

FAMILY INFLUENCES ON CHILD HEALTH AND DEVELOPMENT

1. Meta Hypothesis

Family resources and processes shape the structure and quality of children's homes, childcare, school experiences, and economic opportunities. These resources and processes affect children's developmental and health trajectories and mediate or moderate other environmental influences on children's outcomes.

2. Specific Hypotheses

1. The nature and stability of family structures, including parental unions, household composition, and living arrangements, affect child outcomes, including functioning of stress-responsive biological regulatory systems, levels of social competence and emotional regulation, and internalizing and externalizing behavior problems.
2. Families' social networks influence child health and development by providing or limiting access to instrumental or emotional support for either child or adult family members by placing demands on parents' time for helping others, by providing or limiting access to information and health-supportive resources, by exposing children to positive or abusive relationships, or by supporting healthy or unhealthy norms for health-related behaviors.
3. Family socioeconomic status (e.g., income, wealth, parents' education, and occupation) influences the health and development of children both directly and by moderating the effects of risk factors such as prematurity.
4. Children with emotionally or physically unhealthy family members are likely to be in poor mental or physical health themselves, in part because of shared genetic predispositions but also because of constrained parenting and compromised resources. Children who are exposed to negative family dynamics display more problematic health and developmental outcomes.
5. Parental promotion of healthy lifestyle behaviors through teaching and modeling contribute to better physical and mental health outcomes in children.
6. Parental monitoring of children's activities at home and in their neighborhoods enhances child health and development.

3. Background and Justification

Families are the epicenters of social-environmental influences on children's health and development (Demo & Cox, 2000; McLoyd, Cauce, Takeuchi, & Wilson, 2000). Most studies of children's health and development hypothesize that family variables have direct, mediating, or moderating influences on children's health and on social and cognitive developmental outcomes.

A review of the existing research suggests that two major domains: family resources and family processes, are primary influences on children's health and development. The family resources domain includes family structure (i.e., parental unions, household composition, and family living arrangements); family socioeconomic status (e.g., parents' and other household members' education, income, wealth, health insurance, and human capital); social resources (ties and access to supportive others); family physical and mental health; and family identity (e.g., identification with cultural norms,

attitudes, and values associated with specific racial, ethnic, religious, or other socially defined groups). The family processes domain includes management (e.g., decision making, resource allocation, parental involvement and engagement in children's school and education, seeking medical care, and engaging children in activities such as sports); parenting (e.g., parental practices such as monitoring, nurturance, protection, and guidance; parenting styles; and direct interactions between parents and children); and family climate (i.e., family cohesion, marital/spousal relationships and family violence). The links between these domains and processes operate and change as children develop.

3.1 Public Health Importance

Prevalence/incidence

Many children in the United States are living in households with potentially problematic family resources and processes. In 2005, 18.2 percent of children younger than 18 and 21.3 percent of children younger than 5 lived in poverty (U.S. Census Bureau, 2005). Children comprise the largest group living in poverty in the United States.

Estimates as recent as 2005 indicate that 68 percent of children live in two-parent families, down from 77 percent in 1980 (U.S. Census Bureau, 2005). The U.S. Census Bureau estimates that one-third of children today are born to unmarried mothers and may grow up either in single-parent families or spend significant portions of their lives living with other relatives or stepparents. Half of all children in America younger than 16 will someday live in a single-parent household (Fields, 2001).

Family violence, a critical dimension of family climate, has profound effects on children (National Research Council, 1993). In 2004, 872,000 (11.9 per 1,000) children were victims in maltreatment cases substantiated by state child protective services (U.S. Department of Health and Human Services [HHS], 2006), which is known to be a conservative estimate of the true prevalence of maltreatment.

Economic and/or social burden

Although there is substantial variability overall, adults who grew up in families with conflictual parental relationships or divorce are more likely to experience depression, adjustment difficulties, and dissolution of their own marriages during adulthood (O'Connor, Thorpe, Dunn, & Golding, 1999). The relation between parental divorce and the child's subsequent adult difficulties is mediated through the quality of childhood parent-child relationships and, therefore, is potentially malleable.

Family economic status is correlated with children's economic status in adulthood, although there is certainly elasticity in these predictions (Charles & Hurst, 2003), thus making such intergenerational patterns potentially modifiable. Efforts to better understand and minimize this reproduction of inequality would lower poverty rates and increase societal well-being.

3.2 Justification for a Large Prospective Longitudinal Study

A large prospective longitudinal study of the influence of families on child development is essential for accurate examination of how families influence the unfolding of child developmental outcomes through time.

Family processes and resources change during time, and the timing, sequence, and duration of exposures to these family characteristics may have differential effects on children's outcomes.

Socioeconomic status may vary during a child's life, having both short- and long-term effects on health and development. Research suggests that economic disadvantage during childhood has lasting effects observable in the form of health disparities during adulthood and old age (Hayward & Gorman, 2004). Family resources that affect income, however, are not static. Changes in employment, marital status, and living arrangements can produce sharp changes in household incomes, in the environments in which children live, and in their access to medical care. Cross-sectional data provide only a snapshot of exposures and outcomes and, therefore, are less useful for understanding how child health and development are affected differently by concurrent or cumulative family circumstances. Differential timing of exposure is also important. Research on family poverty (Duncan & Brooks-Gunn, 1997) identifies early childhood as a vulnerable period in which the experience of poverty has disproportionate effects on development. A longitudinal study would allow for further identification of potentially sensitive periods in child development when the effects of specific family exposures might be heightened.

A large sample size is essential for several reasons. The United States is becoming more diverse, and norms about family structure and process differ across racial, ethnic, and religious groups. Consequently, the same family exposures could have different impact within subpopulations. A large sample size will permit the National Children's Study (NCS) to assess the impact of the family on child health and development within and across diverse subpopulations. A large sample is also needed to capture the effects of low-prevalence yet high-impact family exposures such as family violence and child maltreatment. The field of child maltreatment research has struggled to estimate accurate prevalence rates, to establish adequate comparison groups when examining the effects of maltreatment on development, and to deal with issues of retrospective bias in the family relations of maltreated children. A large representative sample and a prospective study will be invaluable in reducing bias in these analyses.

3.3 Scientific Merit

Family resources

Although divorce rates have stabilized since the 1990s, the general acceptability of divorce has also contributed to structural changes in families such that children are more likely to live in a single-parent or cohabiting household at some time in their lives. Children's living arrangements have become not only more diverse but also more unstable, especially for low-income and some minority (e.g., African American) families (Wu, Bumpuss, & Musick, 2001). Evidence suggests that children who experience changes in family structure and concomitant residential instability are at risk for low educational attainment in late adolescence (Hill, Yeung, & Duncan, 2001). The effects of poverty on child health and development are also greatest among single-parent families. For example, rates of low birth weight and preterm infant births are higher among African-American single mothers living in poverty (Brooks-Gunn & Chase-Lansdale, 1995).

Children's health and both household income and parental education are well linked. Poverty, single-parent family status, and low parental education levels all contribute to children's poor health outcomes (Bauman, Silver, & Stein, 2006). There is a health gradient that persists through all income and education levels such that children from families with higher incomes and more parental education have a higher probability of being healthy and developing to their highest potential. It is still the case, however, that 66 percent of children from the poorest quintile are in excellent or very good health (Case & Paxson, 2002). It is important to understand why and how the latter group thrives despite limited resources. There is a growing understanding that family wealth (i.e., accumulated assets) has an effect on child health and psychosocial functioning above and beyond that of income (Bradley & Corwyn, 2002). Moreover, there is increasing attention to racial disparities in family wealth that exceed differences in income (Conley, 2001). Further research is needed to understand how specific types of family resources interact with each other and with family processes in influencing health and developmental outcomes.

Family social resources, including enhanced material resources (e.g., goods and services, information), emotional support (which may buffer the negative appraisal of stressful events), social engagement (connection to productive activities), and social influences (maintenance of healthy norms and behaviors) have been linked to child health and development. Research has documented associations between caregiver stress, caregiver social isolation, and child health outcomes (Wright, Rodriguez, & Cohen, 1998). Evidence also documents the significance of social support during pregnancy for fetal growth (Feldman, Dunkel-Schetter, Sandman, & Wadhwa, 2000). Much remains to be learned, however, about the social, psychological, behavioral, and biological pathways involved in these associations.

The physical and mental health of parents and other family members can impact the health and well-being of children. Physical or psychological disabilities faced by parents, caregivers, or siblings can compromise the quantity and quality of nurturing provided to children. Children whose parents suffer from serious psychological problems such as depression or alcoholism have a higher risk for ineffective or inconsistent parenting, maltreatment, placement in foster care, and homelessness (Coyne & Downey, 1991; Mowbray et al., 2000; Oyserman, Mowbray, Meares, & Firminger, 2000). More general parental life stress also impacts parenting, even if only temporarily (e.g., death in the family, chronic illness, poor relationship quality, marital or cohabitation dissolution, work stress, neighborhood crime and violence) (Ge, Conger, Lorenz, & Simmons, 1994).

Race, ethnicity, and immigrant status represent important cultural and structural factors that influence families and children. Family and culture research shows differences in the ways in which parents manage children's lives, provide supervision and guidance, and support their goals. For example, the literature suggests concepts especially salient to immigrant families are parental respect, family loyalty, pride, parental expectations, and family obligations (Fuligni, Tseng, & Lam, 1999; National Research Council, 1998). This research has made it clear that family process constructs (warmth/closeness, monitoring, involvement) among immigrants do not hold the same meaning as they do for native-born families (Garcia Coll & Patcher, 2002). Similar research has focused on racial differences in parenting practices (Jones, Zalot, Chester, Foster, & Sterrett, in press; McLoyd et al., 2000). Family also plays an important role in children's attitudes and beliefs regarding the role that race, ethnicity, and gender play in their lives (Hughes & Chen, 1997; Spencer, 1983). Identity attitudes have been linked to children's outcomes in a variety of domains including self-esteem (Smith, Walker, Fields, Brookins, & Seay, 1999), academic beliefs and performance (Witherspoon, Speight, & Thomas, 1997), friendship selections (Hamm, 2000), substance use and abuse (Marsiglia, Kulis, & Hecht, 2001; Scheier, Botvin, Diaz, & Ifill-Williams, 1997), engagement in risky sexual behaviors (Belgrave, Van Oss, & Chambers, 2000), and violence (Arborna, Jackson, McCoy, & Blakely, 1999). These social identities also play a role in buffering the deleterious impact of experiencing racial, ethnic, and gender discrimination (Sellers & Shelton, in press; Williams, Spencer, & Jackson, 1999). Thus, it is important that a study like this captures parenting processes and family climate characteristics that facilitate health and healthy behavior across different ethnic, racial, and immigrant groups.

Family processes

Parent-child relationships can have direct effects on child health and children's exposure or vulnerability to a variety of social and environmental health risk factors. Altering family resources (e.g., socioeconomic status, family structure) is not always a practical focus for intervention. In contrast, family processes (such as parenting practices) can be modified through intervention and often mediate the links between family resources and child outcomes.

Parenting style has a considerable influence on children's developmental outcomes. Models of parenting highlight the centrality of the emotional quality (i.e., level of warmth, trust) of the parent-

child relationship in determining whether parents are effective in disciplining their children, learning about their children's everyday activities, serving in the role of advisor and confidant, and conveying their beliefs and values (Darling & Steinberg, 1993). A substantial body of research documents that "authoritative" parenting styles, characterized by high levels of warmth, high expectations for maturity, and moderate levels of discipline, are linked to children's social competence, achievement, and self-regulation abilities (Parke & Buriel, 1998). When relationships are high in warmth and trust, children are also more likely to respond positively to socialization efforts. Family environments characterized by high conflict, aggression, and violence adversely affect child health outcomes (Repetti, Taylor, & Seeman, 2002).

Effective parenting also requires that children perceive parents as having power and status, because children are more likely to identify with and model adults they perceive as powerful. Parental power may come in such forms as parents' access to resources, their ability to protect their child from illness or danger, and their ability to solve common problems (Parke & Buriel, 1998). Qualitative research suggests that socioeconomic differences in how parents view the task of fostering children's development may be associated indirectly with children's health outcomes, as low-income parents engage in fewer prevention behaviors and positive interventions on behalf of their children (Lareau, 2003). Another body of work documents links between parental monitoring and well-being outcomes in childhood and adolescence, including school grades, association with deviant peers, involvement in delinquent activities, and conduct problems (Crouter & Head, 2002). The conditions under which parents are more or less effective at monitoring their children are less well understood, but the emotional quality of the parent-child relationship may be an important moderating factor (Stattin & Kerr, 2000).

3.4 Potential for Innovative Research

The NCS has the potential to provide an innovative and unprecedented body of longitudinal data that unites information on family resources and processes from before birth until early adulthood with child physical and mental health outcomes. No such comprehensive data resources currently exist.

The large, representative sample will allow the NCS to establish the nature and scope of family resources in the United States in a way that has not been possible to date, including how such resources vary across population subgroups. Family processes are often studied within small convenience samples or targeted subgroups rather than across varied populations. Initial documenting of the full range of family characteristics will be an innovation in the field of family research.

The study will examine the links between family influences and child outcomes within and across ethnic, racial, and socioeconomic subgroups. Such subgroup analyses, which have been done on limited samples, will permit a better understanding of how the same family practices have different consequences for child development within differing groups. This information will be an invaluable starting point for tailoring interventions to different types of families.

3.5 Feasibility

Family resources and processes influence child health and development outcomes throughout childhood and adolescence with key critical periods arising for specific elements of family influence (e.g., parental control over children's activities, diet, and hygiene declines with age). However, neighborhood context and family resources moderate this decline. As control declines, monitoring of the child rises and becomes more important. There are well validated and standardized assessment tools for measuring both resources and structure. Repeated assessments throughout the study will capture these progressive changes.

Relatively fixed information on the family (e.g., race, ethnicity, education of grandparents) can be measured once or twice during the study period. Relatively stable family factors can be collected regularly but at less frequent intervals than factors that may change often. For example, wealth, specific parenting practices, family climate, and family social resources might be included in this set. Information that might change more unpredictably, such as family structure, income, parental employment, child care arrangements, and residence, needs to be assessed more frequently to account for changes.

Because family resources and family process are active fields of research within the social sciences, valid and reliable measurement tools, including parental report measures, observational measures of family processes, and report measures for older children and adolescents, are available, which will ensure robust measurement of family influences. Child development outcomes, including academic achievement, social competence, and behavior problems are measurable through well-established and standardized measures, again available from multiple reporters.

4. Exposure Measures

4.1 Individuals Targeted for Measurement

Family resources

- Family structure (marital status, living arrangements, residential mobility)
- Socioeconomic status (income, employment)
- Social support
- Parental physical and mental health
- Family identity

Family process

- Parental management of child health
- Parenting (warmth, discipline, monitoring)
- Family climate
- Parental mental health

4.2 Methods

Family resource measures

- Interview
- Questionnaire
- Medical record review

Family process measures

- Interview
- Questionnaire
- Direct observation of parent-child interaction

4.3 Life stage

Family resource measures

- Prenatal through late adolescence, ongoing regular assessments

Family process measures

- Birth through late adolescence, regular questionnaire/interview assessments
- Observation of parent-child interaction during infancy, childhood, adolescence

5. Outcome Measures

5.1 Outcomes Targeted for Measurement in Child

- Social and emotional functioning
- Risk-taking behavior and aggressive behavior problems
- Child health status
- Academic achievement
- Educational attainment

5.2 Outcome Methods

- Questionnaires/interviews with parents, children, teachers (measuring child social, emotional, and behavioral functioning)
- Direct testing/observation of child (social behavior, aggressive behavior, achievement)
- Medical record review
- School record review

5.3 Life stage

- Social/emotional: Infancy through late adolescence
- Risk-taking behavior/aggression: Preschool through late adolescence
- Health status: Infancy through late adolescence
- Academic achievement: Middle childhood and late adolescence
- Educational attainment: Late adolescence

6. Important Confounders, Mediators, and Effect Modifiers

Many of the covariates listed in the other hypotheses will impact this hypothesis as the health outcomes studied are wide ranging. Some examples are:

- **Genetic influences:** Genetic susceptibility to environmental stressors or predisposition for psychopathology that may be passed from parent to child can influence both family functioning and child outcomes.
- **Demographic variables:** Age, gender, language spoken, migration history, etc., may interact with family structure and processes (some demographic information will be exposures depending on specific hypothesis).
- **Parental education level:** Highest grade attained or participation in school or training programs may interact with family structure and processes.
- **Media influences:** Frequency and content of television viewing and video and computer use may impact child mental health outcomes.
- **Neighborhood characteristics:** Geographic area of residence, as well as neighborhood characteristics, may affect family resources and processes and influence child outcomes of interest.

7. Power and Sample Size

Starting with the birth cohort of 100,000, the minimum odds ratio between measures of the child's health and development and hypothesized exposures related to family influences will depend on the measures of exposure and outcome, the prevalence of the exposure and outcome, and the age at which the assessment is completed. The age of assessment determines the number of children retained in the study for analysis. For this discussion, higher levels of exposure are assumed to contribute to higher levels of the outcome. The calculations assume a target of 80 percent power using a two-sided 95 percent confidence interval and an intraclass correlation based on the NCS sample design.

The following table shows the minimum odds ratio that can be reliably detected as a function of assumptions about the prevalence of the outcome, exposure, and age of assessment.

Prevalence of the outcome	Prevalence of the exposure	Age of assessment	Minimum odds ratio that can be reliably detected
50%	50%	5	1.06
5%	50%	5	1.15
50%	5%	5	1.15
5%	5%	5	1.35
50%	1%	5	1.36
5%	1%	5	1.81
50%	50%	20	1.07
5%	50%	20	1.16
50%	5%	20	1.16
5%	5%	20	1.38
50%	1%	20	1.40
5%	1%	20	1.88

8. Other Design Issues

- Ethical/burden considerations:** Family privacy must be protected for the collection of sensitive information on family climate. Nonetheless, detected instances of child abuse and/or neglect must be reported to authorities. Regarding burden, because this study will combine comprehensive measurement of both health and family dynamics, the burden on families must be considered in setting limits to the scope of measurement.

