

How health issues affect child development

University of North Carolina at Chapel Hill
Frank Porter Graham Child Development Center

early *Developments*

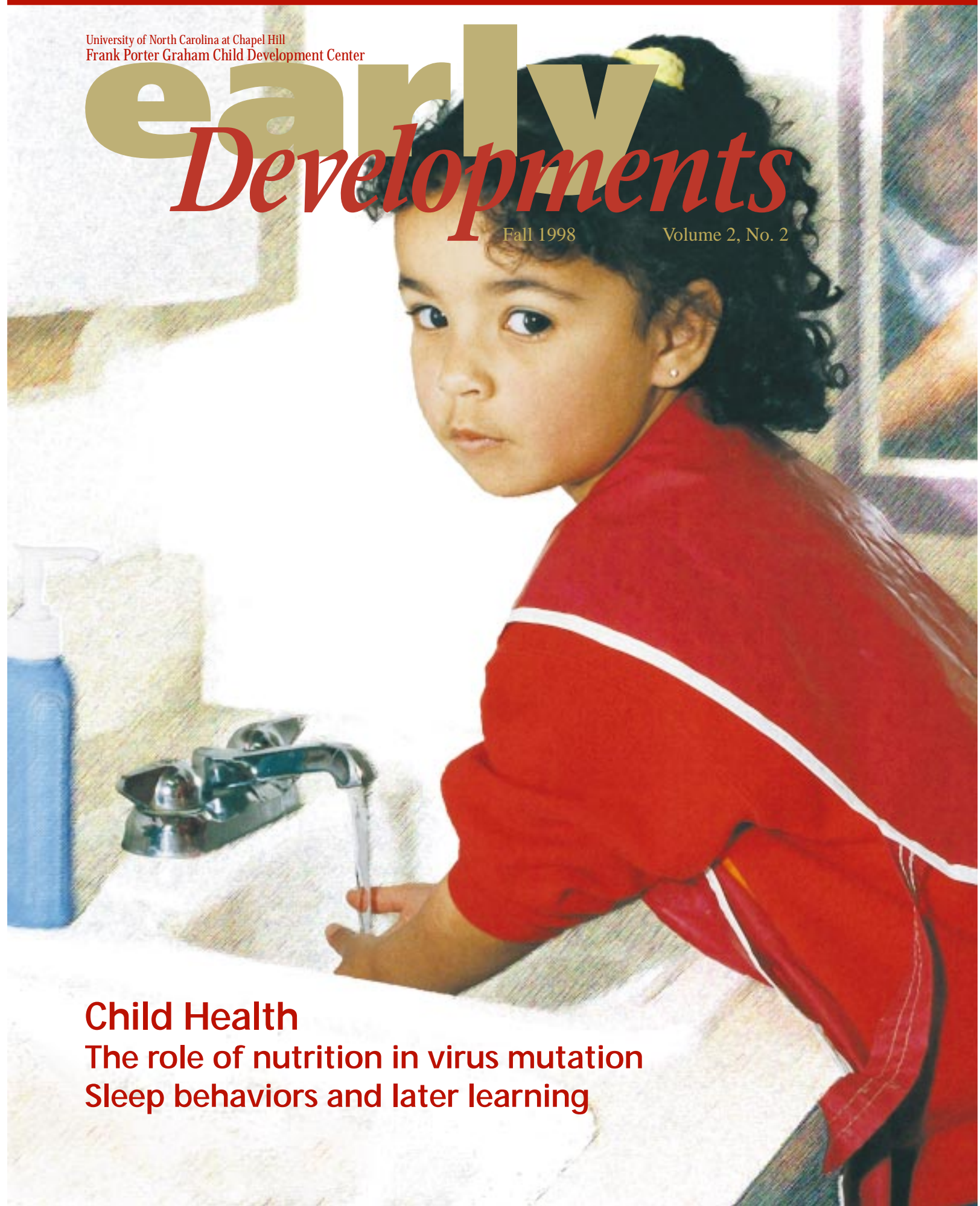
Fall 1998

Volume 2, No. 2

Child Health

The role of nutrition in virus mutation

Sleep behaviors and later learning



Field notes

Could there be a link between groundbreaking research at the Frank Porter Graham Child Development Center and the “bird flu” that prompted Hong Kong officials to slaughter more than a million chickens last winter?

Melinda Beck, an FPG researcher, has established—in mice at least—that the common coxsackievirus, which gives us mild colds or perhaps a slight sore throat, can mutate into a nasty bit of business that can affect the heart muscle with fatal consequences. The mutation can come about when the host is deficient in either selenium or vitamin E. The unsettling part is that once mutated the virus can go on to attack people with no nutritional deficiencies.

This is fascinating new work that may help explain why new influenzas appear in the world every year or so. And the implications of her findings for healthy populations are profound. In this issue of *Early Developments*, our articles highlight Beck’s work and other research at FPG involving children’s health.

However, our researchers don’t just do research, they help translate research into good practice. One example is Joanne Roberts, a senior FPG investigator who has studied otitis media—infection of the middle ear—and bridged the gap that often occurs between research and practice. She has worked with the U.S. Department of Health and Human Services to draw up recommendations for medical management and hearing testing for children with otitis media with effusion (OME), fluid in the middle ear.

In a new book, *Otitis Media in Young Children: Medical, Developmental, and Educational Considerations*, Roberts and her co-editors provide not only the latest research on otitis media, but also its effects on children’s communication and learning. The book’s editors apply research to clinical practice, and explain the best ways to identify, treat, and manage middle ear problems. In this issue of *Early Developments*, we look at Roberts’ work and report on practical strategies for caregivers, teachers and families in dealing with a problem that affects about 30% of preschool children being evaluated for acute illnesses in the outpatient setting.

