

Integrating Qualitative and Quantitative Methods in Longitudinal Measurement and Analysis

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I. Introduction

A. Nature of the research problem

Health and development trajectories are affected by interactions across multiple levels, ranging from molecular genetics to broader sociocultural forces (Bronfenbrenner & Morris, 1998), and are shaped through interactions with family members and others in close proximity as well as by more distal actors in one's social network, such as health care professionals and politicians. These are complex factors, and understanding their influence on maternal and child health and development requires a matching complexity and integration of methods at multiple levels. Advances in both quantitative and qualitative methods have enhanced our ability to measure developmental outcomes, describe patterns of change, and identify factors associated with change. However, the integration of both approaches in applied research has lagged behind their use individually. Each approach provides complementary information, and the weaknesses of one method can be offset by the strengths of the other. To oversimplify, qualitative data can provide in-depth information about developmental processes and their contexts, but usually include observations of only a small number of individuals so generalizability of findings is suspect. While the meaning or interpretation of results is often persuasive and closely linked to the data, it is difficult to determine the extent to which findings are idiosyncratic to the individuals studied. Quantitative data can describe developmental trajectories and identify correlates of change in a manner that facilitates generalizability, but is less useful for describing processes or the meanings that underlie behaviors and attitudes. In quantitative approaches, the meaning or interpretation of findings is based on assumptions that measurement of constructs was accurate and appropriate for the population sampled.

Integration of both methods can provide greater breadth and depth of understanding. However, researchers attempting to integrate both approaches face many barriers at all phases—in the initial design, measurement development and/or selection, data collection, data analysis and interpretation, and dissemination—and successful examples of thoroughly integrated studies are few. In this project, we worked to devise exemplar models of methods integration. We proposed to develop procedures and models that use more advanced techniques within both traditions; combine them to produce more comprehensive measurements of health and development processes and outcomes; apply these innovative models in two important areas related to child health; and document the process of these efforts. Integrating methods in two main areas of child health entailed 1) combining qualitative analysis of ethnographic interviews with item response analysis to enhance precision and cultural sensitivity of quantitative measures in three currently funded longitudinal projects, and 2) integrating different models of qualitative analysis and statistical modeling techniques within and across the three projects to describe developmental trajectories and processes involved in (a) parental beliefs about and implementation of safety practices with infants and (b) the relation of parental beliefs to the development of infant self-regulation. The aims of this work are to 1) demonstrate the utility of applying more sophisticated qualitative and quantitative methods to integrating measurement and analysis; 2) document the factors that promote integration; 3) provide solutions to challenges of integration; and 4) contribute exemplary models and examples of integration for use in health research. We believe that this study has demonstrated the value added when analyses are integrated.

The three longitudinal projects that were the focus of our efforts used quantitative and qualitative data to address measurement questions and test hypotheses about early development, but they did not explicitly describe how or the extent to which integrated analyses would be conducted. We proposed to add measures to already funded assessments and conduct more extensive analyses than originally proposed with the explicit purpose of developing strategies for *integrating* qualitative and quantitative methods. The selected projects varied in terms of who was studied, when they were studied, and the level of the research teams' commitment to conducting and integrating both qualitative and quantitative data analysis. Working with three different projects that varied along these important dimensions, we were able to

document which types of procedures used to integrate methods were most successful given the research design of each study and the level of cooperation and investment of the research team. These projects also enabled us to address measurement and analysis issues related to diversity in location (urban or rural), race/ethnicity, socioeconomic status, or disability. Our study of integrating methods included longitudinal studies of health and normative development of minority, low-income, and special needs children, and sought to identify child, parental (maternal and paternal), and family strengths as well as problems. This study addressed Healthy People 2010 Goals of increasing quality and years of healthy life and eliminating health disparities and MCHB Strategic Research Issues #2 by studying the contributions of contextual effects on disparities in MCH outcomes (parenting and child safety outcomes) and #4 of promoting health development of MCH populations by providing information to health providers regarding parenting and safety practices of at risk populations (low-income white and African-American families living in rural and urban locations or families with a child with Fragile X Syndrome). Findings from this study should have increased validity due to the integration of quantitative and qualitative data and should aid in understanding racial and social differences in both parenting and safety practices. Improved methods for integration should promote improved research practices, especially of MCH populations, by providing guidelines for integrating qualitative and quantitative approaches to improve both the validity and generalizability of research results.