9. References

- Arborna, C., Jackson, R.H., McCoy, A., & Blakely, C. (1999). Ethnic identity as a predictor of attitudes of adolescents toward fighting. *Journal of Early Adolescence, 19*(3), 323-340.
- Bauman, L., Silver, E., & Stein, R. (2006). Cumulative social disadvantage and child health. *Pediatrics, 117*, 1321-1328.
- Belgrave, F.Z., Van Oss Marin, B., & Chambers, D.B. (2000). Culture, contextual, and intrapersonal predictors of risky sexual attitudes among urban African American girls in early adolescence. *Cultural Diversity and Ethnic Minority Psychology, 6*(3), 309-322.
- Bradley, R.H., & Corwyn, R.F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*(1), 371-399.
- Brooks-Gunn, J., & Chase-Lansdale, P.L. (1995). *Adolescent parenthood*. In M.H. Bornstein (Ed.), *Handbook of Parenting, Vol. 3. Status and social conditions of parenting* (Vol. 3, pp. 113-149). Mahwah, NJ: Lawrence Erlbaum Associates.
- Case, A., & Paxson, C. (2002). Parental behavior and child health. *Health Affairs, 21* (2).
- Charles, K., & Hurst, E. (2003). The correlation of wealth across generations. *Journal of Political Economy, 111*, 1155-1182.

- Conley, D. (2001). Decomposing the black-white wealth gap: The role of parental resources, inheritance, and investment dynamics. *Sociological Inquiry*, *71*, 39-66.
- Coyne, J.C., & Downey, G. (1991). *Social factors and psychopathology: Stress, social support, and coping processes*. In M.R. Rosenzweig & L.W. Porter, (Eds). (1991). Annual review of psychology, Vol. 42. (pp. 401-425). Palo Alto, CA: Annual Reviews.
- Crouter, A.C., & Head, M.R. (2002). Parental monitoring: What are we really measuring and what does it mean? In M.H. Bornstein (Ed.) *The handbook of parenting*. Mahwah, NJ: Erlbaum.
- Darling, N., & Steinberg, L. (1993). Parenting style as context: An integrative model. *Psychological Bulletin*, *113*, 487-496.
- Demo, D., & Cox, M. (2000). Families with young children: A Review of the research in the 1990s. *Journal of Marriage and the Family*, *62*, 876-895.
- Duncan, G., & Brooks-Gunn, J. (1997). *Consequences of growing up poor*. New York: Russell Sage Foundation.
- Feldman, P.J., Dunkel-Schetter, C., Sandman, C.A., & Wadhwa, P.D. (2000). Maternal social support predicts birth weight and fetal growth in human pregnancy. *Psychosomatic Medicine*, *62*, 715-725.
- Fields, J. (2001). Current Population Reports: Living Arrangements of Children. U.S. Census Bureau, issued April 2001. Website, <http://www.census.gov/prod/2001pubs/p70-74.pdf>.
- Fulgini, A.J., Tseng, V., & Lam, M. (1999). Attitudes toward family obligations among American adolescents from Asian, Latin American, and European backgrounds. *Child Development*, *70*, 1030-1044.
- García Coll, C., & Patcher, L.M. (2002). Ethnic and minority parenting (pp. 1-20). In M.H. Bornstein (Ed.). *Handbook of Parenting*, 2nd ed., Mahwah, NJ: Lawrence Erlbaum Associates.
- Ge, X., Conger, R.D., Lorenz, F.O., & Simons, R.L. (1994). Parents' stressful life events and adolescent depressed mood. *Journal of Health and Social Behavior*, *35*(1), 28-44.
- Hamm, J.V. (2000). Do birds of a feather flock together? The variable bases for African American, Asian American, and European American adolescents' selection of similar friends. *Developmental Psychology*, *36*(2), 209-219.
- Hayward, M.D., & Gorman, B.K. (2004). The long arm of childhood: The influence of early-life social conditions on men's mortality. *Demography*, *41*, 87-107.
- Hill, M., Yeung, W., & Duncan, G. (2001). Childhood family structure and young adult behaviors. *Journal of Population Economics*, *14*, 271-299.
- Hughes, D., & Chen, L. (1997). When and what parents tell children about race: An examination of race-related socialization among African American families. *Applied Developmental Science*, *1*(4), 200-214.
- Jones, D.J., Zalot, A., Chester, C., Foster, S., & Sterrett, E. (in press). Childrearing in African American single mother families: A coparenting framework. *Journal of Child and Family Studies*.

- Lareau, A. (2003). *Unequal childhoods: Class, race, and family life*. Berkeley, CA: University of California Press.
- Marsiglia, F.F., Kulis, S., & Hecht, M.L. (2001). Ethnic labels and ethnic identity as predictors of drug use among middle school students in the southwest. *Journal of Research on Adolescence, 11*(1), 21-48.
- McLoyd, V.C., Cauce, A.M., Takeuchi, D., & Wilson, L. (2000). Marital processes and parental socialization in families of color: A decade review of research. *Journal of Marriage and the Family, 62*(4), 1070-1093.
- Mowbray, C., Schwartz, S., Bybee, D., Spang, J., Rueda-Riedle, A., & Oyserman, D. (2000). Mothers with a mental illness: Stressors and resources for parenting and living. *Families in Society, 81*(2), 118-129.
- National Research Council. (1993). *Understanding child abuse and neglect. Panel on research on child abuse and neglect*. Washington, D.C.: National Academies Press.
- National Research Council. (1998). *From generation to generation: The health and well-being of children in immigrant families*. Washington, DC: National Academies Press.
- O'Connor, T., Thorpe, K., Dunn, J., & Golding, J. (1999). Parental divorce and adjustment in adulthood: Findings from a community sample. *Journal of Child Psychology and Psychiatry, 40* (5), 777-789.
- Oyserman, D., Mowbray, C.T., Meares, P.A., & Firminger, K.B. (2000). Parenting among mothers with a serious mental illness. *American Journal of Orthopsychiatry, 70*(3), 296-315.
- Parke, R.D., & Buriel, R. (1998). Socialization in the family: Ethnic and ecological perspectives. In W. Damon (Ed.), *Handbook of child psychology* (pp. 463-552). New York, NY: Wiley.
- Repetti, R.L., Taylor, S.E., & Seeman, T.E. (2002). Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin, 128*(2), 330-366.
- Scheier, L.M., Botvin, G.J., Diaz, T., & Ifill-Williams, M. (1997). Ethnic identity as a moderator of psychosocial risk and adolescent alcohol and marijuana use: Concurrent and longitudinal analyses. *Journal of Child and Adolescent Substance Abuse, 6*(1), 21-47.
- Sellers, R.M., & Shelton, J.N. (In press). Racial identity, discrimination, and mental health among African Americans. *Journal of Personality and Social Psychology*.
- Smith, E.P., Walker, K., Fields, L., Brookins, C.C., & Seay, R.C. (1999). Ethnic identity and its relationship to self-esteem, perceived efficacy and prosocial attitudes in early adolescence. *Journal of Adolescence, 22*(6), 867-880.
- Spencer, M.B. (1983). Children's cultural values and parental child rearing strategies. *Developmental Review, 3*(4), 351-370.
- Stattin, H., & Kerr, M. (2000). Parental monitoring: A reinterpretation. *Child Development, 71*, 1070-1083.

- U.S. Census Bureau. (2005). 2005 American Community Survey. Retrieved May 15, 2007, from <http://www.factfinder.census.gov>
- U.S. Department of Health and Human Services, Administration on Children, Youth and Families. (2006). Child Maltreatment 2004. Washington, DC: U.S. Government Printing Office.
- Williams, D.R., Spencer, M.S., & Jackson, J.S. (1999). Race, stress, and physical health: The role of group identity. In R. J. Contrada (ed.), *Self, social identity and physical health: Interdisciplinary explorations* (pp. 71 –100), New York: Oxford University Press.
- Witherspoon, K.M., Speight, S.L., & Thomas, A.J. (1997). Racial identity attitudes, school achievement, and academic self-efficacy among African American high school students. *Journal of Black Psychology*, 23(4), 344-357.
- Wright, R., Rodriguez, M., & Cohen, S. (1998). Review of psychosocial stress and asthma: An integrated biopsychosocial approach. *Thorax*, 1066-1074.
- Wu, L.L., Bumpuss, L., & Musick, K. (2001). Historical and life course trajectories of nonmarital childbearing. In L.L. Wu and B. Wolfe (Eds.), *Out of wedlock: Causes and consequences of nonmarital fertility* (pp. 3-48). New York: Russell Sage Foundation.

IMPACT OF NEIGHBORHOOD AND COMMUNITIES ON CHILD HEALTH

1. Meta Hypothesis

Neighborhood and community influences are associated with both protective and risk factors within the social, physical, psychological, and environmental domains. These factors impact child development and physical and mental health status and outcomes across an individual's life course.

2. Specific Hypotheses

Neighborhood factors (both positive and negative) can impact child health and development in a variety of ways. Lower income, low-resource communities are characterized by a number of risk factors, such as crime and violence; more pollutants and other toxicants; and weaker or less stable social service, education and health care infrastructures. Higher income, high-resource communities are characterized by factors and infrastructures that support child health and development. The following are examples of specific hypotheses regarding neighborhoods and communities that guide the National Children's Study (NCS):

1. Neighborhoods characterized by lack of social cohesion and efficacy, inadequate social services, and higher levels of social isolation will increase maternal stress levels and impact pregnancy outcomes.
2. Residing within high stress, low resource environments impacts a child's own levels of stress and depression and increases the incidence of conduct disorders within children.
3. Neighborhoods with high levels of environmental pollutants (e.g., lead, mold, endotoxins) within housing and other physical structures will negatively impact cognitive development as well as contribute to the onset of childhood asthma.
4. Neighborhood safety problems related to physical dilapidation and interpersonal violence increase the incidence of intentional and unintentional injury and death. Greater exposure to interpersonal violence is associated with higher levels of aggression and other conduct disorders in children.
5. Neighborhoods with limited access to recreational activities contribute to an early onset of obesity-related chronic conditions including hypertension, heart disease, and diabetes.
6. Neighborhoods characterized by poor social infrastructures, (e.g., inadequate schools, health care and social services) impact family cohesion and stability and complicate the management of health problems such as asthma and diabetes.
7. Children of non-English speaking immigrant families living in linguistically isolated neighborhoods have poorer language and literacy skills and lower academic achievement.
8. Children who live in neighborhoods with higher exposure and easier access to alcohol and illicit drugs will be more likely to develop substance abuse problems and engage in delinquent activities.

3. Background and Justification

Health outcomes for children vary across geographic areas, from smaller micro environments such as local neighborhoods to broader, more macro ones, such as urban, suburban, and rural communities. These patterns of variation are due only in part to the characteristics of the individuals and families who live in these areas; they can also be attributable to systematic differences within different “community” environments.

Neighborhoods and larger communities vary in their structure. Structural characteristics of communities include characteristics of the built environment (e.g., density, housing quality and age, the distribution of parks and recreational facilities, and neighborhood walkability), hazards (e.g., noise, traffic, and crime), and residential stability and demographics (e.g., age, class, gender, racial, ethnic composition).

Neighborhoods and communities also vary substantially in the economic and social resources available to their residents. The economic resources of communities include employment rates and stability; business presence within the community; housing value and property tax; residential mobility; the stability, quality and accessibility of core community infrastructures including schools, public services, religious institutions, community associations and volunteers, and the location and accessibility to grocery stores. Scarce resources produce competition between residents which decreases the level of social cohesion and support and increases the level of relative deprivation within families. The quality of schools is correlated with the economic resources within neighborhoods and communities. These resources affect child health and welfare.

Community social processes that impact families and children include social cohesion and isolation, social organization and infrastructure, social norms, and collective efficacy and social capital. The levels of informal and formal social control impact crime and injury rates and drug and alcohol use and abuse. Socialization, both within the family and larger community structure, impacts how socially acceptable attitudes and behaviors and informal methods of social control are transmitted. Neighborhoods with familial stability allow for the family unit to operate as a moderating variable between neighborhood and community instability (e.g., increased crime and decreased social control). Community structure, resources, and processes are interrelated. How they affect child development and health in relationship with other determinants (e.g., biomedical) are important to uncover.

3.1 Public Health Importance

Prevalence/incidence

Examples of variations in children’s health outcomes across geographic areas include:

- Among the 50 largest cities in the United States in 1991, infant mortality rates ranged from 5.3 per 1,000 births in Miami to 21.0 per 1,000 in Washington, DC, and the percent of births to mothers who received late or no prenatal care in 1994 ranged from 2 percent in Honolulu to 15 percent in Washington, DC (Annie E. Casey Foundation, 1997).
- A study of women living in central North Carolina found that residing in a wealthier census tract was associated with a 40 percent reduction in the risk of preterm birth for Black women (Kaufman, Dole, Savitz, & Herring, 2003).

- Asthma mortality and hospitalization vary significantly among large cities and among neighborhoods within cities. Within cities, asthma death rates are highest in areas with higher concentrations of poor people and minority residents (particularly African Americans) (Lang & Polansky, 1994; Carr, Zeitel, & Weiss, 1992). In Rochester, MN, the relative risks of developing asthma is 60 percent higher among children living close to major highway intersections or railroads (Juhn et al., 2005). Asthma prevalence is low among Mexican American children in the Southwest and high among Puerto Rican children in the East (National Academy of Sciences Institute of Medicine, 2000).
- In a study of community characteristics and blood lead levels in 20,296 children in Monroe County, NY, the overwhelming majority of those with elevated blood lead levels lived in the city. Other community-level variables associated with increased risk of elevated blood lead levels included: lower housing value, older age of housing, higher population density, higher rates of poverty, lower percent of high school graduates, and lower rates of owner-occupied housing (Lanphear, Byrd, Auinger, & Schaffer, 1998).
- Among a national sample of adolescents, those living in rural working class neighborhoods were almost 40 percent more likely to be overweight, and those living in exurban and mixed race urban neighborhoods were about 30 percent more likely to be overweight than those living in newer suburbs (Nelson, Gordon-Larsen, Song, & Popkin, 2006).
- Data from the Project of Human Development in Chicago Neighborhoods indicate that living in an unsafe neighborhood increased aggression in girls ages 9-13 (Molnar, Browne, Cerda, & Buka, 2005). Data from this study also showed that neighborhoods with high social capital had lower aggregate death rates for total mortality and a lower death rate due to heart disease for white men and women and, to a lesser extent, Black men and women (Lochner, Kawachi, Brennan, & Buka, 2003).

Economic and/or social burden

As illustrated above, a large number of child health and developmental outcomes have been associated with neighborhood or other measures of geographic location. The economic and/or social costs of an unhealthy environment depend on the specific health or developmental outcomes being examined as well as the combination of different risk and protective factors within these environments. The potential for improving child outcomes through interventions and other change strategies at the neighborhood and/or community level is large. Because such strategies can produce effects in multiple domains and many individuals, the public health impact can be far greater than individual-level efforts. For example, strategies to strengthen collective efficacy among local parents have the potential to empower them to request core social services and develop mechanisms of informal social control to reduce aggression and risk-taking behaviors, thus improving mental health among children. By building social capital, families may increase their ability to strengthen efforts to increase neighborhood safety, reducing rates of injury, victimization, and other adverse environmental exposures. Improving neighborhood housing conditions and quality can reduce exposure to multiple environmental hazards such as toxicants, resulting in reduced levels of asthma, injury, and lead poisoning. Improved housing also has the potential to reduce levels of neighborhood instability and crime, which in turn lead to a host of social protective factors such as those linked to positive child development.

3.2 Justification for a Large Prospective Longitudinal Study

Answering questions about the impacts of neighborhoods and communities on child health requires a multidisciplinary approach to theory and measurement, and a large, clustered probability sample that is representative of the diverse social, behavioral, and physical environmental characteristics that influence child development. This broad variability and diversity is necessary if we are to investigate the complex mechanisms through which neighborhoods influence child health and well-being. These mechanisms must be tracked longitudinally through multiple stages of child development. The vast majority of existing studies addressing neighborhood effects are cross-sectional, making it impossible to detect effects that occur later in time and the effects of neighborhood change and individual mobility on health. A prospective approach is also needed to detect potential developmental time frames during which neighborhood conditions may be especially important.

3.3 Scientific Merit

Considerable research has been conducted on the effects of neighborhoods on child and adolescent developmental outcomes. Much of this research has been focused on early childhood and adolescence, with a greater focus on developmental and behavioral outcomes than on health outcomes (Leventhal & Brooks-Gunn, 2000; Sampson, Morenoff, & Gannon-Rowley, 2002). In recent years, research on neighborhood effects related to health has expanded dramatically, with particular attention to child health outcomes including pregnancy and birth outcomes (Kaufman et al., 2003; Nelson et al., 2006) physical activity and overweight (Nelson et al., 2006), asthma (Wright, 2006), mental health (Truong & Ma, 2006), and risk behaviors (Cubbin et al., 2005).