—Lloyd Little
editor

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fax: 919-966-0862
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From the director's office

Health and well-being

WHEN YOU HEAR THE TERM CHILD DEVELOPMENT, most people think about language, cognitive, social, or motor development. During early childhood, however, and probably throughout the lifespan, health interacts with development in ways that we are just beginning to understand. Children's health is affected by the environments in which they live and play, as evidenced by the effects of poverty on children's access to nutritious diets or the data showing that ear infections are likely to be higher for infants in child care centers than infants at home. Likewise, child development is affected by children's health. Children who are malnourished, frequently ill, or who have a chronic health condition, are at risk for delayed or impaired development.

Fortunately, the important interrelationships between health and development were recognized when the Frank Porter Graham Child Development Center was established more than 30 years ago. Pediatricians were involved from the very beginning in planning the center and the health of children in child care centers has remained a focus of research ever since. In this issue of *Early Developments* we summarize some of our current major activities in the health arena.

We have learned that health is not just a medical issue, but rather is a topic that needs to be studied by a variety of disciplines, beyond

medicine, including nursing, speech and language pathology, audiology, early childhood education, psychology, social work, nutrition, and virology. Some of this work requires an understanding of the basic molecular mechanisms by which nutrients, disease, or environmental toxins affect the very fabric of our bodies. Other work requires an understanding of health in a social and behavioral context—what it means to families, children, and caregivers, and what can be done to improve it. In many cases we know what should be done, but have a difficult time making it happen. For example, we know that washing hands is one of the best ways to reduce the spread of disease in child care centers, but getting people to do it consistently is very hard.

This means that basic research into disease, nutrition, and health needs to be integrated with educational and psychological research in order to promote healthy development and to prevent problems in health from ever occurring. We know many of the causes of health and safety problems for children today. The challenge is how to create an environment where we put into practice what we know to be effective.

—Don Bailey

Bailey is director of the Frank Porter Graham Child Development Center and holds academic appointments in both the School of Education and the School of Medicine at UNC-Chapel Hill

"Health is not merely the absence of illness, but a positive sense of well-being."

—World Health Organization

Lullabye and good-night

Study finds links between sleep behaviors and later learning and development



Photos by Jane Barlow

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Research into the health of children has been a significant component of the Frank Porter Graham Child Development Center since it was founded 30 years ago.

Hand in hand with the Center's Abecedarian Project of the early 1970s was a continuous study of the health of children attending FPG's child care center. Early researchers began monitoring otitis media and respiratory tract infections and their effect on learning. Data on pulmonary function, lung growth, and vaccine evaluations were collected. FPG also began helping train family nurse practitioners who were attending the University of North Carolina at Chapel Hill.

IN THE 1980s, FPG INVESTIGATORS studied the effects of second-hand cigarette smoke on children and discovered that children who lived with smokers had more lower-respiratory tract infections and more incidents of otitis media with effusion. Center research showed that viruses, such as colds and flus, can disable a child's natural defense system against earaches and other bacterial infections. During that time, FPG also helped in the opening of a number of educational child care centers around the nation for premature children.

Studying sleep in preterm infants

Work in many of these areas continues today. For example, Diane Holditch-Davis of the UNC-CH School of Nursing and an FPG fellow, has a number of ongoing



projects involving premature infants. One of her recent studies found that preterm infants who were given a one-and-a-half-hour nap four times a day, with their beds covered and undisturbed, gained more weight and showed a more rapid decline in the incidence of apnea than infants receiving standard nursing care. By the end of a three-week period, the experimental infants weighed an average of 1,600 grams

versus an average of 1,419 grams for infants in the control group.

Neonatal nurses have long suggested that the stimulation received in the intermediate care unit is inappropriate for the development of convalescent premature infants. In the Holditch-Davis study, infants who were given one-and-a-half-hour naps four times a day slept more than infants who received standard nursing care.

“Thus, a simple modification of nursing care that involved minimum increases in nursing time had an impact not only on the sleeping and waking of preterm infants, but also on the incidence of apnea and rate of weight gain. Since a simple modification of nursing care had relatively large effects, practicing nurses need to carefully evaluate nursing care to determine whether all aspects are needed and effective,” wrote the authors of the study published in *Neonatal Network* 16(8), pp. 35–43, last year.

Holditch-Davis' recent work has focused not only on ways to improve nursing care for premature infants, but also on ways to better assess the health of preterm infants. Here are summaries of several projects in which she has been involved:

Sleeping, waking measures
This study compared electroencephalograms (EEG) and behavioral measures



...those who showed more rapid active sleep development had the highest mean IQ and significantly better language, fine motor, and observational play scores [at three years of age] than children in other clusters.

of sleeping and waking in premature infants to identify differences between these measures that might be indicators of neurological development. Infants selected for the study were at high risk for developmental problems because of birthweight less than 1,500 grams, mechanical breathing or both. The similarities and differences between behavioral and EEG scoring were examined to determine the minute-by-minute agreement.

Results indicate that differences between EEG and behavioral observation do, in fact, reflect the immaturity of the infant's brain. "With additional study, it may be possible to use the developmental patterns of these disagreements to identify infants at risk for neurological problems," Holditch-Davis said.

Sleep-wake behaviors

Can the developmental status of three-year-olds, born prematurely, be predicted from the development of sleep-wake behaviors during the preterm period?

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This study of 51 children who were followed for three years found that those who showed more rapid active sleep development had the highest mean IQ and significantly better language, fine motor, and observational play scores than children in other clusters.

Irritability

Many clinicians believe that infants with chronic lung disease show more irritability and react more negatively to care than other preterm infants. This study examined sleep-wake states and behaviors in a group of infants with chronic lung disease and a

Since a simple modification of nursing care had relatively large effects, practicing nurses need to carefully evaluate nursing care to determine whether all aspects are needed and effective

group without the disease. Infants were also checked when alone and when they were with nurses.

The study found few differences between the groups. Sleep-wake states did not differ. "...there is no evidence that 32- to 36-week preterm infants with chronic lung disease are more irritable or react more negatively to care than other preterm infants," said Holditch-Davis.

