuals, organizations, and governments who care. We see patterns of success that include starting small, building relationships, integrating services, mobilizing the community, providing hands-on care, and making long-term commitments. What emerges is a massive work in process, with much work yet to be done.

Ultimately, truly state of the art health care for children must be defined locally and championed by each state or nation "in the spirit of self-determination," to quote the Alma-Ata Declaration of 1978. Globally, the health system is broken, but there will

not be one system that eventually replaces it and works well for every nation, every community, and every village; there will be many systems, each adapted to and by individual countries and local communities. Nevertheless, there are overarching components and supports that are the responsibility of the global community, particularly those needed to assure that the basic human rights of children, including health, are met throughout the world. This will require a broad-based integrated approach across sectors and a large infusion of resources, such as is outlined in the 2000 Millennium Development Goals.

While more resources are needed to meet the basic needs of children globally, the money has to be spent wisely and more must be spent directly on patient care, human resources, materials, and supplies (and less on policy development). The system will not improve and the work will not get done without bodies and material resources in the field to actually implement the plethora of knowledge and health policies that have already been developed. The examples of excellence in global child health that we have described in this article highlight the fact that there are many straightforward interventions that have already been effectively implemented and could be replicated TODAY in other communities around the world, given a few committed individuals and even modest resources. Sometimes we get stuck when contemplating the enormity of the task before us; change actually occurs when we provide the best care possible to that one child lying or standing before us, using all the knowledge and resources at our disposal and “just do it.”

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## References

1. [http://www.who.int/publications/almaata\\_declaration\\_en.pdf](http://www.who.int/publications/almaata_declaration_en.pdf).
2. <http://www.un.org/millenniumgoals>.
3. Meguid T. Lack of political will is a clinical issue. *BMJ* 2009;338:b1013.

4. Farmer P. Challenging orthodoxies: The road ahead for health and human rights. *Health Hum Rights Intl J* 2008;10:5-19.
5. <http://www.merriam-webster.com/dictionary/stateofheart>.
6. Walker SP, Wachs TD, Gardner JM, Lozoff B, Wasserman GA, Pollitt E, et al. Child development: risk factors for adverse outcomes in developing countries. *Lancet* 2007;369:145-57.
7. WHO. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, June 19-22 1946, and entered into force on April 7, 1948.
8. Morley D. Paediatric priorities in the developing world. London: Butterworths, 1973.
9. Claeson M, Gillespie D, Mshinda H, Troedsson H, Victora CG, Bellagio Study Group on Child Survival. Knowledge into action for child survival. *Lancet* 2003;362:323-7.
10. Bryce J, Black RE, Walker N, Bhutta ZA, Lawn J, Steketee RW. Can the world afford to save the lives of 6 million children each year? *Lancet* 2005;365:2193-200.
11. <http://www.who.int/whr/2005/en>.
12. World Health Organization. The World Health Report 2006: Working Together For Health. Geneva, Switzerland: WHO Press, 2006.
13. <http://www.childinfo.org>.
14. Shonkoff J, Boyce T. *J Am Med Assoc* 2009 (in press).
15. Haines A, Cassels A. Can the millennium development goals be attained? *BMJ* 2004;329:394-7.
16. Sachs JD, McArthur JW. The millennium project: A plan for meeting the Millennium Development Goals. *Lancet* 2005;365:347-53.
17. Victoria CG, Wagstaff A, Schellenberg JA, Gwatkin D, Claeson M, Habicht JP. Applying an equity lens to child health and mortality: More of the same is not enough. *Lancet* 2003;362:233-41.
18. World Health Organization. World Health Statistics 2009. Geneva, Switzerland: WHO Press, 2009.
19. Rosenberg M. Global child health: Burden of disease, achievements, and future challenges. *Curr Probl Pediatr Adolesc Health Care* 2007;37:338-62.
20. [http://www.who.int/child\\_adolescent\\_health/documents/lancet\\_child\\_survival/en/](http://www.who.int/child_adolescent_health/documents/lancet_child_survival/en/).
21. <http://www.who.int>.
22. <http://www.lodoi.com>.
23. <http://www.pih.org>.
24. Walton DA, Farmer PE, Lambert W, Leandre F, Koenig SP, Mukherjee JS. Integrated HIV prevention and care strengthens primary health care: Lessons from rural Haiti. *J Pub Health Policy* 2004;25:159-61.
25. Mukherjee JS, Eustach RE. Community Health workers as a cornerstone for integrating HIV and primary healthcare. *AIDS Care* 2007;19:S73-82 (Suppl 1).
26. Drobac PC, Mukherjee JS, Joseph JK, Mitnick C, Furin JJ, del Castillo H, et al. Community-based therapy for children with multidrug-resistant tuberculosis. *Pediatrics* 2006;117:2022-9.
27. <http://www.searchgadchiroli.org>.
28. Bang AT, Reddy HM, Deshmakh MD, Baitule SB, Bang RA. Neonatal and infant mortality in the ten years (1993-2003) of the Gadchinoli field trial: Effect of home based neonatal care. *J Perinatol* 2005;25:S92-107 (Suppl 1).