The expanding literature on neighborhood effects cannot be fully addressed here. Three recent reviews (Burton & Jarrett, 2000; Leventhal & Brooks-Gunn, 2000; 2003) summarize the literature on the effects of neighborhood characteristics on developmental, health, and behavioral outcomes. Neighborhood socioeconomic status (e.g., measured in terms of income, unemployment, and percent of managerial and professional workers) has positive effects on school readiness, IQ, and achievement in early childhood and adolescence and on overall educational attainment. In addition, these neighborhoods have better school resources, more after-school activities, and better educated faculty. Low-socioeconomic status neighborhoods have also been associated with externalizing (acting-out and aggressive) behaviors and, less consistently, with internalizing (depressive and withdrawn) behaviors, as well as with teen sexual activity and childbearing (Leventhal & Brooks-Gunn, 2000). The effects of racial and ethnic diversity on behavior problems appear to vary depending on the race of the child and the socioeconomic status of the neighborhood. Neighborhood residential instability (or turnover in the neighborhood's population) has been linked to higher rates of behavioral problems such as delinquency and crime, but one study found higher rates of alcohol use in more stable neighborhoods (Leventhal & Brooks-Gunn, 2000).

Many studies find that neighborhood effects are complex, often influencing some groups but not others or influencing the relationships between other determinants and health outcomes. For example, research by O'Campo and her associates (1997) suggests that receiving prenatal care has less influence on birth weight among women living in high-risk neighborhoods than women living in low-risk neighborhoods. One study (Simons et al, 1996) linked community disadvantage to psychological distress and conduct disorders in boys but not girls, while another (Kupersmidt et al., 1995) found that higher neighborhood socioeconomic status acted to reduce levels of childhood aggression among children from single-parent families.

Research on neighborhood effects on obesity has increased rapidly in recent years. While many studies have pointed to the importance of the built environment (e.g., Gordon-Larsen et al., 2006), others suggest it is not just the built environment but also the interactions among land use, infrastructure, and social factors that create obesigenic environments (Lopez & Hynes, 2006; Boehmer et al., 2006; McNeil et al., 2006). Sallis and Glanz (2006) point out, however, that definitive evidence showing causal linkages between environmental factors and obesity remains elusive.

Theoretical models for linking individual behaviors to neighborhood effects have been proposed by several scientists. Jencks and Mayer (1990) propose five alternative mechanisms: (1) neighborhood institutional resources, (i.e., the availability of financial, social, and organizational resources that affect the ways in which a young person enters adulthood); (2) collective socialization, (i.e., the transmission of attitudes and behaviors through role models, supervision, and monitoring and other aspects of community social organization); (3) social contagion, (i.e., the spread of norms, values, and behaviors among residents of neighborhoods); (4) competition among neighborhood residents for scarce community resources; and (5) relative deprivation, (i.e., individuals' and families' assessment of their own well-being compared to the average economic level of the neighborhood). Leventhal and Brooks-Gunn (2000) suggest three complementary mechanisms: (1) availability of institutional resources (learning, health, recreation, etc.); (2) the mediating effects of parental relationships and support networks; and (3) the influence of community formal and informal institutions and norms that serve to guide and monitor behaviors.

In studies of child health and developmental outcomes, the role of the family in mediating and moderating neighborhood influences is crucial (Burton & Jarrett, 2000). Areas with few job opportunities would be expected to influence child outcomes through the effect of job scarcity on parental income, work, and stress. Also, areas that are high in crime may have differing effects on child outcomes depending on the parenting strategies parents adopt in relation to this environmental threat. Children may be affected minimally if they are closely supervised, but strongly if they are not.

Research on the mechanisms responsible for observed neighborhood effects is still in its infancy (Leventhal & Brooks-Gunn, 2000). The Project on Human Development in Chicago Neighborhoods has provided evidence that high levels of collective efficacy, defined as the extent to which neighborhood residents feel empowered to act together toward a common goal, can reduce rates of violent crime within neighborhoods (Sampson, Raudenbush, & Earls, 1997). Many other studies have similarly explored specific effects related to neighborhood resources, structure, and process. However, the research base is still too limited to determine which pathways are most important.

3.4 Potential for Innovative Research

By following children from birth to adulthood, the NCS offers an unprecedented opportunity not only for studying how differences in neighborhood and community factors impact both child development and individual and community health and well-being, but for examining how changes in these factors (whether from transformed communities or through mobility) can affect a child's outcome trajectory over time. These effects can be identified within context and across time, which is fundamental to understanding how influences on child development related to social, psychological, and biomedical factors vary throughout the developmental trajectory. Integrating these domains into one study will allow for a comprehensive understanding for how child development and health status are impacted within real-life settings.

3.5 Feasibility

The research design and study protocol for the NCS offer a variety of both quantitative and qualitative methodologies and instruments for obtaining the necessary data to measure the multiple dimensions of neighborhood and community. Many of these measurements will pose little inconvenience to the study subjects because much of the data can be collected independent of the study subjects. For instance, household location in relationship to crime and injury rates; population density; community infrastructure (including churches, schools, and grocery stores); drug and alcohol “hot spots” and many other characteristics can be captured using global positioning system (GPS) technology. Data available from the Census and the American Community Survey provide information on population characteristics, road networks and transportation grids kept by transportation departments, the locations of schools, commercial establishments and recreational facilities typically maintained by local planning boards, land-use patterns developed from remote imagery, and administrative data on local crime rates and enforcement. The linkage of these coordinates with other data is cost-effective and provides a dynamic multi-factor “map” to characterize local neighborhoods and larger communities. Once the links have been made, it is possible to measure neighborhood characteristics using several different operationalizations of “neighborhood” or “community.” It will even be feasible to embed the smaller neighborhoods or communities into larger ones to understand how these smaller contexts are, in turn, influenced by the larger contexts. It will be important to record GPS household location each time the child moves in order to update the change in context as the child develops and passes through developmental milestones from infancy to adulthood. There are other measures, such as ethnographic observation and neighborhood canvassing, within the protocol that will also be of little inconvenience to the study subjects or residents of the targeted neighborhoods and communities. In addition, there are instruments within the protocol that will assess social and collective efficacy; social isolation and social capital; stability of and access to community infrastructure; and formal and informal social control.

4. Exposure Measures

4.1 Individuals Targeted for Measurement

Primary/familial

- Neighborhood and community characteristics, including:
 - Structure (e.g., age, racial and ethnic composition, population density, housing stocks/quality, and health status of population)
 - Resources (e.g., income, quality of community organizations such as schools, recreational facilities, commercial outlets, public services, religious organizations, and employment opportunities)
 - Processes (e.g., social interaction, crime levels and law enforcement, and political activity)
 - Family’s perceptions of the community and neighborhood; residence history (neighborhood cohesion, collective efficacy)
 - Physical observations of neighborhood condition (e.g., Superfund/hazardous waste sites, dilapidation), recreational facilities, sidewalks, public facilities (e.g., libraries), stores, etc.

4.2 Methods

Primary/familial

- Household surveys
- Direct observation
- Existing state and local databases (e.g., Census Bureau data)
- In-depth local studies or ethnographies (adjunct studies)

4.3 Life stage

- Familial: Prenatal and at moderate intervals (every two to three years) during childhood and adolescence

5. Outcome Measures

5.1 Outcomes Targeted for Measurement in Child

- This hypothesis relates area of residence (neighborhood and community characteristics) to multiple health outcomes. For specific information on measurement issues, see hypotheses associated with:
 - Pregnancy and birth outcomes
 - Weight throughout childhood
 - Asthma incidence
 - Blood lead levels
 - Cognitive (executive function, IQ, etc.) and behavioral outcomes
 - Injury
 - Obesity and physical development

5.2 Methods

- Anthropometry
- Blood sample
- Direct testing/observation of child: Neuropsychological, cognitive, and behavioral tests; autism screening and diagnostic tests
- Injuries: Questionnaire/interview of parents, medical record review

- Asthma:
 - Examination, interview, and testing by medical professional (e.g., history of asthma symptoms, lung function tests, skin prick test, exhaled breath for NO, etc).
 - Medical record review
 - Cord and blood samples

5.3 Life Stage

- Anthropometry: Birth through age 21
- Blood sample: Birth (cord blood), periodically through age 21
- Direct testing/observation: Dependent on testing to be done; periodically through age 21
- Injuries: Periodically through age 21
- Asthma: Periodically through age 21

6. Important Confounders, Mediators, and Effect Modifiers

To differentiate the effects of neighborhoods from those of other exposures, analyses will need to adjust for confounders. Each health outcome is associated with an independent and unique set of covariates and confounders, although some overlap in individual factors, such as components of socioeconomic status, may occur. For example, analyses of the influence of neighborhood indoor and outdoor air pollution on asthma incidence and prevalence should be adjusted for exposures related to child care location if not in the neighborhood, and for genotype. The influence of neighborhood factors (e.g. educational infrastructure) on cognitive performance must be adjusted for parental education and IQ, socioeconomic status, and parenting practices. The influence of neighborhood on unintentional injury should be adjusted for type of child care arrangements as well as parenting practices. It is also important that the influence of neighborhood recreational facilities on individual obesity be adjusted for nutrient and caloric intake as well as genotype. The influence of neighborhood language isolation on language development and school readiness should control for parental and child IQ, socioeconomic status, language spoken by the child care provider, and whether or not the child attended pre-school.

7. Power and Sample Size

Given an exposure measure such as presence of a community characteristic, for example, parks), and a categorical outcome measure, for example, obesity, the relationship between exposure and outcome can be measured using an odds ratio. Starting with the birth cohort of 100,000, the minimum odds ratio that can be reliably detected in the NCS will depend on the specific measures of exposure and outcome, the prevalence of the exposure and outcome, and the age at which the assessment is completed. The age of assessment determines the number of children retained in the study for analysis. For this discussion, higher levels of exposure are assumed to contribute to higher levels of the outcome. The calculations assume a target of 80 percent power using a two-sided 95 percent confidence interval and an intraclass correlation based on the NCS sample design. The intraclass correlation for neighborhood effects is assumed to be 0.33 and the intraclass correlation for outcome is assumed to be 0.04.

The following table shows the minimum odds-ratio that can be reliably detected as a function of the age of assessment and assumptions about the prevalence of the outcome and exposure. For the calculations, the assumed outcome is either the presence of asthma at age 7 (with a reported prevalence of 8.5 percent) and the presence of infant mortality as of age 1 (with a reported prevalence of about 0.7 percent). Three values for the exposure prevalence are assumed to illustrate how the minimum detectable odds ratio varies with exposure prevalence.

Assumed outcome	Prevalence of the outcome	Age of assessment	Prevalence of the exposure	Minimum odds-ratio that can be reliably detected
Asthma at age 7	8.5%	7	50%	1.27
			15%	1.37
			5%	1.63
Infant mortality	0.7%	1	50%	2.28
			15%	2.52
			5%	3.55

For continuous outcome variables, such as IQ, the power can be measured by the difference in the mean IQ between the exposed and unexposed groups. This difference depends on the standard deviation of the observations in each group. The following table shows the minimum exposure-related difference in the mean IQ that can be reliably detected for exposures with prevalence of 5 percent, 15 percent, and 50 percent.

Assumed outcome	Standard deviation of the outcome	Age of assessment	Prevalence of the exposure	Minimum difference in the mean that can be reliably detected
IQ	15	18	50%	1.01
			15%	1.41
			5%	2.32

8. Other Design Issues

- **Ethical/burden considerations:** Data on neighborhoods and communities need to be handled carefully to reduce the risk of identifying specific participants.
- **Cost/complexity of data collection:** Neighborhood-level data needs to be collected using existing resources (e.g., Census Bureau data, other extant databases) and possibly new data collections. The study will need this data for neighborhoods in which participants originally live and those into which study participants move over time. Measures for various types and sizes of geographic unit will likely be required (e.g., states, metropolitan areas, school districts, census block groups). Measuring the social environment may also involve the collection and integration of information on the local areas in which participants live; community surveys of values, attitudes, and social processes; and observational studies of schools, religious organizations, and day care centers.

9. References

- Annie E. Casey Foundation. (1997). *City Kids Count: Data on the Well-Being of Children in Large Cities*. Baltimore, MD: Annie E. Casey Foundation.
- Boehmer, T., Lovegreen, S., Haire-Joshu, D., & Brownson, R. (2006). What constitutes an obesogenic environment in rural communities? *American Journal of Health Promotion, 20*, 411-421.
- Burton, L.M., & Jarrett, R. (2000). In the mix, yet on the margins: The place of families in urban neighborhood and child development research. *Journal of Marriage & the Family, 62*(4), 1114-1135.
- Carr, W., Zeitel, L., & Weiss, K. (1992). Variations in Asthma Hospitalizations and Deaths in New York City. *American Journal of Public Health, 82*(1), 59-65.
- Cubbin, C., Santelli, J., Brindis, C.D., & Braveman, P. (2005). Neighborhood context and sexual behaviors among adolescents: Findings from the national longitudinal study of adolescent health. *Perspectives on Sexual and Reproductive Health, 37*, 125-134.
- Eberhardt, M.S., Ingram, D.D., Makuc, D.M., Pamuc, E.R., Freid, V.M., Harper, S.B., et al. (2001). *Health United States, 2001 Urban and Rural Health Chartbook*. Hyattsville, MD: National Center for Health Statistics.
- Gordon-Larsen, P., Nelson, M., Page, P., & Popkin, B. (2006). Inequality in the built environment underlies key health disparities in physical activity and obesity. *Pediatrics, 117*, 417-424.
- Grunbaum, J., Kann, L., Kinchen, S.A., Williams, B., Ross, J.G., & Lowry, R. (2002). Youth Risk Behavior Surveillance—United States, 2001. *Morbidity & Mortality Weekly Report, 51*(Surveillance Summaries 4), 1-64.
- Jencks, C., & Mayer, S. (1990). The social consequences of growing up in a poor neighborhood. In L.E. Lynn & M.F.H. McGeary, (Eds.). *Inner-city Poverty in the United States* (pp. 111-186). Washington, DC: National Academies Press.
- Juhn, Y.J., Sauver, J.S., Katusic, S., Vargas, D., Weaver, A., & Yunginger, J. (2005). The influence of neighborhood environment on the incidence of childhood asthma: A multilevel approach. *Social Science & Medicine, 60*(11), 2453-2464.
- Kaufman, J.S., Dole, N., Savitz, D.A., & Herring, A.H. (2003). Modeling community-level effects on preterm birth. *Annals of Epidemiology, 13*(5), 377-84.
- Kupersmidt, J.B., Griesler, P.C., Derosier, M.E., Patterson, C.J., & Davis, P.W. (1995). Childhood aggression and peer relations in the context of family and neighborhood factors. *Child Development, 66*(2), 360-375.
- Lang, D.M., & Polansky, M. (1994). Patterns of asthma mortality in Philadelphia from 1969 to 1991. *New England Journal of Medicine, 331*(23), 1542-1546.
- Lanphear, B.P., Byrd, R.S., Auinger, P., & Schaffer, S.J. (1998). Community characteristics associated with elevated blood lead levels in children. *Pediatrics, 101*(2), 264-271.

- Leventhal, T., & Brooks-Gunn, J. (2000). The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. *Psychological Bulletin*, 126(2), 309-337.
- Leventhal, T., & Brooks-Gunn, J. (2003). Children and youth in neighborhood contexts. *Current Directions in Psychological Science*, 12, 27-31.
- Lochner, K.A., Kawachi, I., Brennan, R.T., & Buka, S.L. (2003). Social Capital and neighborhood mortality rates in Chicago. *Social Science & Medicine*, 56(8), 1797-1805.
- Lopez, R.P., & Hynes, H.P. (2006). Obesity, physical activity, and the urban environment: public health research needs. *Environmental Health: A Global Access Science Source*, 5, 25-35.
- McNeill, L.H., Wyrwich, K.W., Brownson, R.C., Clark, E.M., & Kreuter, M.W. (2006). Individual, social environmental, and physical environmental influences on physical activity among black and white adults: A structural equation analysis. *Annals of Behavioral Medicine*, 31, 36-44.
- Molnar, B.E., Browne, A., Cerda, M., & Buka, S.L. (2005). Violent behavior by girls reporting violent victimization: A prospective study. *Archives of Pediatrics & Adolescent Medicine*, 159(8), 731-739.
- National Academy of Sciences Institute of Medicine, Division of Health Promotion and Disease Prevention. (2000). *Clearing the air: Asthma and indoor air exposures*. Washington, DC: National Academies Press.
- National Institutes of Health, Office of Behavioral and Social Sciences Research. (2001). *Toward Higher Levels of Analysis: Progress and Promise in Research on Social and Cultural Dimensions of Health*, June 27-28, 2000 [NIH Publication No. 01-5020]. Bethesda, MD: National Institutes of Health.
- Nelson, M.C., Gordon-Larsen, P., Song, Y., & Popkin, B.M. (2006). Built and social environments: Associations with adolescent overweight and activity. *American Journal of Preventive Medicine*, 31(2), 109-117.
- O'Campo, P., Xue, X., Wang, M.C., & Caughy, M. (1997). Neighborhood risk factors for low birthweight in Baltimore: A multilevel analysis. *American Journal of Public Health*, 87(7), 1113-1118.
- Sallis, J., & Glanz, K. (2006). The role of built environments in physical activity, eating, and obesity in childhood. *The Future of Children*, 16, 89-108.
- Sampson, R.J., & Raudenbush, S.W. (1999). Systematic social observation of public spaces: A new look at disorder in urban neighborhoods. *American Journal of Sociology*, 105(3), 603-651.
- Sampson, R.J., Morenoff, J.D., & Gannon-Rowley, T. (2002). Assessing "Neighborhood Effects:" Social Processes and New Directions in Research. *Annual Review of Sociology*, 28, 443-478.
- Sampson, R.J., Raudenbush, S.W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, 277(5328), 918-924.

- Simons, R.L., Johnson, C., Beaman, J., Conger, R.D., & Whitbeck, L.B. (1996). Parents and peer group as mediators of the effect of community structure on adolescent problem behavior. *American Journal of Community Psychology*, 24(1), 145-171.
- Singer, B., & Ryff, C., (Eds.). (2001). *New Horizons in Health: An Integrative Approach*. Washington, DC: National Academy Press.
- Truong, K., & Ma, S. (2006). A systematic review of relations between neighborhoods and mental health. *The Journal of Mental Health Policy and Economics*, 9, 137-154.
- Wright, R.J. (2006). Health effects of socially toxic neighborhoods: The violence and urban asthma paradigm. *Clinics in Chest Medicine*, 27(3), 413-421.