For further information

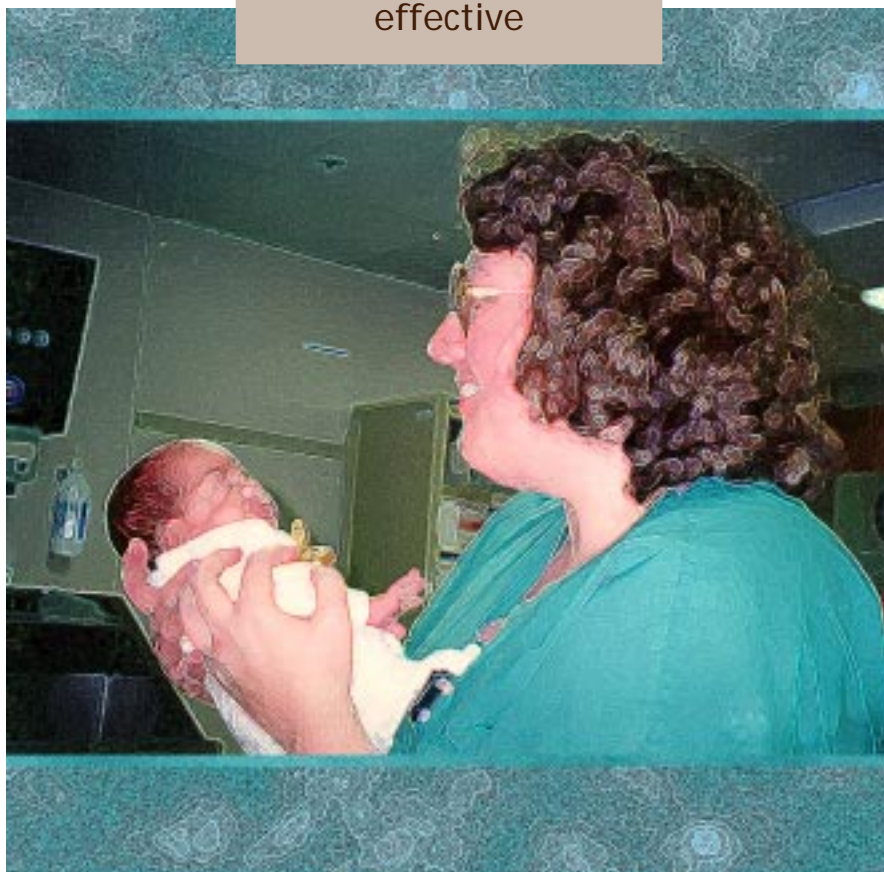
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Studies focus on ways to better assess preterm infant health

Assessing health risks earlier

Ongoing research includes a look at measures of biological risk. Here are summaries of several ongoing research projects at FPG involving infants' health.

Fragile Infants

FPG Fellow Margaret S. Miles is principal investigator of the study "Parental Role Attainment with Medically Fragile Infants." (A medically fragile infant has a serious life-threatening health problem within the first two months as the result of prematurity, a serious birth defect, or severe chronic disease.) The goal of the study is to identify key factors affecting the response of parents, especially those who are high-risk, so that appropriate interventions to support parental role attainment can be developed. Co-principal investigator is Diane Holditch-Davis at UNC-CH's School of Nursing and co-investigators are Peg Burchinal and Barbara Goldman, both at FPG. This study is examining these questions:

- How do parental involvement, identity, and competence with medically fragile infants develop and change over time and across settings, and what are the relationships among parental involvement, identity, and competence?
- How do characteristics of the infant and the infant's illness influence parental involvement?
- How do fathers differ from mothers in parental involvement and what factors influence the development and maintenance of their parental roles?
- What aspects of parental involvement influence the quality of the mother-child relationship at 12 and 15 months?

Taking part in the study are 85 medically fragile infants and their parents, who are being followed until the infants reach 15–18 months.

Risk assessment

The study, "Assessment of Biological and Social Risk in Preterm Infants," is examining four measures of biological risk—sleeping and waking state development, dysmature electroencephalogram (EEG) patterns, neurological insults, and visual attention. Diane Holditch-Davis and her team are examining:

- The effectiveness of these measures in predicting 12- and 24-month health and developmental outcomes
- The relationship between these measures
- The interaction of biological risk measures with measures of social risk in predicting 12- and 24-month developmental and health outcomes
- The identification of predictors of developmental and health outcomes

In this study, 150 high-risk preterm infants from two hospitals are being recruited as soon as their medical conditions are no longer critical. They are being followed for two years past term. "If predictors can be used clinically to identify infants in need of

intervention, then early intervention resources could be targeted to those most likely to benefit from them," said Holditch-Davis.

Support Intervention

In another study, "A Nursing Support Intervention with Mothers of Preterm Infants," Holditch-Davis and Miles are examining a support intervention for mothers of high-risk infants after hospital discharge. Four questions are posed:

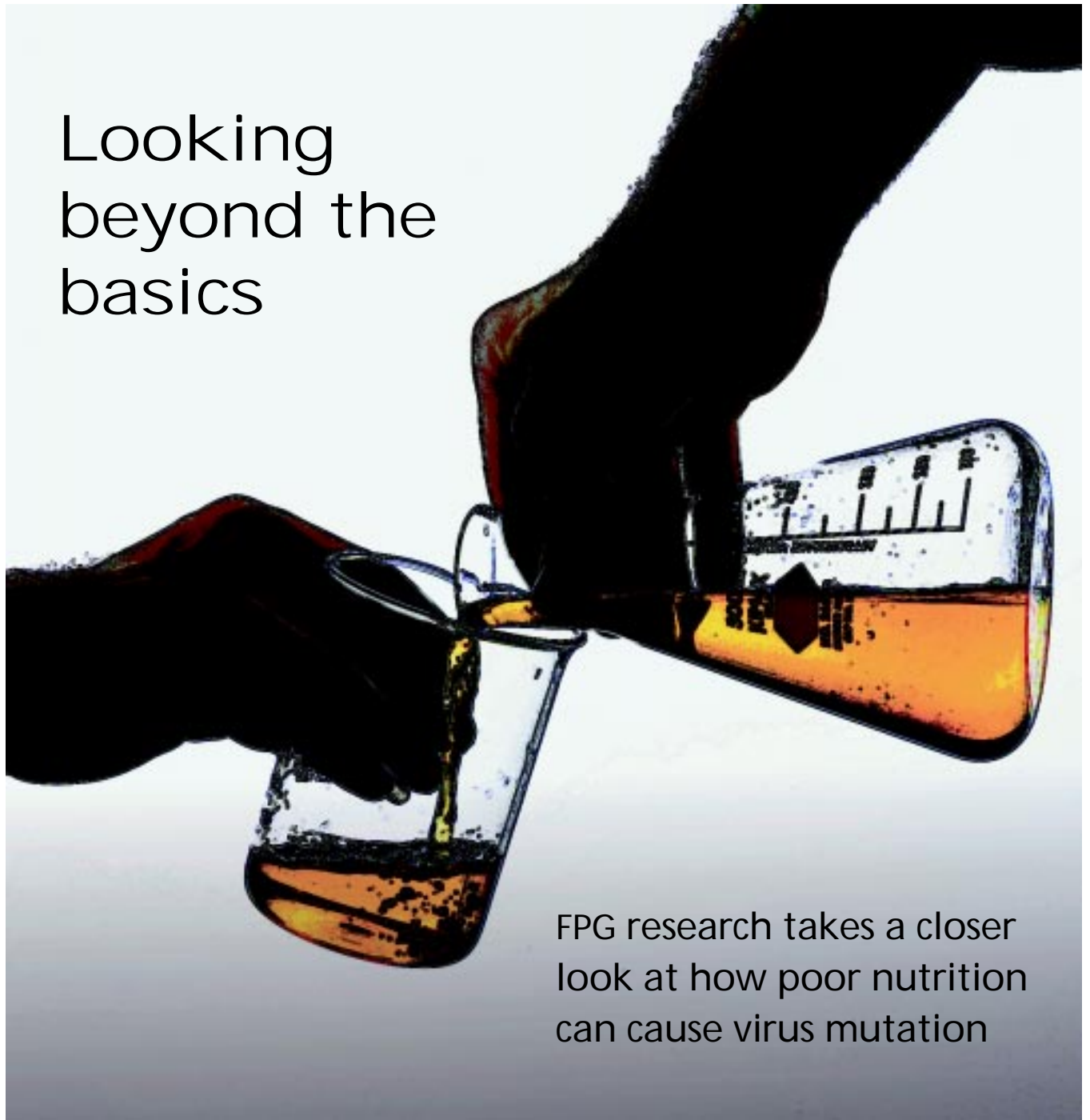
- Is a supportive intervention for mothers of preterm infants at risk for chronic health problems feasible?
- Will the intervention affect the use of services, maternal psychological well-being, and quality of social environment?
- Six months after term, will these mothers have fewer and less intense unresolved issues from their child's experiences in the neonatal intermediate care unit than mothers without this intervention?
- What specific activities will be performed by the intervention nurses?

Forty subjects have been enrolled in the program, and the intervention is being delivered when the infants have been home for at least two weeks.

For further information

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Looking beyond the basics



FPG research takes a closer look at how poor nutrition can cause virus mutation

HAVING MADE THE BREAKTHROUGH THAT LINKED poor nutrition with the mutation of a benign virus into a virulent one, a Frank Porter Graham Center researcher is now taking a closer look at that link to determine exactly how it works.

Earlier work of Melinda Beck established that nutritional deficiencies of either selenium or vitamin E set the stage for the virus, Coxsackievirus B3 (CVB3), to change into a dangerous mutant.

In one new study, Beck and co-principal investigator Jean Handy, also at the University of North Carolina at Chapel Hill, are studying two human diseases strongly associated with a coxsackievirus and a

nutritional deficiency. In China, Keshan disease, which affects the heart tissue, has been found in thousands of people with low selenium levels. However, seasonal outbursts of Keshan disease suggest that an infectious disease is required along with a selenium deficiency. And Chinese scientists have isolated CVB4 (one of the dangerous mutant variations) from victims of Keshan disease.

In Cuba, an epidemic of more than 50,000 cases of a nerve disorder occurred in the early 1990s. Among the factors believed to have led to the epidemic were major changes in the Cuban diet that reduced levels of vitamin E and selenium, among other things. Again, a coxsackie-like virus was isolated from the cerebrospinal fluid of 105

out of 125 patients tested, suggesting a role for this virus in the nerve disorder.

Beck said her study will posit the China and Cuba epidemics as a model for emerging viral diseases caused by a nutritional deficiency, specifically an increase in host oxidative stress. Both selenium and vitamin E act as antioxidants and a deficiency puts stress on the body's immune system. The study will also see if a nutritional deficiency can cause the benign polio virus used in vaccines to mutate into the virulent version.

"Taken as a whole, we believe this study will provide important new information on the critical role of nutrition in emerging infectious diseases, a long neglected area of study," said Beck.

This study is funded by the National Institutes of Health (NIH).

In a second study, also just beginning, Beck is hoping to find out how a deficiency in vitamin E or selenium affects the body's immune functioning. Preliminary data, she said, show that viruses




replicate faster in selenium- or vitamin-deficient mice, and it appears that it is the increased rate of replication that increases the chances of a virus mutation.

This increased reproduction may occur because the immune system is impaired, thus allowing viruses to escape normal mechanisms to control them, or the increased replication may be due to stress. Her study will examine this and also the question of whether a common mechanism of oxidative stress leads to identical changes in a virus.