29. Bang AT, Bang RA, Reddy HM. Home-based neonatal care: Summary and applications of the field trial in rural Gadchiroli, India (1993 to 2003). *J Perinatol* 2005;25:S108-22.
30. Bang AT, Bang RA, Baitule SB, Reddy HM, Deshmukh MD. Management of birth asphyxia in home deliveries in rural Gadchiroli: The effect of two types of birth attendants and of resuscitating with mouth to mouth, tube mask or bag mask. *J Perinatol* 2005;25:S82-91 (Suppl 1).
31. Bang AT, Baitule SB, Reddy HM, Deshmukh MD, Bang RA. Low birthweight and preterm neonates: Can they be managed at home by mother and a trained village health worker? *J Perinatol* 2005;25:S72-81 (Suppl 1).
32. Rey ES, Martinez EG. Manejo Racional del niño prematuro. In: *Curso de Medicina Fetal*. Bogotá, Colombia: Universidad Nacional; 1983. p. 137-51.
33. Charpak N, Ruiz JG, Zupan J, Cattaneo A, Figueroa Z, Tessier R, et al. Kangaroo mother care: 25 years later. *Acta Paediatr* 2005;94:514-22.
34. Whitelaw A, Sleath K. Myth of the marsupial mother: Home care of very low birthweight babies in Bogotá, Colombia. *Lancet* 1985;1:1206-8.
35. Conde-Agudelo A, Diaz-Rossello JL, Belizán JM. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane Database Syst Rev* 2003;CD002771.
36. Sloan NL, Camacho LW, Rojas EP, Stern C. Kangaroo mother method: Randomised controlled trial of an alternative method of care for stabilised low-birthweight infants. *Maternidad Isidro Ayora Study Team. Lancet* 1994;344:782-85.
37. Akcan E, Yiğit R, Atici A. The effect of kangaroo care on pain in premature infants during invasive procedures. *Turk J Pediatr* 2009;51:14-8.
38. Blencowe H, Kerac J, Molyneux E. Safety, effectiveness and barriers to follow-up using an "Early Discharge" kangaroo care policy in a resource poor setting. *J Trop Pediatr* 2009. [Epub ahead of print].
39. Galler JR, Waber D, Harrison R, Ramsey F. Behavioral effects of childhood malnutrition. *Am J Psychiatry* 2005;8:167-72.
40. Lozoff B, Jimenez E, Smith JB. Double burden of iron deficiency in infancy and low socioeconomic status: A longitudinal analysis of cognitive test scores to age 19 years. *Arch Pediatr Adolesc Med* 2006;160:1108-13.
41. Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and child undernutrition: Consequences for adult health and human capital. *Lancet* 2008;371:340-57.
42. Grantham-McGregor S, Bheung YB, Cueto S, Glewwe P, Richter L, Strupp B, et al. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007;369:60-70.
43. Engle PL, Black MM, Behrman JR, Cabral de Mello M, Gertler PJ, Kapiriri L, et al. Strategies to avoid the loss of developmental potential in more than 200 million children in the developing world. *Lancet* 2007;369:229-42.
44. Manary MJ, Sandige HL. Management of acute moderate and severe childhood malnutrition. *BMJ* 2008;337:a2180 [10.1136/bmj.a2180].
45. WHO, WFP, UNSCN, UNICEF. *Community-Based Management of Severe Acute Malnutrition*. Geneva: WHO, 2007.