IMPACT OF MEDIA EXPOSURE ON CHILD HEALTH AND DEVELOPMENT

1. Meta Hypothesis

Exposure to mass and electronic media from stationary and mobile sources can have both positive and negative short- and long-term effects on children. Home- or school-based media include television, video, and interactive media such as electronic games and the Internet. Multimedia mobile devices, including cellular phones, portable digital music players, and portable computers, integrate with traditional radio, television, print, and film media. The amount, type, content, and context of media exposure from infancy through adolescence influences brain and neurological development; cognitive and social development; and risk-behavior factors related to aggression, injury, substance use, sexual health, obesity, and other aspects of physical development. Exposure to specific media content will lead to developmental trajectories along a continuum of prosocial to antisocial behavior.

2. Specific Hypotheses

1. Exposure of children to educational media content enhances the development of cognitive skills and increases academic achievement. The effect of exposure to English-language educational media content (such as “Dora the Explorer” and “Blue’s Clues”) will be maximized in the developmental period of 2-5 years old, especially when other sources of cognitive support and stimulation are minimal and when English is not the first language.
2. The context and amount of exposure to violent media content (in television, movies/videos, and interactive video games) influences the risk of desensitization (including acceptance of interpersonal violence) and aggressive behavior (including injury by a firearm). This effect will be moderated by poverty, exposure to violence in the neighborhood or home, developmental delay or brain injury, and peer group aggression. A subhypothesis is that exposure to news and other “realistic” media violence increases the propensity for children to experience chronic fear and anxiety. This effect is increased by a predisposition for anxiety that may be genetically linked, reflective of living in high-crime neighborhoods, or developed through personal experience with victimization.

3. Background and Justification

Many claims exist regarding the impact of the mass media and especially the newer, more interactive, electronic media, on the health and development of American children. Some suggest media constitute a developmental risk factor, while others point to opportunities for enhancing children’s positive development (American Academy of Pediatrics [AAP], 1999). Recent studies of early childhood exposure to media have concerned many in the public health community because America’s youngest children are increasingly immersed in an electronic culture, yet there is no clear understanding of the impact of this media exposure on child health and development (Christakis & Zimmerman, 2006). From concern for the potential deleterious effects of early media exposure on neurobehavioral development and despite the absence of much scientific evidence at this point, the AAP recommended children younger than 2 not watch television and that children 2 and older be limited to 1-2 hours of educational “screen media” a day (AAP, 1999). Pre-existing and current research that focuses on the effects of broadcast television is becoming outdated with the increasing accessibility of competing portable technologies that integrate Internet, video games, traditional and satellite radio, music videos, and digital film. Given the ubiquitous presence of media in children’s lives, it is imperative to document: (a) what aspects of contemporary media have positive and negative influences on development; (b) at what ages the media

have those effects; and (c) what individual and contextual aspects of younger children's lives put them at risk or opportunity for such developmental pathways. The outcomes for which media effects are hypothesized are central to children's health and development and to the National Children's Study priorities.

3.1 Public Health Importance

Prevalence/incidence

From infancy, American children are exposed to large amounts of media, including videos and television, computers and computer games, and printed media, although the amount and type of this exposure varies. Screen media use begins early, with 61 percent of children younger than 1 watching more than an hour a day and 90 percent of 4- to 6-year-olds watching more than two hours a day. Within this age group, daily time spent with books is considerably less than with screen media at about 40 minutes a day (Rideout, Vandewter, & Wartella, 2003). Beyond early childhood, media use generally increases in time spent, types of media used, and breadth of content. American children between the ages of 2 and 18 spend an average of five and one-half hours each day using media (often using more than one kind simultaneously) (Roberts & Foehr, 2004).

The presence in the media of many potentially noxious images has been well documented. The average child who watches about two hours of television daily will see about 10,000 violent acts per year (National Television Violence Study, 1997-98). Virtually all children experience some exposure to violent media content prior to age 10; those in the top quintile of exposure are considered most at risk of long-term effects (Lefkowitz, Eron, Walder, & Huesmann, 1977).

Studies have found that 70 percent of episodes on primetime television feature alcohol use (Christensen, Henriksen, & Roberts, 2000), and smoking is portrayed in almost all top-grossing movies (Dalton et al., 2002). The amount of sex on television has doubled since 1998, and only about 10 percent of sexual scenes in television programs popular among teens in 2005 contained a sexual precaution message (Kunkel, Eyal, Finnerty, Biely, & Donnerstein, 2005).

Studies have also linked adolescent and young adult health outcomes and behavior with music and music video preferences (Wingood et al., 2003). Music as a cause, indicator or predictor of sexual behavior (Martino et al., 2006), violence, and suicide (Martin, Clarke, & Pearce, 1993; Scheel & Westefeld, 1999) exhibits differentially in young males and females and among racial groups.

Each of these kinds of media content has been linked with corresponding negative health outcomes, including increased anxiety and fear (Cantor, 2001), aggressive behavior, physical assault and injury (Anderson et al., 2003), cigarette smoking (Sargent et al., 2005), and early initiation of sexual intercourse (Brown et al., 2006). Exposure to frequent advertising for non-nutritious foods and the time children spend using the media may also contribute to the epidemic of obesity (Institute of Medicine of the National Academies, 2006). A recent longitudinal birth cohort study conducted in New Zealand estimated that in 26-year-olds, 17 percent of overweight, 15 percent of raised serum cholesterol, and 15 percent of poor fitness could be attributed to watching television for more than two hours a day during childhood and adolescence (Hancois, Milne, & Poulton, 2004).

Because media influences are so widespread, even small effects of media on children's and adolescents' health and development can impact public health outcomes such as these:

- In 2002, 32 percent of violent crimes (including threatened and completed acts of violence) were committed by persons aged 20 or younger. Aggressive behavior can also result in unintentional injury (e.g., from motor vehicle accidents). Motor vehicle crashes are the leading cause of death for 15- to 20-year-olds; aggressive driving is implicated in two-thirds of fatal crashes (U.S. Department of Justice, 2003).
- Recent underage alcohol use was reported by 29 percent of youth aged 12 to 20 (Substance Abuse and Mental Health Services Administration, 2004).
- Obesity is a growing epidemic in America, particularly among children. About one-third of children aged 2-19 are at risk of overweight or are overweight (17 percent) (Ogden et al., 2006).
- More than one-third (34 percent) of U.S. ninth-graders and 63 percent of 12th-graders have had sexual intercourse (Centers for Disease Control and Prevention [CDC], 2006). Young people ages 15-24 acquire half of all new sexually transmitted infections (STIs) each year in the United States and most remain undiagnosed and undetected (Weinstock, Berman, & Cates, 2004). If untreated, STIs can lead to serious health consequences, such as infertility and death (Chesson, Blandford, Gift, Tao, & Irwin, 2004).

Economic and/or social burden

Many of the potential outcomes of media exposure have long-term health costs. For example, incarceration for violent crimes results in earnings loss between 10-30 percent, and decreasing wage growth over the lifecycle that is also associated with lower levels of mental and physical health and lower life expectancy (ChildTrends Data Bank, n.d.). It is estimated that teen childbearing costs taxpayers at least \$9.1 billion a year (Hoffman, 2006). The total estimated burden of the nine million new cases of STIs that occurred among 15- to 24-year-olds in 2000 was \$6.5 billion (Weinstock et al., 2004).

Preventability/malleability

The negative effects of media can be ameliorated and the positive effects enhanced primarily through education of parents and children. Media exposure is potentially malleable, especially when children are young because media are used at the discretion of parents. One intervention that encouraged parents and children to reduce the amount of time the children spent watching television and videotapes and playing videogames resulted in lower body mass index among elementary school children (Robinson, 1999). Research suggests parental mediation can reduce the negative effects of media use, but it is not clear what strategies are most effective (Vandewater, Park, Huang, & Wartella, 2005).

3.2 Justification for a Large Prospective Longitudinal Study

Much of the prior work on media effects has been cross-sectional rather than longitudinal, which makes it difficult to assess the role of media in growth and development through time. Some recent longitudinal findings have been based on samples in other countries that could be similar to the United States (Hancox, Milne, & Poulton, 2005). Although some important exceptions exist in the United States, (e.g., research on the effects of violent television viewing [Huesmann & Eron, 1986]; research on educational television viewing [Anderson, Huston, Schmitt, Linebarger, & Wright, 2001]); and the PSID

Child Development Supplement Data, CDS I and II, [<http://www.psiconline.isr.umich.edu/CDS/>]), little is known about how long-term media use affects children. Since no studies have had the capacity to study the effects of media exposures on children's health and development starting at birth, the National Children's Study could measure the effects of media exposures controlled by parents and not children. Most of the longitudinal studies relied on convenience samples, locally random samples, or some combination of the two, obviating the ability to assess prevalence and differences in impacts across population groups. The National Children's Study (NCS) will provide the opportunity to track media diets early and through time, examine how uniform these patterns are across subgroups, and assess multiple prosocial and antisocial outcomes.

3.3 Scientific Merit

The underlying conceptual model is that exposure to electronic screen media until age 2 influences attention and cognitive development negatively, and exposure after age 2 produces results dependent on type of content. Exposure to educational/prosocial content across different kinds of media predicts compliant behavior, school readiness, and school achievement. Exposure to violent/antisocial content predicts noncompliant behavior, antisocial behavior, and aggression.

Media exposure may affect children's development beginning in infancy through a number of pathways. Although studies have consistently shown book exposure is associated with positive consequences, particularly for the development of literacy, the effects of early exposure to electronic media are less clear. Some studies have indicated exposure to video at those younger than 2 is associated with attention deficit symptoms and slower cognitive development (Thakkar, Garrison, & Christakis, 2006). Current theory suggests both direct interaction of children with screen media and distractions caused by exposure to background media may affect neurodevelopment. Increasingly, television programs and videos (e.g., "Teletubbies" and "Baby Einstein") are created for children younger than 2. Although this content is promoted as educational for infants and toddlers, recent studies have indicated children younger than 2 show little to no learning from video as compared to equivalent live demonstrations (Kuhl, Tsao, & Liu, 2003). Time spent watching TV may also displace other potentially more valuable activities basic to neurodevelopment, such as active play or parental interactions.

As cognitive abilities mature, media may influence children's perception of normal and abnormal social behavior, social reality, and cultural norms. Most evidence suggests that the kind of content matters, and different media diets will lead to different outcomes. Short-term prospective studies, for example, have shown adolescents with aggressive tendencies tend to seek out violent content in action films, video games, and Internet sites, and subsequently behave more aggressively than adolescents exposed to less violent content. The bidirectional process may result in the development of antisocial behavior (Slater, Henry, Swaim, & Anderson, 2003). Some theory suggests the amount of exposure to the narrow and typically violent view of the world offered by television results in the adoption of that world view (Gerbner, Gross, Morgan, Signorielli, & Shanahan, 2002).

Much of the research on the effects of media on social behavior based on Bandura's cognitive social learning theory (Bandura, 2001) suggests children learn how to behave by watching attractive adult role models, both in real life and vicariously through the media. Desensitization theory suggests young people exposed to certain types of graphic media depictions (e.g., sex and violence) may become less reactive to these stimuli, and, in the case of violence, more indifferent to the plight of others (Molitor & Hirsch, 1994). The effects of media on social development (e.g., sharing, showing empathy, etc.) has been best demonstrated in the area of children's educational programs (Friedrich & Stein, 1973). Shows such as "Sesame Street" and "Barney" have been successful in eliciting specific types of prosocial behaviors when those behaviors were modeled in the program. We expect that the more consistently

children are exposed to prosocial content across media (e.g., television, computer/video games, Web sites), the more they will behave in prosocial rather than antisocial ways.

3.4 Potential for Innovative Research

The cohort of children and the measurement of social, psychological, and biological development makes possible the examinations of complex interactions involving multiple aspects of the child's social environment, biological predispositions, and dynamic media diets that have not been possible. The longitudinal design provides an unparalleled ability to demonstrate associations between media exposures and developmental outcomes in children. The types of media to which children are exposed are expected to continue to change throughout the Study. Most research focuses on television. Although it is expected television will continue to be a central medium in children's lives, the proliferation of new media provides a ripe area for new research. The majority of existing research is focused on school-age children and adolescents and on one outcome at a time; young children are often excluded. As discussed, even young children are now spending time with electronic media. The study provides a unique opportunity to examine the short-term and long-term effects of such early media exposure on multiple outcomes.

Prior research indicates aggressive antisocial behavior is increased by exposure to violent content and decreased by educational and prosocial content whereas academic achievement is enhanced by exposure to educational and prosocial content and diminished by violent content. A media diet rich in prosocial/educational content has been associated with increased high-school grades, greater literacy, and reduced aggressiveness during adolescence (Hoffman, 2006). Although findings of this research suggested different developmental trajectories, there is little information about whether particular subgroups or ages are more or less susceptible to media influence and to what extent antisocial behavior and academic achievement are mutually influencing (Chesson et al., 2004). It is also not clear if negative trajectories can be interrupted. Research conducted throughout the NCS has the potential to fill these gaps in understanding and may shed brighter light on how both positive and negative media exposure impacts children's development.

3.5 Feasibility

Critical periods for exposures and outcomes

The first two years of life are thought to be critical for media effects on neurodevelopment. The preschool years are key ages for cognitive development and the development of other abilities necessary for school readiness. Social development may be affected by the media throughout childhood. Engagement in risk behaviors is likely a function of media exposures throughout childhood and adolescence.

Availability of needed subgroups, settings, strategies

There are no special needs. The large sample should provide sufficient variation in exposure and outcomes.

Measurement tools

Valid and reliable measures of most exposure and outcome variables of interest exist, although some have not been tested with all age groups or do not exist in languages other than English. Types of media exposure and measurement tools will be updated as the child, new media and measurement technologies develop. Interview time is the primary burden for parents and children. The

use of new technologies for monitoring media use may be helpful in reducing that burden. Parents typically appreciate being asked about their child's media use because they are interested in the media's prosocial and antisocial effects (Rideout & Hamel, 2006), and older children and adolescents enjoy thinking about their own use of the media.

4. Exposure Measures

Exposure will be defined as time exposed to particular categories of content: educational (subdivided into primarily prosocial or academic), violent (titles that contain one or more instances of violent or antisocial behavior), and other (neither educational/prosocial or violent/antisocial) (Hoffman, 2006).

4.1 Individuals Targeted for Measurement

Primary/parental

- Audiovisual media: Frequency and content of television viewing, video games, and computer use
- Print media: Frequency of reading to child (up to age 5)

Primary/child

- Stationary audiovisual media: Frequency and content of television/movie viewing, video game and computer use at home, school, library or other neighborhood sources (age 6 and periodically through adolescence)
- Print media: Frequency of reading for pleasure and school (age 6 and periodically through adolescence)
- Use of mobile multimedia devices: Frequency and content of Podcasts, Internet, radio, games and movies (age 6 and periodically through adolescence)

4.2 Methods

Primary/parental

Interview parent attitudes toward media (prenatal, 2, 5, 7, 9, and 12 years) and parental mediation of media use (24 and 36 months, 5, 7, 9, 12, and 16 years) (Valkenburg, Krcmar, Peeters, & Marseille, 1999). Another potential measurement tool could be a family media diary, to be maintained for one weekday and weekend day. A parent will record a child's media use until the child is old enough to accurately record personal media consumption. Minutes of media use for each family member will be noted along with type of medium (text, Internet, computer game, TV program, or DVD) and for the child, the title of the media program.

Primary/child

Assessments will include interviews (after age 9), direct observation, household surveys of available media, and media-use diaries tied to analysis of content. In the sixth and later years, it is expected the child's exposure to electronic audio and audiovisual media can be automatically monitored by a pendant or bracelet device worn by the child. Several commercial entities are developing such items

to assess media exposure. The technology makes use of an inaudible signal embedded in the audio track that provides the title. The technology will automatically record the title, time, and duration of exposure. The data can then be linked to content analysis to calculate each child's exposure to prosocial and antisocial content.

4.3 Life Stage

Parent attitudes toward media and parental mediation of media use

- Primary/parental (periodically, prenatal through adolescence)

Family media diary

- Primary/child (periodically, birth through adolescence)

5. Outcome Measures

5.1 Outcomes Targeted for Measurement in Child

Although the primary outcomes will be any major antisocial behavior (as indicated by criminal record) and scholastic achievement (obtained from high school and post-high school academic records), subcategories of outcome will include aggressive behavior and language and cognitive development measured starting in preschool. Violence, sexual health, and attitude outcomes will be measured from preadolescence through early adulthood.

5.2 Outcome Methods

Measures of neurological, cognitive, social, and physical development of the child will be collected for various other study hypotheses and should include school records, medical records, and criminal records (in adulthood).

5.3 Life Stage

Periodically, birth through late adolescence and early adulthood.

6. Important Confounders, Mediators, and Effect Modifiers

A number of mediating and moderating variables will affect both media exposure and outcomes. From an ecological perspective, these include:

- Factors associated with neighborhoods/school environment such as likelihood of exposure to violence, child care, school quality
- Factors associated with the home environment such as socioeconomic status, number of adults and children present, languages spoken, exposure to domestic violence, exposure to alcohol and drug abuse
- Factors associated with the parents such as stability of marital union, parenting style, maternal depression, parental co-viewing and media discussion

- Factors associated with the child such as race/ethnicity, genetics, learning disabilities, psychological predispositions (e.g., sensation seeking, anxiety), conduct disorders, trauma and brain injuries, sleep disorders, language development, social alienation

7. Power and Sample Size

For the specific hypothesis that children from non-English speaking families regularly exposed to English-language educational programming during the preschool years will be 1.5 times more likely to be school-ready than children from non-English speaking families who are not regularly exposed to English-language educational programming, there is a .05 level of significance for a difference in odds of 1.5, (17 percent of children who are regularly exposed to English language educational programming will be school-ready relative to 12 percent of those who are not exposed to English language educational programming) with power of .90.