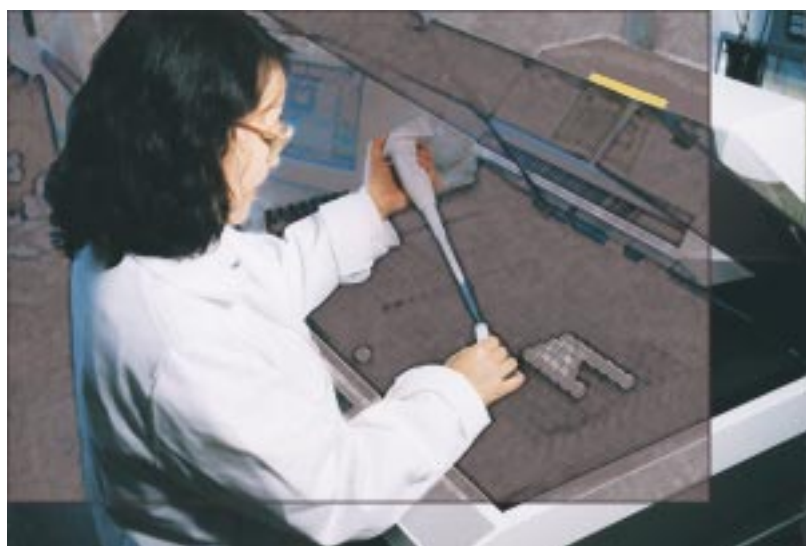
[In any given population of a virus, there is enormous variety in the actual makeup of individual viruses. Thus, a particular virus is really only a statistical consensus of a genetically heterogeneous population that is in constant flux. Some scientists call this "a swarm" or "cloud" of related mutants. It is this constant flux that allows viruses to be widely adaptable to changing environmental conditions.]

Also, Beck's study will determine if selenium or vitamin E supplements can prevent or reduce CVB3-induced myocarditis.

Consulting with her on this second project are Orville A. Levander, a nutritional chemist at the U.S. Department of Agriculture's Agricultural Research Service, and John F. Sheridan at Ohio State University.

This project is funded by NIH, although past work on CVB3 has been supported by the U.S. Department of Agriculture. 

"...we believe this study will provide important new information on the critical role of nutrition in emerging infectious diseases..."



The mystery of the virus

If implications of virus mutations are profound even for well-nourished populations, they are vastly more important for undernourished populations

NUTRITION HAS LONG BEEN KNOWN to affect the body's ability to respond to infectious disease. The traditional explanation of this has been that nutrient deficiencies weaken the immune system. Thus, the host is more susceptible to infections.

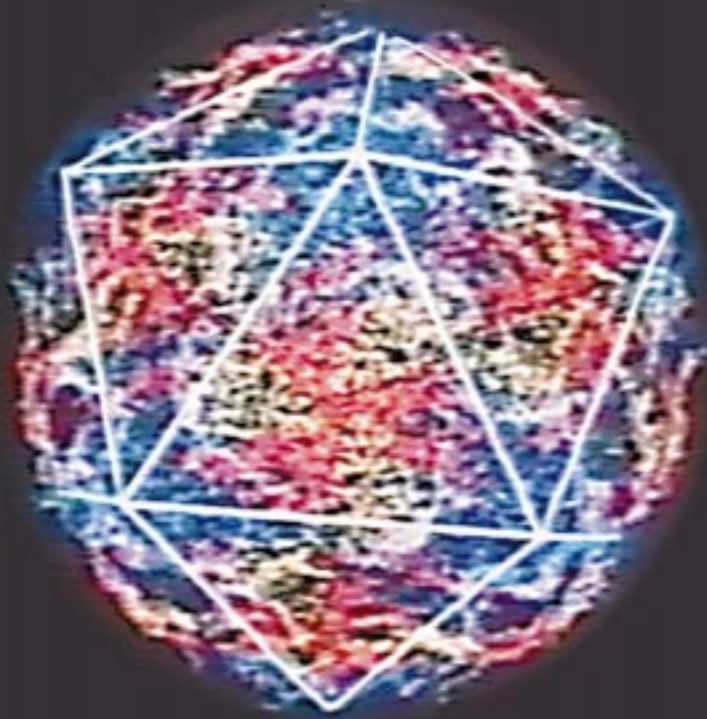
However, FPG researcher Melinda Beck has shown that a host deficiency in either selenium or vitamin E can lead to a mutation in the virus, such that a benign strain becomes virulent and a virulent strain becomes more virulent. The mutant

virus can even attack healthy bodies. The implications of Beck's findings for even well-nourished populations are profound. For example, the benign form of coxsackievirus infects about 20 million Americans a year.

Orville Levander, who consults with Beck and is a nutritional chemist with the U.S. Department of Agriculture, wrote in an article in the May, 1997 issue of *The Journal of Nutrition* that if the findings with coxsackievirus are applicable to other viruses in the same family, the results could

be of "great public health significance" because this family of viruses (known by their composition as ribonucleic acids or RNAs) constitutes the majority of all plant, animal and human viruses. For example, Ebola, Dengue, influenza, measles, hepatitis, polio, the common cold, and HIV are all RNA viruses.

In another article in that same issue of *The Journal of Nutrition*, Beck wrote, "... a single individual with HIV harbors a broad array of viral variants. Perhaps the nutritional status of the patient contributes to the generation



White lines superimposed on this viral structure highlight the assembly of the virus capsid, which behaves as an assembly of five pentamers. The capsid serves to protect the viral RNA which resides inside this outer shell.

The capsid structure of a typical coxsackievirus

of these mutants. Thus, proper nutrition becomes important not only from the standpoint of the host but also from the standpoint of the pathogen.”

In China, Keshan disease, an infection of the heart tissue, has long been associated with selenium deficiencies in people and in the soil. But, because Keshan epidemics have been seasonal, scientists suspected an infectious agent. It wasn't until Beck's work that the nature of the links became recognized.

If other viruses have this same propensity to mutate in selenium-deficient people or animals, it might explain why new influenza strains regularly emerge from China, where selenium-deficient soils are common. Many flu viruses, for example, are thought to originate in ducks, jump to pigs, and then infect people.