46. Manary MJ, Ndkeha MJ, Ashorn P, Maleta K, Briend A. Home based therapy for severe malnutrition with ready-to-use food. *Arch Dis Child* 2004;89:557-61.
47. Maleta K, Kuittinen J, Duggan MB, Briend A, Manary M, Wales J, et al. Supplementary feeding of underweight, stunted Malawian children with a ready-to-use food. *J Pediatr Gastroenterol Nutr* 2004;38:152-8.
48. <http://www.projectpeanutbutter.org>.
49. Galler JR, Ramsey F. A follow-up study of the influence of early malnutrition on development: Behavior at home and at school. *J Am Acad Child Adol Psychiatry* 1989;28:254-61.
50. Galler JR, Ramsey F, Solimano G. The influence of early malnutrition on subsequent behavioral development III. Learning disabilities. *Pediatr Res* 1984;18:309-13.
51. Caribbean Food and Nutrition Institute, Frazer H, National Nutrition Centre (Barbados) and Ennis M. *Nutrition Country Profile of Barbados*. 2003. Available from: <http://www.FAO.org>.
52. <http://www.PAHO.org>.
53. Joshi R. Saving lives in Nepal through vitamin A distribution, 2005. Available from: [http://www.unicef.org/early\\_childhood/index\\_30261.html](http://www.unicef.org/early_childhood/index_30261.html).
54. Fiedler JL. The Nepal national vitamin A program: Prototype to emulate or donor enclave? *Health Policy Plann* 2000;15:145-56.
55. Bhattacharya S, Black R, Bourgeois L, Clemens J, Cravioto A, Deen JL, et al. The cholera crisis in Africa. *Science* 2009;324:885.
56. Garrett V, Ogutu P, Mabonga P, Ombeki S, Mwaki A, Aluoch G, et al. Diarrhoea prevention in a high-risk rural Kenyan population through point-of-use chlorination, safe water storage, sanitation, and rainwater harvesting. *Epidemiol Infect* 2008;136:1463-71.
57. O'Reilly CD, Freeman MC, Ravani M, Migele J, Mwaki A, Ayalo M, et al. The impact of a school-based safe water and hygiene programme on knowledge and practices of students and their parents: Nyanza Province, western Kenya, 2006. *Epidemiol Infect* 2008;136:80-91.
58. Mukutsa P, Nzaku K, Ogutu P, Barasa P, Ombeki S, Mwaki A, et al. Challenges in implementing a point of use water quality intervention in rural Kenya. *Am J Pub Health* 2001;91:1571-73.
59. Lule JR, Mermin J, Ekwaru JP, Malamba S, Downing R, Ransom R, et al. Effect of home-based water chlorination and safe storage on diarrhea among persons with human immunodeficiency virus in Uganda. *Am J Trop Med Hyg* 2005;73:926-33.
60. Thevos AN, Kaona KA, Siajunza MT, Quick RE. Adoption of safe water behaviors in Zambia: Comparing educational and motivational approaches. *Educ Health* 2000;13:366-76.
61. Quick RE, Kimura A, Thevos A, Tembo M, Shamputa I, Hutwagner L, et al. Diarrhea prevention through household level water disinfection and safe storage in Zambia. *Am J Trop Med Hyg* 2002;66:584-89.
62. <http://www.reliefweb.org>.
63. Olness K, Torjesen K, Mandalakas A. *How to Help the Children in Humanitarian Disasters*, 2nd Edition. Kenyon (MN): Health Frontiers; 2006.
64. Balaban V. Psychological assessment of children in disasters and emergencies. *Disasters* 2006;30:178-98.