For the specific hypothesis that children who are in the top quintile of exposure to violent media will be 1.5 times more likely to experience a firearm injury during the period from birth to age 21 than are children who are less exposed to violent media, there is a .05 significance level for a difference in odds of 1.5 (top quintile = .008, other quintiles = .005) with a power of .90.

8. Other Design Issues

- **Cost/complexity of data collection:** A unique aspect of data collection for this hypothesis includes gathering and archiving samples of various media types including television programs, videos, and video games.
- **Cost of sample analysis:** Media content analysis (i.e., coding, categorizing, etc., the samples of videos, television programs, video games) can be costly but can be archived for future analysis using separate funds.

9. References

- American Academy of Pediatrics, Committee on Public Education. (1999). Media education. *Pediatrics*, *104*(2pt1), 341-343.
- Anderson, C.A., Berkowitz, L., Donnerstein, E., Huesmann, L.R., Johnson, J.D., Linz, D., et al. (2003). The influence of media violence on youth. *Psychological Science in the Public Interest*, *4*(3), 81-110.
- Anderson, D.R., Huston, A.C., Schmitt, K.L., Linebarger, D.L., & Wright, J.C. (2001). Early childhood television viewing and adolescent behavior: The Recontact Study. *Monographs of the Society for Research on Child Development*, *66*(1, Serial No. 264).
- Bandura, A. (2001). Social cognitive theory of mass communication. *Media Psychology*, *3*, 265-299.
- Brown, J.D., L'Engle, K.L., Pardun, C.J., Guo, G., Kenneavy, K., & Jackson, C. (2006). Sexy media matter: Exposure to sexual content in music, movies, television and magazines predicts black and white adolescents' sexual behavior. *Pediatrics*, *117*, 1018-1027.

- Cantor, J. (2001). The media and children's fears, anxieties, and perceptions of danger. In D.G. Singer & J.L. Singer (Eds.), *Handbook of children and the media* (pp. 207-222). Thousand Oaks, CA: Sage Publications.
- Centers for Disease Control and Prevention [CDC]. (2006). Youth risk behavior surveillance—United States, 2005. *Morbidity and Mortality Weekly Report*, 55(SS-5).
- Chesson, H.W., Blandford, J.M., Gift, T.L., Tao, G., & Irwin, K.L. (2004). The estimated direct medical cost of sexually transmitted diseases among American youth, 2000. *Perspectives on Sexual and Reproductive Health*, 36(1), 11-19.
- ChildTrends Data Bank. (n.d.). Young Adults in Jail or Prison. Retrieved May 11, 2007, from <http://www.childtrendsdatabank.org/indicators/89YoungAdultsJailPrison.cfm>
- Christakis, D.A., & Zimmerman, F.J. (2006). Media as a public health issue. *Archives of Pediatric and Adolescent Medicine*, 160, 445-446.
- Christensen, P.G., Henriksen, L., & Roberts, D.F. (2000). *Substance use in popular primetime television*. Washington, DC: Office of National Drug Policy.
- Collins, R.L., Elliott, M.N., Berry, S.H., Kanouse, D.E., Kunkel, D., Hunter, S.B., et al. (2004). Watching sex on television predicts adolescent initiation of sexual behavior. *Pediatrics*, 114, 280-289.
- Dalton, M.A., Tickle, J.J., Sargent, J.D., Beach, M.L., Ahrens, M.B., & Heatherton, T.F. (2002). The incidence and context of tobacco use in popular movies from 1988 to 1997. *Preventive Medicine*, 34(5), 516-523.
- Friedrich, L., & Stein, A.H. (1973). Aggressive and prosocial television programs and the natural behavior of preschool children. *Monographs of the Society for Research in Child Development*, 38 (4, Serial No. 151).
- Gerbner, G., Gross, L., Morgan, M., Signorielli, N., & Shanahan, J. (2002). Growing up with television: Cultivation processes. In J. Bryant & D. Zillmann (Eds.), *Media effects: Advances in theory and research* (2nd ed.) (pp. 43-67). Mahwah, NJ: Lawrence Erlbaum Assoc.
- Hancox, R.J., Milne, B.J., & Poulton, R. (2004). Association between child and adolescent television viewing and adult health: A longitudinal birth cohort study. *Lancet*, 364, 257-62.
- Hancox, R.J., Milne, B.J., & Poulton, R. (2005). Association of television viewing during childhood with poor educational achievement. *Archives of Pediatric and Adolescent Medicine*, 159, 614-618.
- Hoffman, S. (2006). *By the numbers: The public costs of teen childbearing*. Washington, DC: National Campaign to Prevent Teen Pregnancy.
- Huesmann, L.R., & Eron, L. (1986). *Television and the aggressive child: A cross-national comparison*. Hillsdale, NJ: Lawrence Erlbaum.
- Institute of Medicine of the National Academies, Board on Children, Youth, and Families, Food and Nutrition Board. (2006). *Food marketing to children and youth: Threat or opportunity?* Washington, DC: National Academies Press.

- Kuhl, P.K., Tsao, F.-M., & Liu, H.-M. (2003). Foreign-language experience in infancy: Effects of short-term exposure and social interaction on phonetic learning. *Proceedings of the National Academy of Sciences*, *100*(15), 9096-9101.
- Kunkel, D., Eyal, K., Finnerty, K., Biely, E., & Donnerstein, E. (2005). Sex on TV 4. Menlo Park, CA: Kaiser Family Foundation.
- Lefkowitz, M.M., Eron, L.D., Walder, L.O., & Huesmann, L.R. (1977). *Growing up to be violent: A longitudinal study of the development of aggression*. New York: Pergamon Press.
- Leigh, W. (2003). *National costs of teen pregnancy and teen pregnancy prevention*. Washington, DC: Joint Center for Political and Economic Studies.
- Martin, G., Clarke, M., & Pearce, C. (1993) Adolescent suicide: Music preference as an indicator of vulnerability. *Journal of the American Academy of Child and Adolescent Psychiatry*, *32*(3), 530-535.
- Martino, S.C., Collins, R.L., Elliot, M.N., Strachman, A., Kanouse, D.E., & Berry, S.H. (2006). Exposure to degrading versus nondegrading music lyrics and sexual behavior among youth. *Pediatrics*, *118*, 430-441.
- Molitor, F., & Hirsch, K.W. (1994). Children's toleration of real-life aggression after exposure to media violence: A replication of the Drabman and Thomas studies. *Child Study Journal*, *24*, 191-207.
- National Television Violence Study* (Vols. 1-3). (1997-1998). Thousand Oaks, CA: Sage Publications.
- Ogden, C.L., Carroll, M.D., Curtin, L.R., McDowell, M.A., Tabak, C.J., & Flegal, K.M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *Journal of the American Medical Association*, *295*(13), 1549-1555.
- Rideout, V., & Hamel, E. (2006). *The media family: Electronic media in the lives of infants, toddlers, preschoolers and their parents*. Menlo Park, CA: The Henry J. Kaiser Family Foundation.
- Rideout, V.J., Vandewter, E.A., & Wartella, E.A. (2003). Zero to six: Electronic media in the lives of infants, toddlers and preschoolers. Menlo Park, CA: Henry J. Kaiser Family Foundation.
- Roberts, D.F., & Foehr, U.G. (2004). *Kids & media in America*. Cambridge, UK: Cambridge University Press.
- Robinson, T.N. (1999). Reducing children's television viewing to prevent obesity: A randomized control trial. *Journal of the American Medical Association*, *282*, 1561-1567.
- Sargent, J.D., Beach, M.L., Adachi-Mejia, A.M., Gibson, J.J., Titus-Ernstoff, L.T., Carusi, C.P., et al. (2005). Exposure to movie smoking: Its relation to smoking initiation among U.S. adolescents. *Pediatrics*, *116*(5), 1183-1191.
- Scheel, K.R., & Westefeld, J.S. (1999) Heavy metal music and adolescent suicidality: An empirical investigation. *Adolescence*, *34*(134), 253-257

- Slater, M.D., Henry, K.L., Swaim, R.C., & Anderson, L.I. (2003). Violent media content and aggressiveness in adolescents: A downward spiral model. *Communication Research*, 30(6): 713-736.
- Substance Abuse and Mental Health Services Administration. (2004). *Results from the 2003 National Survey on Drug Use and Health: National Findings* [Electronic version] (Office of Applied Studies, NSDUH Series H-25, DHHS Publication No. SMA 04-3964). Rockville, MD.
- Thakkar, R.R., Garrison, M.M., & Christakis, D.A. (2006). A systematic review for the effects of television viewing by infants and preschoolers. *Pediatrics*, 118(5), 2025 – 2031.
- U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics. (2003). Criminal victimization in the United States, 2002 statistical tables (Publication no. NCJ200561). Retrieved May 11, 2007, from <http://www.ojp.usdoj.gov/bjs/abstract/cvusst.htm>
- U.S. Department of Transportation, National Highway Traffic Safety Administration. (2002) Traffic safety facts 2002: Young drivers (DOT Publication No. HS 809 619). Washington, DC: National Center for Statistics and Analysis.
- Valkenburg, P.M., Krmar, M., Peeters, A.L., & Marseille, N.M. (1999). Developing a scale to assess three styles of television mediation: “Instructive mediation,” “restrictive mediation,” and “social covieing.” *Journal of Broadcasting and Electronic Media*, 43(1), 52-66.
- Vandewater, E., Park, S.E., Huang, X., & Wartella, E. (2005). “No, you can’t watch that!” Parental rules and young children’s media use. *American Behavioral Scientist*, 48(5), 608-623.
- Weinstock, H., Berman, S., & Cates, W. (2004). Sexually transmitted infections in American youth: Incidence and prevalence estimates, 2000. *Perspectives on Sexual and Reproductive Health*, 36(1), 6-10.
- Wingood, G.M., DiClemente, R.J., Bernhardt, J.M., Harrington, K., Davies, S.L., Robillard, A., et al. (2003) A prospective study of exposure to rap music videos and African American female adolescents. *Health*, 93(3), 437-439.

SOCIAL INSTITUTIONS AND CHILD HEALTH AND DEVELOPMENT

1. Meta Hypothesis

Interactions between children and families and the formal child care, school, and religious institutions in their communities influence children's cognitive, social, and emotional development.

2. Specific Hypotheses

1. The physical and social environments of nonparental child care settings influence child health and cognitive and social functioning. Variations in the quality of child care affect child outcomes. Child care mediates some family influences on child outcomes.
2. Children's participation in schools affects social, emotional, and physical development. Provision of health services and of curricula targeting health promotion directly influences children's health and mental health outcomes. Child, family, and community factors interact with structural and functional aspects of schools to shape child development.
3. Family participation in religious organizations during early and middle childhood (ages 3-10) results in better emotional health and fewer health-compromising behaviors during middle adolescence (ages 14-15). These effects are stronger in female children, ethnic minority and immigrant families, in impoverished areas, and when the religious organizations provide effective mechanisms for integrating adolescents into the life of the religious community.

3. Background and Justification

Formal institutions available to children and families in a community are key contextual variables that influence children's cognitive, social, and emotional development. Although a number of institutions are influential for child health and development, child care, schools, and religious institutions are particularly influential among very broad sectors of the population. In more limited studies, these institutions all have been found to have a significant influence on children's physical and mental health outcomes.

Although there have long been avenues of inquiry addressing institutions as important contexts for development (particularly for emotional adjustment and mental health outcomes), there rarely have been opportunities to examine the interactive influence of multiple institutions or the interactions between institutions and other important developmental contexts, such as family or neighborhood.

Many of the institutions encountered by children and families are publicly supported organizations that serve large numbers of individuals. They represent settings that are potentially modifiable in ways that enhance children's development or settings where specific interventions or treatments could be delivered. Almost all children attend school for the majority of their childhood years; large numbers also are involved in preschool and child care programs. The identification of the factors within these programs that influence developmental pathways is critical to efforts to reform or reshape the organizations that serve children.

To date, there have been no population-based, prospective longitudinal studies that examine the influences of child care on children's health and development. The most comprehensive study, the NICHD Study of Early Child Care and Youth Development, followed about 1,300 children from birth through age 15 at 10 sites across the country. The participants, however, were not representative of the

current U.S. population and low income children were underrepresented. Similarly, no research of this scope has been conducted on the impact of school characteristics and family religion on children's health and development. Although the Department of Education has undertaken a number of studies on schools, none has been a longitudinal study that follows children from birth through high school, and thus none has had the capacity to look at complex interplay over time between early family and neighborhood contexts, schools, and child and adolescent outcomes. This research will permit examination of interactions between diverse family and institutional environments as predictors of children's cognitive, social, and emotional development.

3.1 Public Health Importance

Prevalence/incidence

Examples of the prevalence of exposure to child care, school, and religious institution influences and the nature of those exposures include:

- **Child care:** Estimates from the 2001 National Household Education Survey showed that 41 percent of infants younger than age 1 were in regular nonparental child care arrangements; by age 4, nearly four-fifths of all children were in child care (Mulligan, Brimhall, & West, 2005).
- **Schools:** Almost all American children attend school outside the home, and most of those children attend public school. School facilities may be a significant source of environmental hazards. The U.S. General Accounting Office (GAO) estimated in 1995 that about 60 percent of the nation's schools were in need of major repairs (GAO, 1995). Apart from the physical risks, deteriorating school buildings detract from the learning environment and require the diversion of resources from the school's instructional mission. In 2001, the American Public Health Association raised concerns about children's exposure to lead, radon, mold and moisture, asbestos, inadequate plumbing, poor lighting, and indoor air pollution in school buildings (American Public Health Association, 2001).
- **Religion:** Among adolescents aged 13-18, 87 percent are affiliated with an organized religion, 80 percent pray, and 40 percent pray daily (National Study of Youth and Religion, 2002). More than half of all American teens attend religious services at least monthly, with 38 percent attending every week (National Study of Youth and Religion, 2002). More than half are involved in religious youth groups at some point during their high school years. Both religious affiliation and practice vary significantly by region, gender, race, and urban/rural residence (National Study of Youth and Religion, 2002; Wilcox, Rostosky, Randall, & Wright, 2001).

Economic and/or social burden

There is a tremendous burden being borne by families, communities, and the nation, for detrimental social, emotional, and cognitive child outcomes, although exact impact depends on the specific outcome being examined. The annual cost of depression alone in the United States ranged between \$44 billion and \$53 billion in 1990. Adjusted for inflation, this estimate would be close to \$70 billion today (Greenberg, Leong, Birnbaum, & Robinson, 2003). The rate of depression among adolescents may be of particular concern, as some population estimates suggest that adolescent depression

has a prevalence of more than 8 percent (Birmaher et al., 1996), which is higher than the rate among adults.

Societal costs associated with juvenile aggression and delinquency are difficult to estimate but include both immediate financial costs and the long-term costs of each individual's contributions to society. By age 17, 37 percent of juveniles report that they have engaged in vandalism, 27 percent report assaulting someone with the intent to injure, and 8 percent report belonging to a gang. Less supportive family structure and a lack of engagement in school are both related to negative outcomes. However, in some situations, school may pose its own risks, with 4 percent of teens in 2003 reporting they had been injured during a fight at school (Snyder & Sickmund, 2006).

These patterns are complex, and determining both burden and avenues for intervention requires a multifaceted understanding of the influences. Nonetheless, the quantity and nature of social institutions to which children and families have access can be directly influenced by targeted policies. Because most children attend public schools, and because child care is becoming an increasingly public issue, understanding the role of social institutions in children's development is a worthwhile undertaking.

3.2 Justification for a Large Prospective Longitudinal Study

A large, longitudinal study will permit the kind of exploration of the interplay between levels of influence in a child's life that has not been possible in smaller cross-sectional studies.

Exposure to social institutions may vary considerably across families, communities, and regions. Different forms of child care may be preferred, religious involvement and affiliation varies, and schools have diverse characteristics. Individuals who have experience with particular combinations of institutions can cluster into population subgroups too small to be studied adequately in most research. Only a large, representative sample like that in the NCS can hope to document fully the range of supports and risks posed by the intersection of family and neighborhood qualities and their social institutions.

These patterns of environment-environment interaction may also be extremely complex, and the same type of institutional experience, for example, time spent in a center-based child care during infancy, might have different influences on children depending on both familial characteristics and subsequent school contexts.

To be best understood, institutional influences must be studied prospectively over time. Although institutions themselves may continue to exist over time, capturing their characteristics or an individual child's experience of the institutions retrospectively would involve fundamental methodological biases. Different institutions also become important for children at different developmental periods, such as the sequencing of early child care and subsequent school. Religious institutions may play a different role for youth as they enter adolescence than they did during childhood. In addition to these direct exposures at particular times in development, institutions may have indirect influences on later development as they are mediated through or moderated by family characteristics.

3.3 Scientific Merit

Child care: Quality of child care arrangements is consistently found to be associated with child outcomes in cognitive, social, and health domains (Deater-Deckard, Kinkerton, & Scarr, 1996; NICHD Early Child Care Research Network, 1998). In particular, the nature of the relationships and interactions between children and their caregivers is an essential aspect of quality shown to be related to developmental outcomes. In addition, structural aspects of the setting, including group size, staff-to-child ratios, and staff training are consistently shown to be associated with health and developmental outcomes,

including incidence of infectious disease, attachment, social orientation, and peer competence (Clarke-Stewart, Gruber, & Fitzgerald, 1994). The influences of child care have been demonstrated even when controlling for family-level factors that are likely to influence development (Clarke-Stewart, Gruber, & Fitzgerald, 1994). The effects, however, appear to be stronger for certain groups, such as high-risk children and low-income children. The NCS will permit an exploration of child care at a level of diversity of both the child care context and subgroup effects that has not yet explored through research.