One scientist has theorized that Ebola contains genes dependent on selenium. The theory goes that when selenium levels in Ebola-infected cells drop, or are too low to begin with, the virus reproduces and “escapes” in search of cells with more selenium; thus, spreading the infection through the body. Much of the soil in Zaire, where cases of Ebola have been reported, is deficient in selenium. Several scientists are testing selenium in the treatment of AIDS.

The significance of Beck's findings is not limited to nutritionally deprived populations. In theory, it would take only one selenium-deficient person or animal to produce a new family of virus mutants.

Levander suggested a systematic survey of various nutritional deficiencies to determine which were capable of directing the evolution of viruses. It would also seem reasonable, he said, to screen various viruses to see which, aside from coxsackie, are affected by host nutrition.

Beck, in fact, is planning to do exactly that. She says her next series of grant requests will be to see if mutations of the influenza virus can be caused by nutritional deficiencies. She said, “We will try to answer some of the questions around, for example, the ‘bird flu’ in Hong Kong.

However, we need preliminary data before speculating on that.”

The Hong Kong cases are the first in which an avian influenza virus apparently has jumped to humans without first going through pigs or other animals. Beck's work may provide clues to solving this mystery. **ed**

Malnourished children are already at risk for developmental delays and are more susceptible to illness and disease

If the implications of research into coxsackievirus by Melinda Beck for even well-nourished adults are profound, the implications for children are extreme.

“The coxsackievirus is a very common childhood virus. Children and immune-compromised individuals are especially susceptible to this virus,” said Beck. A mutant and virulent form of the virus abroad in a population could be devastating.

Beck's work on nutrition also dovetails with a new report from UNICEF, which says that over 200 million children under the age of five in developing countries are malnourished. “Malnourished children often suffer the loss of precious mental capacities. They fall ill more often. If they survive, they may grow up with lasting mental or physical disabilities,” writes Kofi A. Annan, secretary-general of the United Nations, in the report, “The State of the World's Children 1998.”

The report states, “In young children, malnutrition dulls motivation and curiosity and reduces play and exploratory activities. These effects, in turn, impair mental and cognitive development by reducing the amount of interaction children have both with their environment and with those who provide care.

“Of the nearly 12 million children under five who die each year in developing countries mainly from preventable causes, the deaths of over 6 million, or 55 percent, are either directly or indirectly attributable to malnutrition. Malnourished children, unlike their well-nourished peers, not only have lifetime disabilities and weakened immune systems, but they also lack the capacity for learning that their well-nourished peers have.

“Almost half of the economic growth achieved by the United Kingdom and a number of western European countries between 1790 and 1980, for example, has been attributed to better nutrition and improved health and sanitation conditions, social investments made as much as a century earlier.”

In the United States, researchers estimate that over 13 million children—more than one in every four under the age of 12—have a difficult time getting all the food they need, a problem that is often at its worst during the last week of the month when families' social benefits or wages run out, according to the UNICEF report.



Testing, 1... 2... 3...

Hearing research offers strategies for dealing with ear infections

Otitis media is one of the most common illnesses of early childhood and the most frequent diagnosis made by physicians in young children. Direct and indirect healthcare costs for the diagnosis and management of otitis media are estimated at \$3.5 billion annually.

Acute otitis media is diagnosed in about 30% of preschool children being evaluated for acute illnesses in the outpatient setting. Otitis media with effusion (OME—fluid in the middle ear) occurs in as much as 40% of children during the first two years of life. Of particular concern to parents and caregivers is that the incidence of otitis media in children is highest between three months and two years of age, according to Dr. Fred Henderson, a pediatrician and an investigator at FPG. Henderson authored a chapter on “Medical Management of Otitis Media” in the book, *Otitis Media in Young Children: Medical, Developmental and Educational Considerations*, published last year.

Otitis media, which has been studied at the Frank Porter Graham Center for more than three decades, may be significant to the development of young children because OME can impair the transmis-

sion of sound, causing a mild to moderate conductive hearing loss. (Details on several FPG studies involving otitis media were in *Early Developments*, Vol. 2, No. 1.)

FPG researcher Joanne Roberts, one of the editors of *Otitis Media in Young Children*, said that her own research and a survey of current literature may lend some support to a hypothesized linkage between OME and language development. Here’s the hypothesis:

A child with OME may experience a mild to moderate fluctuating hearing loss and thus receive a partial or inconsistent auditory signal. As a consequence, the child may appear distracted and disorganized. The illness associated with OME may diminish the child’s interactions with people and objects. Frequent bouts may result in the child having fewer opportunities to establish a knowledge base from which language develops. The child may restrict or change his or her interactions with caregivers.

Prolonged or frequent OME could affect child outcomes in attention, speech-language, and academics. The child could then be at a disadvantage for learning the basics of language. For example, a

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Recent publications

By researchers at the Frank Porter Graham Child Development Center

Preserving childhood for children in shelters.

T. Harms, A. Richardson, & P. Rolandelli (Eds.). (1998). Washington: CWLA Press.

Differentiation without separation: Challenging the gifted adolescent in the middle school classroom.

J. Gallagher, & M. Coleman. (1997). In J. Flood, D. Lapp, & K. Wood (Eds.), *Staff development guide for middle school teachers* (pp. 193–199). New York: Macmillan/McGraw Hill.

Blending middle school philosophy and the education of gifted students: Five case studies.

M. Coleman, J. Gallagher, & J. Howard. (1997). Washington: National Association for Gifted Children.

Cooperative learning and gifted students: Reports on five case studies.

M. Coleman, J. Gallagher, & S. Nelson. (1997). Washington: National Association for Gifted Children.

Leadership manual for completing a comprehensive self-assessment of gifted services.