65. Hagan JF Jr, American Academy of Pediatrics, Committee on Psychosocial Aspects of Child and Family Health, Task Force on Terrorism. Psychosocial implications of disaster or terrorism on children: A guide for the pediatrician. *Pediatrics* 2005;116:787-95.
66. Allen GM, Parrillo SJ, Will J, Mohr JA. Principles of disaster planning for the pediatric population. *Prehosp Disaster Med* 2007;22:537-40.
67. Reissman D, Schreiber MD, Shultz JM, Ursano RJ. Disaster mental and behavioral health. In: Koenig, KL, Schultz, CH, editors. *Disaster medicine*. Cambridge, UK: Cambridge University Press, 2009.
68. [http://www.unicef.org/infobycountry/paraguay\\_23016.html](http://www.unicef.org/infobycountry/paraguay_23016.html).
69. Piyavhatkul N, Pairojkul S, Suphakunpinyo C. Psychiatric disorders in tsunami-affected children in Ranong province, Thailand. *Med Princ Pract* 2008;17:290-5.
70. <http://www.womensrefugeecommission.org/girlsstories>.
71. <http://www.womensrefugeecommission.org>.
72. Women's Commission for Refugee Women and Children. Beyond firewood: Fuel alternatives and protection strategies for displaced women and girls, 2006. Available from: <http://www.womenscommission.org/pdf/fuel.pdf>.
73. Women's commission for refugee women and children. From the ground up: education and livelihoods in southern Sudan. 2007. Available from: [http://www.womenscommission.org/pdf/sd\\_ground.pdf](http://www.womenscommission.org/pdf/sd_ground.pdf).
74. Women's Refugee Commission. *Refugee Girls: The Invisible Faces of War*. New York: Pearson, 2009.
75. Berde CB, Sethna NF. Analgesics for the treatment of pain in children. *N Engl J Med* 2002;347:1094-103.
76. Stephens BK, Barkey ME, Hall HR. Techniques to comfort children during stressful procedures. *Adv Mind Body Med* 1999;15:49-60.
77. Krauss B, Green SM. Procedural sedation and analgesia in children. *Lancet* 2006;367:766-80.
78. Tsao CI, Zeltzer LK. Complementary and alternative medicine approaches for pediatric pain: A review of the state-of-the-science. *Evid Based Complement Alternat Med* 2005;2:149-59.
79. Olness K. Effects on brain development leading to cognitive impairment: A worldwide Epidemic. *J Dev Behav Pediatr* 2003;24:120-30.
80. <http://www.ummeed.org>.
81. Beaglehole R, Dal Poz MR. Public health workforce: Challenges and policy issues. *Hum Resour Health* 2003;1:4.
82. Kabene SM, Orchard C, Howard JM, Soriano MA, Leduc R. The importance of human resources management in health care: A global context. *Hum Resour Health* 2006;4:20.
83. Buchan J. What difference does ("good") HRM make? *Hum Resour Health* 2004;2:6.
84. <http://www.human-resources-health.com>.
85. <http://www.hrhresourcecenter.org>.
86. Freedman LP, Waldman RJ, de Pinho H, Wirth ME, Chowdery AMR, Rosenfield A. Who's got the power? In: *Transforming Health Systems for Women and Children*. UN Millennium Project. Task Force on Child Health and Maternal Health, 2005. Available from: <http://www.unmillennium-project.org>.
87. Ferrinho P, Van Lerberghe W, Fronteira I, Hipólito F, Biscaia A. Dual practice in the Health Sector: Review of the evidence. *Hum Resour Health* 2004;2:14.
88. WHO. *Task Shifting: Rational Redistribution of Tasks Among Health Workforce Teams: Global Recommendations and Guidelines*. Geneva: WHO, 2008 Available from: <http://www.who.int>.
89. <http://www.who.int/whosis/en/index.html>.
90. Olness K, Torjesen H. Use of volunteers to help launch a pediatric residency program in Lao People's Democratic Republic. *Ambul Child Health* 2001;7:109-19.
91. Gordon G, Vonvichit E, Hansana V, Torjesen K. A model for improving physician performance in developing countries: A three-year postgraduate training program in Lao People's Democratic Republic. *Acad Med* 2006;81:399-404.
92. <http://www.child-to-child.org>.
93. Hawes H, Bailey D, Bonato G, editors. *Child to Child: A Resource Book*, 3rd Edition. London, UK: The Child to Child Trust; 2009.
94. [http://www.unicef.org/albania/education\\_8440.html](http://www.unicef.org/albania/education_8440.html).
95. <http://www.child-to-child.org/resources/index.html>.
96. <http://www.talcuk.org>.