Schools: Schools provide many direct services and offer curricula that influence physical and mental health. These include health and physical education programs, special education services, counseling and therapeutic services, and programs aimed at the prevention of risky behaviors. Moreover, structural and interactional features such as lack of strong instructional practices; class size; school climate; teacher expectations; student perceptions; promotion of cooperation or competition; involvement of parents and community members; and feelings of safety and security are among the many variables that may influence health more indirectly through cognitive and social development (Roeser & Eccles, 2000). School facilities are themselves a potentially significant source of environmental hazards, including lead, radon, mold and moisture, asbestos, inadequate plumbing, poor lighting, and chemical toxins, such as cleaning and instructional supplies (American Public Health Association, 2001). Therefore, there is a need to examine longitudinally the influences of schools and school experiences on students' health and development.

Religious institutions: Research on the determinants and consequences of children's individual involvement in religious organizations is lacking as their primary involvement with religion seems to be through engagement of the entire family, but there is a significant body of research that links adolescent health behaviors to religiosity. Focus groups have found that parents feel that church involvement of their children prevents high-risk behaviors (Sim, Jordan-Green, & Wolfman, 2005) and that churches may play an important role in promoting healthy attitudes (Smith, Faris, Denton, & Regnerus, 2003). Adolescents who regularly attend church services and say religion is important to them are more likely to use seat belts, exercise, maintain a healthy diet and sleep habits, and have positive self-esteem; and they are less likely to initiate sex at an early age, smoke, drink, and engage in delinquent behaviors (Regnerus, 2003). Religious organizations may influence parents and children via social control, social support, and values and identity (Wallace & Williams, 1997). Family participation in religious organizations and religious practice influence children's health and development indirectly through parenting, the child's social context, and the child's internalization of values, and these influences cumulate over the course of development. Further, influences are modified by gender, race, ethnicity, poverty, immigrant status, and characteristics of the religious organization (Roeser & Eccles, 2000).

3.4 Potential for Innovative Research

Bio-ecological theories of human development (Bronfenbrenner, 2005) have long posited that human development unfolds over time as a consequence of a synergistic set of contextual influences. These influences exist on multiple levels and include, but are not limited to, the individual's biological and social characteristics, family relationships, social institutions, community, and society. This theoretical view has generated substantial research over time, but few studies have been able to examine the interplay of even the first three elements of human ecology on a large scale. Because of limitations in study scope and sample size, most research has been limited to a single type of social institution (e.g., school) or even a subtype of institution (e.g., kindergarten classrooms).

There have been few opportunities for observing developmental trajectories within multiple contexts, and studies focusing on children in context often have not taken social institutions into account. Moreover, the extent to which organizations interact with one another remains largely unexplored, although there are examples from the prevention literature that suggest that systems-level interventions

may have significant impacts. There has been little prospective longitudinal research that has examined the simultaneous influences of family, child care, and schools on children's health and development, and no major study that has used a representative population. Research on the effects of family religious practices on children's health and development has been even more limited in scope, often covering individual subgroups of religion and rarely examining complex environment-environment interactions.

3.5 Feasibility

It is important to narrow the research questions and choose carefully what to measure. Measurement of institutional influences will be required at several time-points during childhood. Over the course of development, children's interactions with institutions will change and broaden, with different institutions coming into prominence during different developmental periods, and different dimensions of those institutions becoming more salient at different points in the course of childhood.

Because of the broad nature of the sample, a wide variety of child care arrangements, school settings, and religious institutions will be represented in the National Children's Study (NCS). This will permit evaluation of characteristics of many settings and many subgroups of institutions.

Assessment of child social, emotional, and cognitive outcomes will be addressed using a multi-method approach, obtaining data from parents, directly from children, and from reporters external to the family such as teachers or observers. Multi-method research ensures better psychometric properties of constructs than would be obtained through single measurements. Assessment tools for all of these outcome domains exist already within the field of child development research, and show excellent internal consistence and test-retest reliability as well as convergent validity across reporters and measurement modalities. Measurements will also be repeated over time, ensuring that trajectories of child health and adjustment can be tracked as various institutions exert their influences over time.

4. Exposure Measures

4.1 Individuals Targeted for Measurement

Primary maternal/paternal/child

Family measures

- Religious affiliation, religiosity, religious practice
- Family structure
- Parenting practices
- Social Support from religious institutions and other sources

Primary maternal/paternal/child

Social institution measures

- Child care characteristics
 - Structural aspects (presence of a stimulating environment, group size, staff ratios, etc.)
 - Functional aspects (caregiver interactions, continuity, curriculum, policies, etc.)
 - Timing of placement in childcare, number of hours spent per day, etc.
- Child care sub-study
 - The child care substudy development group has proposed that a subgroup of participants will be assigned to the child care assessment cohort prior to the first standard data collection point. Approximately 79 percent of that cohort is expected to use some level of regular nonparental child care at sometime during childhood. At each regular visit with this cohort, permission to seek information from the child care provider would be obtained. For children who are in regular child care outside the home for a specified time and duration, for example 30 or more hours per week in the past month, a site visit would be conducted at the child care location. For children in regular care for a lesser time and duration, 10 percent of the cases would have site visits conducted. Consequently, hypotheses that involve data collected at the regular child care location are anticipated to be collected on a subset of the NCS participants.
- School characteristics
 - Programs and policies (e.g., learning disabilities, health promotion, breakfast and lunch programs, violence/drug use/high-risk sexual behavior prevention, etc.)
 - Structural (e.g., class and school size, instructional weaknesses, safety)
 - Health and mental health counseling services
 - Facilities (condition, indoor air quality, cleanliness, safety hazards, exposure to toxics)
- Religious organization characteristics
 - Teachings, policies
 - Social cohesion
 - Activities for children, youth, and adults
 - Size

4.2 Methods

Primary maternal/paternal/child

Family measures

- Interview
- Observation of parent-child interaction

Primary maternal/paternal/child

Social institution measures

- Interviews and questionnaires (child, parents, child caregivers, teachers); administrative/school records; direct observation

4.3 Life Stage

Primary maternal/paternal/child

Family measures

- Prenatal and ongoing through adolescence

Primary Maternal/Paternal/Child

Social institution measures

- Child care: Annually during the preschool years; once during year that the child enters school; once during the 6-8 year period; once during the 8-11 year period
- School: Upon entry into school; during middle childhood; as children enter adolescence; as children prepare to leave high school
- Religious institutions: Preschool years; middle childhood; middle adolescence

5. Outcome Measures

5.3 Outcomes Targeted for Measurement in Child

- Social and emotional function
- Risk-taking behavior and aggressive behavior
- Cognitive function (also see measurement issues associated with neurodevelopmental and behavioral outcomes in hypotheses focused on neurodevelopment and behavior)
- Religious involvement

5.4 Methods

- Questionnaires/interviews with child, parents, caretakers (measuring child cognitive, social, and behavioral characteristics)
- Direct testing/observation of child (neuropsychological, cognitive, and behavioral tests; social function)
- School records review (grades/performance/behavior)

5.4 Life Stage

- Timing varies depending on the specific outcome: Preschool years, middle childhood, and middle adolescence

6. Important Confounders, Mediators, and Effect Modifiers

- Family factors (parental education level, number of siblings, socioeconomic status, shared family genetic characteristics, etc.)
- Neurotoxic environmental exposures (lead, pesticides)
- Environmental exposures to neurotoxicants have been shown to affect neuropsychological function including alterations in cognition, sensory, motor, social, emotional development and executive function
- Injury (repeated head trauma)
- Neighborhood attributes (e.g., noise, community violence, etc.)
- Media factors
- Prenatal infection

7. Power and Sample Size

The following calculations assume a birth cohort of 100,000 children, 98 percent retention per year, and a target power of 80 percent using a two-sided 95 percent confidence interval. The calculations also have some assumptions about the intraclass correlation (a measure of clustering) of the outcome and exposure data.

With subjects taking an achievement test at age 18, the NCS would be able to detect a score decrement when comparing high to low exposure quartiles of approximately 0.61 points (where the population standard deviation is 15).

For categorical data, the minimum odds ratio between measures of the child's health and development and hypothesized exposures related to social institutions will depend on the measures of exposure and outcome, the prevalence of the exposure and outcome, and the age at which the assessment

is completed. The age of assessment determines the number of children retained in the study for analysis. For this discussion, higher levels of exposure are assumed to contribute to higher levels of the outcome. The following table shows the minimum odds ratio that can be reliably detected (i.e., with a power of 80 percent) as a function of assumptions about the prevalence of the outcome and exposure. All assessments are assumed to occur at age 18.

Prevalence of the outcome	Prevalence of the exposure	Age of assessment	Minimum odds-ratio that can be reliably detected
80%	50%	18	1.09
80%	10%	18	1.15
80%	5%	18	1.21
50%	50%	18	1.07
50%	10%	18	1.11
50%	5%	18	1.16
10%	50%	18	1.11
10%	10%	18	1.19
10%	5%	18	1.27
1%	50%	18	1.39
1%	10%	18	1.62
1%	5%	18	1.87

The calculations above assume the exposure and outcome measurements are individual measurements on each child and assume an intraclass correlation of 0.04, believed to be appropriate for such measures from the NCS sample design. When the exposure is a community characteristic, such as a school characteristic, the intraclass correlation will be larger. However, an appropriate value is difficult to estimate. On the assumption that a value of 0.33 is reasonable, the following provides approximate results when the exposure is a community variable.

With subjects taking an achievement test at age 18, the study would be able to detect a score decrement when comparing high to low exposure quartiles of approximately 1.07 points.

For categorical variables, the following table shows the minimum odds-ratio that can be reliably detected (i.e., with a power of 80 percent) as a function of assumptions about the prevalence of the outcome and a community level exposure.

Prevalence of the outcome	Prevalence of the exposure	Age of assessment	Minimum odds-ratio that can be reliably detected
80%	50%	18	1.18
80%	10%	18	1.34
80%	5%	18	1.52
50%	50%	18	1.14
50%	10%	18	1.25
50%	5%	18	1.36
10%	50%	18	1.25
10%	10%	18	1.42
10%	5%	18	1.59
1%	50%	18	2.01
1%	10%	18	2.47
1%	5%	18	3.09

8. Other Design Issues

- **Interview and confidentiality:** Assessment interview time is the major burden for parents and children. Teachers and child care providers, particularly in less formal and unregulated settings, may experience data collection as intrusive and have concerns about confidentiality.
- **Religious diversity and sensitivity:** Care will be taken to treat religious differences with sensitivity.
- **Cost/complexity of data collection:** Some training will be required for administration of assessments, but it will not be extensive. Efforts will be made to select reliable, valid, and low-cost instruments requiring limited training.
- **Need for community involvement:** Measuring the social environment will involve the collection and integration of information on the local areas in which participants live. Gathering administrative data will require the agreement of the respondents as well as the cooperation of agencies that hold data.

9. References

- American Public Health Association. (2001). Policy Statement: Creating healthier school facilities. *American Journal of Public Health, 91*(3), 494-495.
- Birmaher, B., Ryan, N.D., Williamson, D.E., Brent, D.A., Kaufman, J., Dahl, R.E., et al. (1996). Childhood and adolescent depression: A review of the past 10 years, Part I. *Journal of the American Academy of Child and Adolescent Psychiatry, 35*(11), 1427-1439.
- Bronfenbrenner, U., (2005). *Making human beings human: Bioecological perspectives on human development*. Thousand Oaks, CA: Sage Publications Ltd.
- Clarke-Stewart, A., Gruber, C.P., & Fitzgerald, L.M. (1994). *Children at home and in day care*. Hillsdale, NJ: L. Erlbaum Assocs.
- Deater-Deckard, K., Kinkerton, R., & Scarr, S. (1996). Child care quality and children's behavioral adjustment: A four year longitudinal study. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 37*(8), 937-948.
- U.S. General Accounting Office. (1995, February). *School Facilities: Condition of America's Schools* [Publication No. GAO/HEHS 95-61]. Washington, DC: U.S. Government Printing Office.
- Greenberg, P.E., Leong, S.A., Birnbaum, H.G., & Robinson, R.L. (2003). The economic burden of depression with painful symptoms. *Journal of Clinical Psychiatry, 64*(Suppl. 7):17-23.
- Mulligan, G.M., Brimhall, D., & West, J. (2005). *Child Care and Early Education Arrangements of Infants, Toddlers, and Preschoolers: 2001 (NCES 2006-039)*. U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.
- National Study of Youth and Religion (2002). Retrieved May 25, 2007 from <http://www.youthandreligion.org/news/5-2-2002.html>

- NICHD Early Child Care Research Network. (1998). Early child care and self-control, compliance, and problem behavior at 24 and 36 months. *Child Development* 69(4), 1145-1176.
- Regnerus, M. (2003). Religion and positive adolescent outcomes: A review of research and theory. *Review of Religious Research*, 44(4), 394-413.
- Roeser, R., & Eccles, J. (2000). Schooling and mental health. In A.J. Sameroff, M. Lewis, & S.M. Miller, (Eds.). *Handbook of Developmental Psychopathology*. New York: Kluwer Academic Press.
- Shonkoff, J., & Phillips, D. (Eds.). (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy Press.
- Sim, T., Jordan-Green, L., & Wolfman, J. (2005). Parents' perception of the effects of church involvement on adolescent substance abuse. *Journal of Religion & Health*, 44(3), 291-301.
- Smith, C., Faris, R., Denton, M.L., & Regnerus, M. (2003). Mapping American adolescent subjective religiosity and attitudes of alienation toward religion: A research report. *Sociology of Religion*, 64(1):111-133.
- Snyder, H.N., & Sickmund, M. (2006). *Juvenile Offenders and Victims: 2006 National Report*. Washington, DC: U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention.
- Wallace, J.M.J., & Williams, D.R. (1997). Religion and adolescent health-compromising behavior. In J. Schulenberg, J.L. Maggs, & K. Hurrelmann, (Eds.). *Health Risks and Developmental Transitions during Adolescence* (pp.444-468). New York: Cambridge University Press.
- Wilcox, B., Rostosky, S.S., Randall, B., & Wright, M.L.C. (2001). Reasons for Hope: A Review of Research on Adolescent Religiosity and Sexual Behavior. In B.D. Whitehead, B.L. Wilcox, S.S. Rostosky, B. Randall & M.L.C. Wright. *Keeping the Faith: The Role of Religion and Faith Communities in Preventing Teen Pregnancy*. Washington, DC: National Campaign to Prevent Teen Pregnancy.

INFLUENCES ON HEALTHY DEVELOPMENT

1. Meta Hypothesis

Positive influences and protective factors in children's development, including family processes and parenting, biologically based child characteristics, and access to and use of high quality community services, have direct and indirect positive effects on development. These positive influences promote competence and buffer the negative effects of social, environmental, and biological risk (e.g., poverty, stress, birth weight/gestational age, integrity of cognitive, sensory, and motor systems, genetic polymorphisms) on development, leading to healthy cognitive, social, and physical child outcomes.

2. Specific Hypotheses

1. Good parental marital quality and positive parenting behavior will promote positive social outcomes for all children but particularly those at risk for poor outcomes due to low birth weight, family stress, or poverty.
2. Heritable or biologically based child characteristics, such as intelligence and temperament, will lead to positive outcomes in the face of adversity in both academic and socioemotional domains.
3. High quality child care experiences will promote positive cognitive, social, and language development, both among children in general and particularly among children at risk for poor developmental outcomes due to poverty.
4. Parental access to and use of developmentally-oriented health and social services will promote better physical, social, and academic success in children who have social or biological risk factors.

3. Background and Justification

While some research does focus on healthy development in children and youth, traditional research emphasis has been on assessing the presence or absence of pathological outcomes rather than the presence of positive outcomes. There is an important need to be able to measure the impact of a range of environmental influences not just on specific pathological outcomes but also on individual differences in positive development. A thorough understanding of healthy development in all children, and particularly in children at risk for poor developmental outcomes, informs scientific understanding of both healthy and maladaptive developmental trajectories (Cicchetti & Rogosch, 1996) and permits a more informed approach to initiatives and interventions that promote healthy development.

The core outcome concept in positive development is competence. Competence is defined as successful adaptation and healthy functioning (Masten, 2001; Masten & Coatsworth, 1998; Waters & Sroufe, 1983). Competent children and adults are able to use the resources available to them in the environment to adapt successfully to life's demands and challenges (Waters & Sroufe, 1983) and to be productive members of society. Competence as an outcome in research may be conceptualized as specific to a particular age period, specific to a domain of functioning, or some combination of the two (Masten & Coatsworth, 1998).

3.1 Public Health Importance

Prevalence/incidence

Early healthy functioning is one mechanism that can put children on trajectories of further competence and healthy adaptation. Children who show early signs of social competence tend to become even more prosocial with development (Baillargeon et al., 2007). Developmental outcomes that fall within a healthy range are predominant, but research on predictors of children's relative placement within that healthy range is still needed.

Data from the first wave of the Early Childhood Longitudinal Survey—Kindergarten Cohort indicate that 18-42 percent of children demonstrate a significant lag in their approach to learning (West, Denton, & Germino-Hausken, 2000; Zill & West, 2001). Such children who are not ready for the challenges of the school environment have often faced earlier adversities that derail their progress (Hair, Halle, Terry-Humen, Lavelle, & Calkins, 2006). Nonetheless, most children enter kindergarten with at least basic skills in the key domains of reading, mathematics, and social relationships.