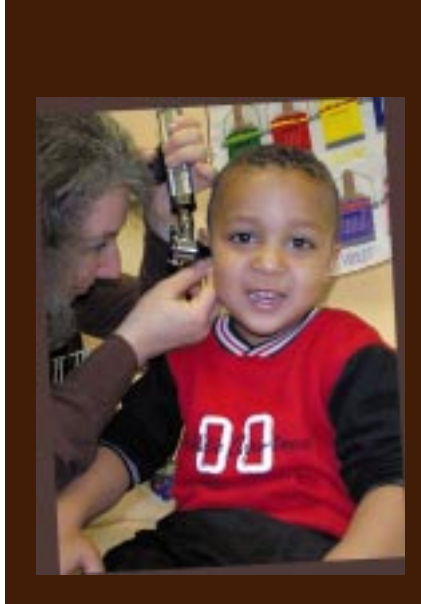
M. Coleman, J. Gallagher, & C. Harradine. (1997). Chapel Hill: Univ. of North Carolina, Frank Porter Graham Child Development Center, Statewide Technical Assistance for Gifted Education.

Programming for gifted learners: Developing a system-level plan for service delivery.

A. Harrison, & M. Coleman. (1997). Chapel Hill: Univ. of North Carolina, Frank Porter Graham Child Development Center, Statewide Technical Assistance for Gifted Education.

hearing loss from OME can make it hard for a child to hear the “-s” in plurals and possessives and to hear short words, such as “is” and “the.” These difficulties may in turn later affect academic achievement, particularly in reading and other language-based subjects.

However, Roberts said, there is no consensus in the research community about the precise relationship between speech and language skills and a child’s OME history. “Clearly, there continues to be the need for methodologically rigorous studies to examine OME sequelae,” she says.




Roberts makes these suggestions in her book to parents, the early care and education workforce, and those in the medical professions for management strategies for dealing with OME:

- It is important to identify when children with OME have a hearing loss, the degree of the loss, and if it involves both ears.
- Hearing screening should occur after children have bilateral OME for three months or after recurrent episodes of OME.
- Some children are at increased risk for OME and for language difficulties and their hearing should be routinely checked, particularly during the winter. These groups include children with Down syndrome, fetal alcohol syndrome, and craniofacial abnormalities.
- The language skills of children with persistent OME should be monitored to see if a child is showing a language delay.
- Families and other caregivers of young children with recurrent or persistent OME need current, understandable, and accurate information in order to make decisions about management.

- Many children with OME and hearing loss do not exhibit obvious symptoms. Increasing caregivers’ awareness of the subtleties of signs, along with screenings, may best identify children at risk for language learning difficulties due to OME.
- Children who have hearing loss need listening environments that optimally facilitate language. For example, the saliency of the speech signal should be increased and background noise minimized.
- For a child with ongoing OME or a history of OME who is having hearing or attention difficulties, an open classroom or large group setting with background noise may be particularly difficult.

- Children who frequently experience OME may benefit from a highly responsive language environment, such as interactive games, immediate and consistent responses to the child, checking to make sure the child understands directions and new information, and so forth.
- Increase children’s attention to language by singing simple songs with repeated words and phrases, playing word and listening games, rhyming games and so forth.
- Some children with a history of OME may exhibit language difficulties and need to be enrolled in speech-language therapy. Some children may benefit from acoustic amplification.

(*Otitis Media in Young Children: Medical, Developmental, and Educational Considerations* is published by Paul H. Brookes Publishing Co., Baltimore, MD.) 

Educating exceptional children. (8th ed.).

S. Kirk, J. Gallagher, & J. Anastasiow. (1997) Boston: Houghton-Mifflin.

Family and professional perspectives on early intervention: An exploration using focus groups.

P. Wesley, V. Buysse, & S. Tyndall. (1997). *Topics in Early Childhood Special Education*, 17 (4), 435–456.

Part H updates (2nd ed.).

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Helping children breathe easier

Respiratory infections are still the major health problem in child care settings

The prevention of respiratory infections in child care centers remains a public health challenge, according to a paper delivered during a synthesis conference on "Research Into Practice in Infant/Toddler Care" held in the fall of 1997 by the National Center for Early Development & Learning (NCEDL).

Drs. Albert M. Collier and Frederick W. Henderson, both pediatricians at the University of North Carolina at Chapel Hill, said a survey of current literature reveals "no published data describing a successful intervention to reduce the risk of upper respiratory diseases in day care centers." Both are also FPG fellows.



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Research, including work done for more than 30 years at FPG's own child care center, shows that viral respiratory tract infections peak during the second six months of life, between seven months and one year of age. During this period, the level of antibodies is at its lowest in life. That's because of the decreasing level of antibodies passed across the placenta from the child's mother during pregnancy and the fact that it takes the child's immune system about two years to begin producing antibody levels approaching those of a mature child.

Children under the age of three who attend child care have more respiratory infections than children of the same age who are cared for at home. The severity of these infections in young children is also greater. Children who are routinely in contact with only three children daily rather than 30 children have less of a chance of coming into contact with an infectious agent. Children attending child care will be infected with viral respiratory infections earlier than children living at home with no siblings in school.

- Respiratory infections account for 75% to 90% of infections in child care settings, according to several large studies. In an FPG study of 206 children followed for 864 child-years, infants less than a year old had an average of nine respiratory illnesses a year of which 46% were associated with otitis media and 13% with lower respiratory manifestations.
- Collier and Henderson suggested that one strategy for future research in the control of respiratory tract infections in child care would be to increase the individual child's immunity to the most important respiratory agents. This should be approached first by making sure that the children and child care staff are fully vaccinated on schedule for vaccine-preventable respiratory illness.
- Second, research could focus on maternal immunization during pregnancy to optimize the level of antibodies in the mother to a particular respiratory tract pathogen. Passive antibodies would then be

National studies in the news

at a high level to pass across the placenta to the newborn. As the mother's passive antibodies disappear, the child might then be immunized with new vaccines against common respiratory pathogens.

The researchers predicted that in the near future vaccine development will certainly focus on the respiratory syncytial, parainfluenza, and influenza viruses. "Adenoviruses could also be an important target for prevention," they said.

Curiously enough, they said, a synthesis of research shows no evidence that excluding sick children from a child care center reduces the incidence of acute respiratory disease. Children with viral respiratory infections excrete the infectious virus four to five days before they show signs and symptoms of the infection.