Some children do achieve healthy, competent functioning despite the presence of early adversity and risk factors. In the realm of behavior and conduct, approximately 12 percent of infants and toddlers have significant behavioral or emotional problems (Briggs-Gowan, Carter, Skuban, & Horwitz, 2001). Research indicates, however, that less than 50 percent of children with conduct problems during the toddler or preschool period continue to have significant problems 1-2 years later (Baillargeon et al., 2007; Lavigne et al., 1998). Although this is encouraging, the absence of significant problems cannot be equated with optimal healthy functioning. Exact prevalence of resilient outcomes is an elusive statistic as the particular competency being studied and the particular risk or adversity challenging the development of that competency will affect the likelihood that a child will manifest a resilient outcome.

Economic and/or social burden

Many children in the United States are living in households with circumstances that could put them at risk for poor developmental outcomes. In 2005, 18.2 percent of children younger than 18 years old, and 21.3 percent of children younger than 5 years old, lived in households below the national poverty line (U.S. Census Bureau, 2005). Estimates from 2005 indicate that only 68 percent of children are currently living in two-parent families, down from 77 percent in 1980 (U.S. Census Bureau, 2005). Poverty, stress, family difficulties, health problems, developmental or physical disability, and learning or behavioral problems can put children at risk for decrements in their functioning over time (Schoon, 2006).

Studies show that children with deficits in emotional and social skills at school entry are likely not only to have ongoing behavioral and emotional problems but also to suffer in academic achievement in the long-term (Wentzel & Asher, 1995). Prospective longitudinal research has demonstrated that psychosocial factors prior to school entry, such as poor quality home environments and negative early caregiving experiences, can predict later high school dropout (Jimerson, Egeland, Sroufe, & Carlson, 2000). Yet the mechanisms that change these negative trajectories over time or those that could be implemented to move children onto more positive trajectories are not well understood.

Preventability/malleability

Because healthy, competent outcomes are desirable, the concepts of preventability and malleability can be best conceptualized as efforts to promote competence and health in children at risk due to adversity. Resilience can be a natural process through which children's interpersonal and intrapersonal resources assist them achieve optimal outcomes despite the presence of threats to

development (Luthar & Cicchetti, 2000). Resilience, however, can also be promoted through bolstering systems such as parenting behavior, home environment, and child cognitive and social functioning. Intervention studies with premature infants such as the Infant Health and Development Program (IHDP, 1990) have sought to promote resilient outcomes through broad-based intervention services. Programs such as Head Start serve children from low-income families for preschool-based intervention designed to promote school-readiness and subsequent school success (U.S Department of Health and Human Services, Administration for Children and Families, 2005). A greater understanding of the pathways to competence and resilience would permit greater tailoring of programs to the particular risks and needs of children and their families.

3.2 Justification for a Large Prospective Longitudinal Study

Research on influences on positive outcomes and resilient outcomes requires tracking of a variety of protective or ameliorative exposures and experiences over time. Exposures that predict positive child outcomes, such as marital quality and parenting behaviors, child care experiences, access to and utilization of child health or intervention services, and child characteristics, will all be assessed by the NCS at multiple time points. Elements of biological or social risk whose effects on child outcomes might be moderated by these exposures will also be assessed on the NCS including, but not limited to, poverty, low parental educational attainment and literacy, prematurity, and developmental disability.

The tracking of exposures over time is essential because the influence of the exposures may differ across developmental periods. For example, the specific timing of the onset of non-parental child care may be relevant for promoting individual differences in positive childhood adjustment and adaptation at some ages, but not at others (NICHD Early Child Care Research Network, 1998). Many of these exposures will also change in their quality or quantity over time, and the changes themselves may be pertinent to child adjustment. Finally, the duration and cumulative levels of exposures over time, both for risk factors and for exposures that might ameliorate risk and promote healthy outcomes, may be important for child competence.

Repeated assessments of child outcomes, including physical, cognitive/academic, and social outcomes, are also essential to an understanding of healthy development. Examining the predictors of an absolute level of child adjustment at a given time point is certainly valuable. Nonetheless, because healthy development is an ongoing process rather than an event (Yates, Egeland, & Sroufe, 2003), only through identifying improvement or decrement of child functioning over time can we fully understand which exposures promote positive trajectories of development. Complex statistical techniques such as growth curve modeling utilize multiple time points of child outcomes to demonstrate trajectories of functioning over development (Burchinal, Nelson, & Poe, 2006).

The large sample size of the NCS will be important for the examination of rare risk factors and of interactive effects of risks and exposures on child outcomes. Subgroups of individual or overlapping risks (e.g., poverty, very low birth weight, developmental disability) can only be found in sufficient numbers in a large sample, and interactions with protective or ameliorative exposures may follow different patterns depending on the nature of the risk. Interactions between risk and protective factors are, by definition, the only way to examine processes of resilience in child development (Luthar & Cicchetti, 2000). Additionally, some exposures that promote healthy development in all children may act synergistically such that the greatest magnitude effect is seen only when two exposures interact.

3.3 Scientific Merit

Healthy development, and specifically competence, can be conceptualized as comprising successful navigation of developmental tasks appropriate to a particular phase of life, such as secure

attachments with caregivers in infancy, school readiness in preschool, or social and academic competence during the school years. It can also be conceptualized as concerning more specific domains of functioning (social competence, cognitive competence) as they develop throughout the lifespan (Masten & Coastworth, 1998). Competence may be achieved through unimpeded progression of competent functioning over time or through the more challenging attainment of competence despite adversities that threaten healthy development, described as “resilient outcomes” (Masten, 2001).

The processes involved in resilience are neither unusual nor extraordinary. They are normal adaptive human systems at work. These are the fundamental, innate behavioral and physiological systems that promote successful functioning. The broad systems that promote healthy, competent outcomes include, but are not limited to, family and caregiver-child relations and child characteristics such as adaptive cognitive functioning and intelligence (IQ), self-regulatory systems for emotion and behavior, and the desire to explore and learn (Masten, 2001). When these systems function well, they can protect the functioning of children who face environmental, social, and biological risk factors. In addition to these interpersonal and intrapersonal adaptive systems, societal resources such as child care and preschool experiences and health care access and services can ameliorate risk and facilitate the functioning of adaptive systems either directly or indirectly.

Family process and caregiver-child relationships

Within the domain of family functioning, both marital and caregiver-child relationships serve as protective factors for children’s development. Marital relationships provide social and emotional support to caregivers, enabling them to approach parenting with greater ease and facilitate competence in their children. For parents of toddlers and preschoolers, harmonious marital relationships predict child attachment security with mothers (Goldberg & Easterbrooks, 1984) and attachment security and interactive competence with fathers (Frosch, Mangelsdorf, & McHale, 2000; Goldberg & Easterbrooks, 1984). Even within groups of highly stressed mothers, those who report high levels of marital harmony have children who are more likely to be securely attached to them (Kazui, 1997). Research shows that mothers who report high levels of love and support in their marriages have infants who score higher on tests of cognitive and language development, and display better emotion regulation skills (Porter, Wouden-Miller, Silva, & Porter, 2003). High quality marital relationships also provide models of harmonious interpersonal functioning for older children. Parents who engage in constructive behaviors during disagreements, as compared to those who engage in destructive conflict behavior, have children who show higher levels of positive emotionality (Cummings, Goeke-Morey, Papp, & Dukewich, 2002).

Social support within the family can also modify the effects of genetic polymorphisms on children’s development (Fox et al., 2005). Children who have a short allele for the promoter region of the serotonin transporter gene (5-HTT) are at risk for a behavioral tendency toward fearfulness, shyness, and inhibition in the face of novelty. Yet, when such children are raised in families with high levels of support, they exhibit normal, competent functioning in these areas (Fox et al., 2005).

Whereas most theoretical models suggest that marital quality acts indirectly on child development, parent-child relationship quality has a more direct influence with responsive, nurturing, and authoritative parenting promoting competence and well-being in children (Borkowski, Ramey, & Bristol-Meyer, 2002). Early positive parenting has been shown to predict subsequent socioemotional and language competence in young children (Belsky & Fearon, 2002), and to predict increases in academic and social competence from childhood to adolescence (Masten et al., 1999).

Among children at biological risk for poor developmental outcomes, positive parent-child relationship interactions predict higher levels of competence than would be expected given the compromises to their early physiological functioning. Among mothers of preterm children, those who

exhibit high levels of maternal responsiveness during infancy have children who have higher than predicted levels of social and language competence during preschool (Beckwith, & Rodning, 1996). Additionally, very low birth weight infants whose mothers adapt interactions responsively to their children's limitations and changing abilities show increases in social skills over time at a rate faster than those infants whose mothers are less responsive (Landry, Smith, Miller-Loncar, & Swank, 1998).

Children in families with high levels of social risk also show resilient outcomes when they experience high quality parent-child relationships. In low socioeconomic status, high stress families, children often have difficulty in the domains of academic achievement and social behavior. Nonetheless, research has shown that high quality parent-child relationships can promote better-than-expected trajectories of development. Young children whose families have high levels of social and contextual risk fare better on preschool expressive language abilities and social competence if their mothers are nurturing and supportive than if their mothers are rejecting or emotionally distant (Belsky & Fearon, 2002). Likewise, in high social-risk families, early supportive and stimulating home environments predict greater-than-expected increases in academic achievement through childhood and adolescence (Jimerson, Egeland, & Teo, 1999).

Child characteristics

Some child characteristics have been identified in the literature as protective factors, such that children with particular qualities function better than expected in the face of biological or social risk. High IQ, which may permit greater cognitive flexibility, is associated with resilient outcomes. Children who face particularly high levels of adversity yet have high IQs score significantly higher on measures of both social and academic competence in adolescence than do their counterparts with lower IQs (Masten et al., 1999). Child characteristics associated with resilient outcomes, however, are not narrowly restricted to highly heritable features such as IQ. Among children at biological risk (born preterm), better neonatal neurobehavioral organization also predicts subsequent social and academic competence in middle childhood and adolescence above and beyond variance accounted for by levels of socioeconomic risk (Cohen, 1995).

A variety of child temperamental characteristics have also emerged as relevant to resilient outcomes. In families at risk due to high levels of stress and low socioeconomic status, children with the best social competence skills are those who have low temperamental emotional reactivity and high levels of sociability (Smith & Prior, 1995), even when the temperamental qualities are assessed 7 years earlier (Mathiesen & Prior, 2006). Among children attending Head Start, those who combined the temperamental qualities of adaptability, flexibility, and willingness to approach novelty were among the most competent socially, well beyond what would be predicted given the levels of adversity their families face (Mendez, Fantuzzo, & Cicchetti, 2002).

Child care experiences

Experience in a high quality child care or preschool can promote positive child functioning in the domains of cognitive, language, and social development. High quality child care is characterized by a safe, health-promoting environment; cognitive and social stimulation; and sufficient staffing by caring, responsive adults (Votruba-Drzal, Coley, & Chase-Lansdale, 2004). Research on the effects of child care has focused primarily on the quality of care, although the age of onset and the duration of care have also been studied.

High quality care experiences promote better cognitive and language development in infancy and early childhood (Burchinal, Roberts, Nabors, & Bryant, 1996; Caughy, DiPietro, & Strobino, 1994; NICHD Early Child Care Research Network, 2002; Peisner-Feinberg et al., 2001); better social

competence in early childhood (NICHD Early Child Care Research Network, 2002; Peisner-Feinberg et al., 2001; Volling & Feagans, 1995; Vortruba-Drzal et al., 2004); and better social and language outcomes into middle childhood (Belsky et al., 2007; Peisner-Feinberg et al., 2001). In addition to overall quality of child care being important to child outcomes, caregiver characteristics, such as training/qualifications and warmth with the child, and care environment characteristics, such as child-staff ratio, have emerged as particularly important features in predicting child outcomes (Burchinal et al., 1996; NICHD Early Child Care Research Network, 2002).

Because families select the child care they use, family characteristics are often confounded with child care effects. Nonetheless, child care does seem to have effects on child development above and beyond what can be accounted for by family characteristics (NICHD Early Child Care Network, 2002; Peisner-Feinberg et al., 2001). Research has also examined the family characteristics that might interact with child care quality to promote resilient child outcomes and has found that the positive effects of high-quality child care seem to be the greatest for children who come from low-income families and children whose home environments provide lower levels of cognitive and social stimulation (Caughy et al., 1994; Peisner-Feinberg et al., 2001).

Access to developmentally-oriented child services and health care

Healthy development may be promoted in children at risk for poor health and developmental outcomes through early intervention services and access to health care services. The 2004 Individuals with Disabilities Act (Public Law 108-446), Part C mandated public funding of early intervention services for children under age 3 with developmental disabilities or who are at risk for developmental delay. Children at risk for poor developmental outcomes due to poverty and social risk are also eligible for publicly funded early intervention programs such as Head Start and Early Head Start. Access to this array of programs has been variable, however, with some parents unaware of eligibility criteria or how to obtain needed services (Peterson et al., 2004; Shannon, 2004).

Many of these programs have been effective in promoting at least short-term gains in positive child outcomes. The Infant Health and Development Program (IHDP, 1990) was an intervention program designed for families and their infants who were at risk for developmental delays and difficulties due to low birth weight and preterm birth. Services provided included home visitation from birth to age 3, educationally-oriented child care at ages 2-3, and links to community resources. Long-term follow-up showed that families who participated for more days had children who showed greater increases and sustained advances in cognitive development (Hill, Brook-Gunn, & Waldfogel, 2003). Other early intervention programs showing positive effects on cognitive outcomes have focused on nutrition (Worobey, Pisuk, & Decker, 2004) or on broad family and child services (Reynolds, & Ou, 2004).

Head Start and Early Head Start are federally funded programs that provide intervention services to children and families at risk due to poverty. Early Head Start provides services during pregnancy and up to child age 3, including a combination of home-visitation and center-based services addressing child health and development. At age 3, children who participated in Early Head Start scored better than a control group on cognitive, language, and social development outcomes (Love et al., 2005). Head Start, available for preschool-age children at risk due to poverty, provides an enriched preschool experience to foster positive child health and development. Recent evaluation findings show that Head Start children show gains on pre-literacy skills, socialization skills, access to health care, and health status (U.S. Department of Health and Human Services, Administration for Children and Families, 2005).

In addition to these intervention services, access to regular health care services reduces the likelihood of children having medical needs that are not addressed. Children living with both parents, children whose parents had at least high school degrees, and children whose families were more than 200

percent above the poverty threshold are the most likely to have their medical needs met, most likely to have timely health care without regard to cost, and most likely to have health insurance (Bloom, Dey, & Freeman, 2006).

3.4 Potential for Innovative Research

Healthy outcomes are not static phenomena. They are a process of positive adaptation to ever changing environments and intra-individual developmental changes. Although much research has been conducted on resilient and healthy outcomes, little research has been able to examine resilience as the process unfolds from birth until early adulthood. Additionally, the complexity and depth of such research has been limited by relatively small samples usually found in longitudinal research on child outcomes. The NCS will provide the rare opportunity to uncover these trajectories in greater depth, including statistical approaches such as growth curve analyses that permit modeling of individual differences in non-linear trajectories of development over time.

Because healthy outcomes do change over time, the scope and duration of the NCS will provide an opportunity to examine longitudinally the exposures that help maintain healthy outcomes, and those that erode competence. For example, early intervention can promote short-term gains, but a better understanding is needed of the conditions that cause those gains to be lost again (Zigler & Styfco, 2001). Understanding what interferes with resilience and when children are most susceptible to additional risk will allow interventionists to design ongoing program follow-up to counter these risks.

The NCS will also permit a more effective exploration of gene-environment interactions and their effects on genetic expression and resilience outcomes. Studies to date have either been retrospective or with relatively small samples, limiting the range of analyses. The greater sample size and range of data on the NCS will allow for more power and more complexity in analyses, thus opening the potential to identify more varied mechanisms through which genetic risk might be modified to produce healthy outcomes.

3.5 Feasibility

Although infancy and early childhood risks may be particularly critical for resilience research, the most complete view of healthy development and competence requires tracking of risk, protective factors, and competence throughout development. Periodic assessment of the developmentally appropriate manifestations of these domains will be possible on the NCS.

Resilience analyses, which look at factors that promote healthy development despite risk factors, require representation of subgroups in the sample. Relevant risk subgroups, such as families living in poverty, children born preterm or at low birth weight, and children with developmental disabilities, should be adequately represented in the NCS.

Valid and reliable measures of child competence exist in various domains, including social, physical, and cognitive development, and are widely available due to extensive prior research in these fields. Measures of exposures, such as family functioning, child characteristics, experiences in child care, and use of developmental services, have also been assessed in previous research, and valid and reliable measures are available using a range of methodologies. Such measures are minimally intrusive, and costs per administration are reasonable.

4. Exposure Measures

4.1 Individuals Targeted for Measurement

Primary/parent and family

- Marital quality
- Parenting/parent-child relationship (warmth, nurturing, sensitivity)
- Life stress
- Use of developmentally-oriented health or social services

Primary/child

- Child temperament
- Child IQ
- Child neurobehavioral organization
- Child care (quality, age at entry, hours, stability)
- Child care substudy
 - The child care substudy development group has proposed that a subgroup of participants will be assigned to the child care assessment cohort prior to the first standard data collection point. Approximately 79 percent of that cohort is expected to use some level of regular non-parental child care at some time during childhood. At each regular visit with this cohort, permission to seek information from the child care provider would be obtained. For children who are in regular child care outside the home for a specified time and duration, for example 30 or more hours per week in the past month, a site visit would be conducted at the child care location. For children in regular care for a lesser time and duration, 10 percent of the cases would have site visits conducted. Consequently, hypotheses that involve data collected at the regular child care location are anticipated to be collected on a subset of the NCS participants.

Secondary/parent and family

- Socioeconomic status (income, employment)

Secondary/child

- Gestational age/birth weight
- Developmental delay/disabilities
- Genetics

4.2 Methods

Primary/parent and family

- Interview (marital quality, parenting style, stress, use of services)
- Observation (parent-child interaction)

Primary/child

- Parent interview (temperament, child care)
- Direct child assessment (IQ, neurobehavioral organization)
- Observation (temperament)
- Interview with child care provider/observation (substudy)

Secondary/parent and family

- Interview (socioeconomic status)

Secondary/child

- Medical record review (gestational age, preterm birth, disabilities)
- Direct assessment of child (developmental delay)
- Blood for genetic analysis

4.3 Life Stage

Primary/parent and family

- Beginning after birth and continuing periodically through adolescence (marital quality, parenting, stress, use of services)

Primary/child

- Birth (neurobehavioral organization)
- Infancy/childhood (temperament)
- Periodically through infancy and childhood (child care)
- Childhood (IQ)

Secondary/parent and family

- Periodically prenatal through adolescence (socioeconomic status)

Secondary/child

- Birth (gestational age, preterm birth, disability, blood)
- Infancy/childhood (developmental delay/disability)

5. Outcome Measures

5.1 Outcomes Targeted for Measurement in Child

- Social competence
- Cognitive development/achievement
- Physical and motor development
- Health status

5.2 Outcome Methods

- Interviews with parent, child care provider, teacher
- Direct assessment and observation of child

5.3 Life Stage

- Periodically from birth through age 21

6. Important Confounders

- Exposure to environmental toxins (including lead or other toxins), either at home or in a child care setting, has the potential to reduce the child's competence (Hubbs-Tait, Kennedy, Droke, Belanger, & Parker, 2007) even in otherwise enriched settings.
- Parental IQ might account for some exposures because higher IQ parents could be more skilled at parenting and at organizing and managing the child's environment (Bradley et al., 1993; van Bakel & Riksen-Walraven, 2002).
- Genetics might link competence across generations (Kim-Cohen, Moffitt, Caspi, & Taylor, 2004) as some components of competence (including but not limited to IQ) are passed down from parent to child.
- Service provision (intervention, child care) effects might be confounded with parenting variables, as parents who are more engaged with their children might seek intervention or choose different features of the service environment (Burchinal & Nelson, 2000; McCurdy & Daro, 2001).

7. Power and Sample Size

There are many possible outcome measures and exposures discussed as part of this hypothesis. Many different analyses could be conducted, each with different power characteristics. The

following illustrates the power using several possible analyses. For this discussion, power is defined as the smallest difference between the exposed and non-exposed groups that could be reliably detected using the NCS data, i.e., the minimum effect size. In this case “reliably detected” corresponds to a power of 80 percent for detecting a significant difference based on a two-sided 95 percent confidence interval. The calculations include a design effect based on the sample design of the NCS and assume year-to-year retention of 98 percent and an assessment at age 10. In addition, the calculations assume that a complete set of exposure and outcome values are available for 80 percent of the children still in the study at the time of the statistical assessment.

For the power calculations below, the outcome and most exposure variables are assumed to be continuous. The continuous variables are assumed to have a distribution that can be reasonably approximated by a normal distribution. For the purposes of illustration, the outcome can be assumed to be child’s social competency and the primary exposure is parenting quality. The child’s social competence will be measured at several different times during the Study.

The relationship between the exposure and outcome can be described by the slope, which is the change in the outcome measure associated with a one-unit change in the exposure. The minimum effect size is then the minimum slope that can be reliably detected. The slope depends on the standard deviations of the outcome and exposure variables. To simplify the presentation and calculations, the outcome and exposure variables are assumed to be scaled to standard deviations of 1.0. As a result, the slope is the change in the outcome measured in standard deviation units associated with a one standard deviation increase in the exposure. For example, the minimum detectable slope might be 0.20. This means that a one standard deviation increase in the exposure is associated with a 0.20 standard deviation increase in the outcome.

In the most simple example, the child’s social competency (Y) measured at one time might be predicted by parenting quality (X) using linear regression. The following table shows the minimum slope that can be reliably detected and the associated r-square.

Minimum effect size for the model $Y = X$.

Parameter	Minimum value that can be reliably detected
X	0.0166
r-square	0.00028

In most cases, other covariates will also be included in the model. The following table shows the minimum effect sizes assuming three independent variables (X, W, and Z), all normally distributed and having pair-wise correlations on 0.20. In general, higher correlations among the variables will result in larger minimum effect sizes.

Minimum effect size for the model $Y = X W Z$. The value of r-square corresponds to a model where each parameter is equal to the minimum effect size.

Parameter	Minimum value that can be reliably detected
X	0.0172
W	0.0172
Z	0.0172
r-square	0.00028

Many models will also include an interaction. The following table shows the minimum effect sizes assuming a model with two independent variables (X and Z) and the interaction of X and Z. X and Z are assumed to be all normally distributed and have a correlation on 0.20.

Minimum effect size for the model $Y = X + Z + X*Z$. The value of r-square corresponds to a model where each parameter is equal to the minimum effect size.

Parameter	Minimum value that can be reliably detected
X	0.0169
Z	0.0169
X*Z	0.0163
r-square	0.00091

The interaction term may be a categorical variable, such as an indicator of children that were born preterm. The following table shows the minimum effect sizes assuming a model with two independent variables (X and C) and the interaction of X and C, where C is coded as 1 for children born preterm and 0 otherwise. For the calculations, 12 percent of children have C = 1. Also the correlation between C and X is 0.15. Using these assumptions, the minimum effect sizes are shown below.

Minimum effect size for the model $Y = X + C + X*C$, where C is a categorical variable. The value of r-square corresponds to a model where each parameter is equal to the minimum effect size.

Parameter	Minimum value that can be reliably detected
X	0.0178
Z	0.0536
X*Z	0.0519
r-square	0.0015

Having determined that there are significant differences between preterm and other children, the analyst can fit separate models to both groups of children. The following table shows the minimum effect sizes for a linear regression model predicting Y from X applied to the 12 percent of the children with C = 1 using the correlation assumptions above. Because there are fewer children in the analysis, the design effect is slightly lower.

Minimum effect size for the model $Y = X$ fit to a subset of 12 percent of the children.

Parameter	Minimum value that can be reliably detected
X	0.0322
r-square	0.0012

The models fit to these data are likely to have many covariates and interactions. The minimum effect sizes will depend on the number of parameters and the correlations among the variables. Larger minimum effect sizes are generally associated with more dependent variables, including interactions, and higher correlations among the dependent variables. In general, the NCS will provide adequate power for assessing relationships among the anticipated dependent and independent variable. More complex models can also be fit to the data, including growth curve models with or without latent components. The minimum effects sizes for these models are likely to be larger.

8. Other Design Issues

Direction of effects in analyses must be considered and controlled. Rather than effects going directionally from exposure to child outcome, there could be reverse effects or reciprocity over time. For example, highly competent children might foster better parenting and more harmonious marital relations, and this may then lead to greater competence in children. Both longitudinal analyses and controlling for earlier values of the variables in longitudinal analyses will be important for ruling out or understanding reverse-causation.

9. References

- Baillargeon, R., Normand, C., Seguin, J., Zoccolillo, M., Japel, C., Perusse, D., et al. (2007). The evolution of problem and social competence behaviors during toddlerhood: a prospective population based cohort survey. *Infant Mental Health Journal, 28*, 12-38
- Beckwith, L., & Rodning, C. (1996). Dyadic processes between mothers and preterm infants: Development at ages 2 to 5 years. *Infant Mental Health Journal, 17*, 322-333.
- Belsky, J., & Fearon, R.M.P. (2002). Infant-mother attachment security, contextual risk, and early development: A moderational analysis. *Development and Psychopathology, 14*, 293-310.
- Belsky, J., Vandell, D., Burchinal, M., Clarke-Stewart, K.A., McCartney, K., Owen, M.T., et al. (2007). Are there long-term effects of early child care? *Child Development, 78*, 681-701.
- Bloom, B., Dey, A.N., & Freeman, G. (2006). Summary health statistics for U.S. children: National Health Interview Survey, 2005. National Center for Health Statistics. *Vital Health Statistics, 10* (231).
- Borkowski, J.G., Ramey, S.L., & Bristol-Power, M. (Eds.) (2002). Parenting and the child's world: Influences on academic, intellectual, and social-emotional development. Mahwah, NJ: Erlbaum.
- Bradley, R.H., Whiteside, L., Caldwell, B., Casey, P., Kelleher, K., Pope, S. et al. (1993). Maternal IQ, the home environment, and child IQ in low birthweight, premature children. *International Journal of Behavioral Development, 16*, 61-74.
- Briggs-Gowan, M., Carter, A., Skuban, E., & Horwitz, S. (2001). Prevalence of Social-Emotional and Behavioral Problems in a Community Sample of 1- and 2-Year-Old Children. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*, 811-819.
- Burchinal, M., & Nelson, L. (2000). Family selection and child care experiences: Implications for studies of child outcomes. *Early Childhood Research Quarterly, 15*, 385-411.
- Burchinal, M., Nelson, L., & Poe, M. (2006). Growth curve analysis: an introduction to various methods for analyzing longitudinal data. *Monographs of the Society for Research in Child Development, 71*, 65-87.
- Burchinal, M., Roberts, J., Nabors, L., & Bryant, D. (1996). Quality of center child care and infant cognitive and language development. *Child Development, 67*, 606-620.
- Caughy, M.O., DiPietro, J., & Strobino, D. (1994). Day-care participation as a protective factor in the cognitive development of low-income children. *Child Development, 65*, 457-471.

- Cicchetti, D., & Rogosch, F. (1996). Equifinality and multifinality in developmental psychopathology. *Development and Psychopathology, 8*, 597-600.
- Cohen, S. (1995). Biosocial factors in early infancy as predictors of competence in adolescents who were born prematurely. *Developmental and Behavioral Pediatrics, 16*, 36-41.
- Cummings, E.M., Goeke-Morey, M., Papp, L., & Dukewich, T. (2002). Children's responses to mothers' and fathers' emotionality and tactics in marital conflict in the home. *Journal of Family Psychology, 16*, 478-492.
- Frosch, C., Mangelsdorf, S., & McHale, J. (2000). Marital behavior and the security of preschooler-parent attachment relationships. *Journal of Family Psychology, 14*, 144-161.
- Fox, N., Nichols, K., Henderson, H., Rubin, K., Schmidt, L., Hamer, D., et al. (2005). Evidence for a gene-environment interaction in predicting behavioral inhibition in middle childhood. *Psychological Science, 16*, 921-926.
- Goldberg, W., & Easterbrooks, M.A. (1984). Role of marital quality in toddler development. *Developmental Psychology, 20*, 504-514.
- Hair, E., Halle, T., Terry-Humen, E., Lavelle, B., & Calkins, J. (2006). Children's school readiness in the ECLS-K: Predictions to academic, health, and social outcomes in first grade. *Early Childhood Research Quarterly, 21*, 431-454.
- Hill, J., Brooks-Gunn, J., & Waldfogel, J. (2003). Sustained effects of high participation in an early intervention for low-birth-weight premature infants. *Developmental Psychology, 39*, 730-744.
- Hubbs-Tait, L., Kennedy, T.S., Droke, E., Belanger, D., & Parker, J. (2007). Zinc, iron, and lead: Relations to Head Start children's cognitive scores and teachers' ratings of behavior. *Journal of the American Dietetic Association, 107*, 128-133.
- Infant Health and Development Program. (1990). Enhancing the outcomes of low birthweight, premature infants: A multisite randomized trial. *Journal of the American Medical Association, 263*, 3035-3042.
- Jimerson, S., Egeland, B., Sroufe, L.A., & Carlson, E. (2000). A prospective longitudinal study of high school dropouts: Examining multiple predictors across development. *Journal of School Psychology, 38*, 525-549.
- Jimerson, S., Egeland, B., & Teo, A. (1999). A longitudinal study of achievement trajectories: Factors associated with change. *Journal of Educational Psychology, 91*, 116-126.
- Kazui, M. (1997). The influence of cultural expectations on mother-child relationships in Japan. *Journal of Applied Developmental Psychology, 18*, 485-496.
- Kim-Cohen, J., Moffitt, T., Caspi, A., & Taylor, A. (2004). Genetic and environmental processes in young children's resilience and vulnerability to socioeconomic deprivation. *Child Development, 75*, 651-668.

- Landry, S., Smith, K., Miller-Loncar, C., & Swank, P. (1998). The relation of change in maternal interactive styles to the developing social competence of full-term and preterm children. *Child Development, 69*, 105-123.
- Lavigne, J.V., Arend, R., Rosenbaum, D., Binns, H.J., Christoffel, K.K., & Gibbons, R.D. (1998). Psychiatric disorders with onset in the preschool years, I: Stability of diagnoses. *Journal of the American Academy of Child and Adolescent Psychiatry, 37*, 1246-1254.
- Love, J., Kisker, E., Ross, C., Raikes, H., Constantine, J., Boller, K., et al. (2005). The effectiveness of Early Head Start for 3-year-old children and their parents: Lessons for policy and programs. *Developmental Psychology, 41*, 885-901.
- Luthar, S., & Cicchetti, D. (2000). The construct of resilience: Implications for interventions and social policies. *Development and Psychopathology, 12*, 857-885.
- Masten, A. (2001). Ordinary magic. *American Psychologist, 56*, 227-238.
- Masten, A., & Coatsworth, J.D. (1998). The development of competence in favorable and unfavorable environments: Lessons from research on successful children. *American Psychologist, 53*, 205-220.
- Masten, A., Hubbard, J., Gest, S., Tellegen, A., Garmezy, N., & Ramirez, M. (1999). Competence in the context of adversity: Pathways to resilience and maladaptation from childhood to late adolescence. *Development and Psychopathology, 11*, 143-169.
- Mathiesen, K., & Prior, M. (2006). The impact of temperament factors and family functioning on resilience processes from infancy to school age. *European Journal of Developmental Psychology, 3*, 357-387.
- McCurdy, K., & Daro, D. (2001). Parent involvement in family support programs: An integrated theory. *Family Relations, 50*, 113-121.
- Mendez, J., Fantuzzo, J., & Cicchetti, D. (2002). Profiles of social competence among low-income African American preschool children. *Child Development, 73*, 1085-1100.
- NICHD Early Child Care Research Network. (1998). Early child care and self-control, compliance, and problem behavior at twenty-four and thirty-six months. *Child Development, 69*, 1145-1170.
- NICHD Early Child Care Research Network. (2002). Child care structure → process → outcome: Direct and indirect effects of child care quality on young children's development. *Psychological Science, 13*, 199-206.
- Peisner-Feinberg, E., Burchinal, M., Clifford, R., Culkin, M., Howes, C., Kagan, S., et al. (2001). The relation of preschool child-care quality to children's cognitive and social developmental trajectories through second grade. *Child Development, 72*, 1534-1553.
- Peterson, C., Wall, S., Raikes, H., Kisker, E., Swanson, M., Jerald, J. et al. (2004). Early Head Start: Identifying and serving children with disabilities. *Topics in Early Childhood Special Education, 24*, 76-88.
- Porter, C., Wouden-Miller, M., Silva, S.S., & Porter, A.E. (2003). Marital harmony and conflict: Links to infants' emotional regulation and cardiac vagal tone. *Infancy, 4*, 297-307.

- Reynolds, A., & Ou, S.R. (2004). Alterable predictors of child well-being in the Chicago longitudinal study. *Children and Youth Services Review, 26*, 1-14.
- Schoon, I. (2006). *Risk and resilience: adaptations in changing times*. New York: Cambridge University Press.
- Shannon, P. (2004). Barriers to family-centered services for infants and toddlers with developmental delay. *Social Work, 49*, 301-308.
- Smith, J., & Prior, M. (1995). Temperament and stress resilience in school-age children: A within-families study. *Journal of the American Academy of Child and Adolescent Psychiatry, 34*, 168-179.
- U.S. Census Bureau (2005). 2005 American Community Survey. Retrieved from <http://factfinder.census.gov>
- U.S. Department of Health and Human Services, Administration for Children and Families (2005). *Head Start impact study: First year findings*. Washington, DC.
- Van Bakel, H., & Riksen-Walraven, M. (2002). Parenting and development of one-year-olds: Links with parental, contextual, and child characteristics. *Child Development, 73*, 256-273.
- Volling, B., & Feagans, L. (1995). Infant day care and children's social competence. *Infant Behavior and Development, 18*, 177-188.
- Votruba-Drzal, E., Coley, R.L., & Chase-Lansdale, P.L. (2004). Child care and low-income children's development: Direct and moderated effects. *Child Development, 75*, 296-312.
- Waters, E., & Sroufe, L.A. (1983). Social competence as a developmental construct. *Developmental Review, 3*, 79-97.
- Wentzel, K., & Asher, S. (1995). The academic lives of neglected, rejected, popular, and controversial children. *Child Development, 66*, 754-763.
- West, J., Denton, K., & Germino-Hausken, E. (2000). *America's Kindergartners: Findings from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99: Fall 1998*. Washington, DC: National Center for Education Statistics.
- Worobey, J., Pisuk, J., & Decker, K. (2004). Diet and behavior in at-risk children: evaluation of an early intervention program. *Public Health Nursing, 21*, 122-127.
- Yates, T., Egeland, B., & Sroufe, L.A. (2003). Rethinking resilience: A developmental process perspective. In S. Luthar (Ed.), *Resilience and vulnerability: Adaptation in the context of childhood adversities* (pp.243-266). New York: Cambridge University Press.
- Zigler, E., & Styfco, S. (2001). Extended childhood intervention prepares children for school and beyond. *Journal of the American Medical Association, 285*, 2378-2380.
- Zill, N., & West, J. (2001). *Entering kindergarten: Findings from the Condition of Education 2000*. (U.S. Department of Education, National Center for Education Statistics Publication No. 2001-035). Washington, DC: U.S. Government Printing Office.