- In another study by FPG researchers, a hygienic intervention was conducted at a random selection of child care centers at the same time as another random group of centers received no intervention. The intervention included such things as:
 - handwashing of children & staff
 - disinfecting the toilet & diapering area
 - physical separation of diapering area from food preparation & service areas
 - hygienic diaper disposal
 - daily washing & disinfecting of toys, sinks, kitchen & bathroom floors
 - daily laundering of blankets, sheets, dress-up clothes, other items
 - hygienic preparing, serving and clean-up of food.

No significant difference in the rates of illness from respiratory tract infections was found in centers with interventions and those without. 🍎

Keeping children healthy outside the home

Researchers cite ways to help control diarrhea in out-of-home child care

The rate of diarrheal disease in children cared for out of the home is two to three times that in children cared for at home, according to a presentation sponsored by the National Center for Early Development & Learning (NCEDL). One study puts the mean cost per episode of diarrhea at \$289, while another finds an average cost of \$172 per child-year.

These findings were presented during a "Research Into Practice in Infant/Toddler Care" synthesis conference by NCEDL in the fall of 1997 in Chapel Hill, NC. Drs. Robin B. Churchill and Larry K. Pickering presented their data and surveyed current literature for their paper, "Health Issues in the Context of Out-of-Home Child Care: Diarrheal Disease in Infants and Toddlers." Both are affiliated with Eastern Virginia Medical School, Norfolk.


An increased rate of diarrheal disease has been shown to occur in children newly enrolled in child care centers, and this is likely due to exposure to pathogens not previously found in the home environment, the researchers said.

Studies, including those at FPG, show that fecal contamination in infant and toddler areas of child care environments is common. Dry surfaces, diapering areas and bathroom sinks and faucets were less likely to be contaminated than the hands of children and staff, classroom sinks and faucets, and toys.

Classrooms with high levels of coliform bacteria on the hands of staff also tend to have high levels on the hands of the children, researchers said.

Several studies, including one by FPG researchers, show that training in hygienic practices including handwashing and diapering techniques resulted in a decrease in severe diarrhea in classrooms caring for children under 24 months.

The researchers said that education of child care providers and parents in handwashing and other hygienic practices and strict adherence to these practices remain "the cornerstone of prevention and control of diarrheal disease in the child care setting."


Vaccines against only two gastrointestinal-tract pathogens have been approved by the U.S. Food and Drug Administration (FDA), but neither is considered important in the child care setting. "Vaccines against enteric pathogens, especially viral agents, represent a promising means of control in the future," the researchers said. The FDA is considering an orally administered vaccine for prevention of rotavirus, a virus commonly implicated in outbreaks of diarrhea in child care settings. 



Pickering & Churchill suggest the following measures to help control and prevent diarrheal disease in child care environments...

- ✦ In child care centers, food preparation areas should be completely separate from diapering and toilet areas.
- ✦ Diaper-changing areas should never be used for temporary placement of food.
- ✦ There should be an adequate number of sinks adjacent to child-size toilets and diapering areas.
- ✦ The use of potty chairs should be discouraged.
- ✦ The use of automated faucet-handle-free handwashing sinks should be considered because they may aid in decreasing fecal contamination.
- ✦ Surfaces should be designed and built for ease of cleaning. For example, diaper-changing surfaces should be nonporous to allow adequate sanitization between uses.
- ✦ Facilities should allow separation of children by age group. Children in diapers especially should be separated from toilet-trained children.
- ✦ Written handwashing procedures and sanitation policies should be available to all staff and procedures should be enforced.
- ✦ Interventions involving parents and the community can be a valuable adjunct in controlling enteric diseases in child care centers. Education on hygienic practices on a community-wide basis has been shown effective in controlling community outbreaks of shigellosis associated with child care centers.

They also suggested that the management of children with diarrhea and control of diarrheal outbreaks in the child care setting include...

- ✦ excluding children with diarrhea from the center
- ✦ grouping infected children in a separate area with separate staff
- ✦ excluding new admissions temporarily
- ✦ offering alternative care arrangements including referral to a sick care center
- ✦ closing a center temporarily if all other measures fail. 

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Research spotlight

Recent findings at FPG

Early Intervention & Mediating Processes in Cognitive Performance of Children of Low-Income African American Families

Margaret R. Burchinal, Frances A. Campbell, Donna M. Bryant, Barbara H. Wasik, and Craig T. Ramey.
Child Development, 68(5), pp. 935–954.

This longitudinal study of 161 African American children from low-income families examined multiple influences—including early childhood interventions and characteristics of the child and family—on longitudinal patterns of children's cognitive performance measured between 6 months and 8 years of age. These children were part of the original Abecedarian study at FPG, and this is a new analysis of data already collected.

Results indicate that children with higher IQs over time tended to have had high-quality child care, responsive and stimulating care at home, and mothers with higher IQs. Findings suggested that child care experiences were related to better cognitive development, in part, because children who received more responsive and stimulating child care became more responsive and

interested in the people and objects in their world. Maternal IQ had both a direct effect on cognitive development during early childhood and an indirect effect through its influence on the family environment.

Early childhood education in a quality care facility and the quality of the family environment were both related to higher child test scores over time, even after adjusting for maternal IQ.

Results indicated that neither the selected characteristics of the mother nor family environment moderated the child care intervention effects. These results in conjunction with results from other intervention studies suggest that responsive care beginning in infancy and continuing through entry to kindergarten may be necessary to achieve long-term child care

effects on cognitive outcomes. These results provide further evidence of the malleability of cognitive performance during early childhood.

In contrast to much previous work, the family environment and the child care intervention both remained substantial predictors in the analysis models even at the last assessment at 8 years of age.

In conjunction with other Abecedarian studies and Carolina Approach to Responsive Education project papers, these results provide clear evidence that intensive, high-quality, child care interventions can change the developmental trajectories of cognitive performance and enhance academic outcomes for African American children from low-income families.