Specific Aim 1: Integrate psychometric and qualitative methods to improve the scoring and cultural appropriateness of longitudinal measures. Multiple strategies will be used to integrate methods in developing instruments that are culturally appropriate and will also have desirable psychometric properties. Cultural appropriateness will be addressed through ethnographic interviews as well as through examining differential item functioning within item response theory (IRT) scoring procedure.

Specific Aim 2: Integrate qualitative and quantitative methods in each of three longitudinal projects to address issues related to two issues: parental beliefs and practices regarding child safety and parenting beliefs and practices regarding discipline and childrearing. Multiple strategies will be used to integrate longitudinal modeling techniques of quantitative data with cultural models and within/cross-case analysis of longitudinal ethnographic data to address two topics important to child health: 1) relating parenting beliefs to the level of their implementation of recommended child safety practices, and 2) relating parental beliefs and practices to the development of self regulation during infancy.

Integrated analyses on both topics were conducted within and across three currently funded longitudinal projects. The three projects were particularly suited to these aims because they included qualitative and quantitative components; were based on similar theoretical models of development (Bronfenbrenner & Morris, 1998); and collected identical measures on a set of key constructs. However, the three selected projects differed in ways that influenced our ability to integrate data: the sampling strategies for qualitative data collection, intended uses of qualitative data, the research teams' experience with ethnographic methods, and level of commitment of the team to integrating methods. In addition, the two specific topic areas were selected because they were expected to elicit different levels of commitment from the research teams. Parental beliefs and practices relevant to safety issues is a topic tangential to each of the projects, while the role of parenting practices in children's acquisition of language and social skills is central to all three. We hypothesized that our success in integrating qualitative and quantitative methods within a given project would depend on the commitment of the research team toward the specific topic as well as to integration in general and the specific study design.

Specific Aim 3: Demonstrate the feasibility of integrating methods, develop exemplar models of integration, and document which types of procedures are most successful given research design and level of cooperation and investment of the research teams. We conducted an ethnographic study of the processes and dynamics of each project to describe how the characteristics of research designs and teams were related to the degree to which integrated data collection and analysis occurred. From these observations, we expected to be able to develop models of integration for specific research contexts as well as provide detailed information on the steps necessary to integrate methods at various phases of a project. Participating in the process and documenting each step, barrier, solution, success and failure aids

in developing models and procedures that are grounded in research realities and therefore, of more direct use to researchers.

B. Purpose, scope, and methods of the investigation

The funded project was designed to examine the extent to which qualitative and quantitative data could be analyzed in a manner that extended the understanding of the research issue beyond that which was possible if only qualitative or quantitative methods were used alone. We employed several different models for conducting the mixed-model analyses in our analyses using the data from the three longitudinal projects.

First, we examined several instruments using a mixed model approach. The instruments that were examined included measures of depressive symptomology and religiosity in the Family Life Study, a measure of infant intentionality that assessed the extent that the mother believed her young infant could be intentionally negative and spoiled in the Durham Study, and quality of life and religion as support in the Fragile X study. Preliminary analyses involved IRT analyses of the items for quantitative scoring and content analysis for qualitative scoring.

Second, we used various approaches for combining qualitative and quantitative data. The first approach to mixed models was primarily used with a longitudinal study of children with fragile X syndrome (FXS). All children in this study had complete qualitative and quantitative data. The qualitative interviews were designed to cover a range of topics of interest to the larger project, including mothers' understandings of FXS, their perceptions of their own and their children's quality of life, child-rearing strategies, and sources of support. With this approach, we analyzed each data set separately for components of quality of life and support, and reported both the unique findings each approach produced as well as how qualitative findings could be used to provide more depth and complexity of meaning to the quantitative findings and suggest ways in which measures could be adapted in light of these complexities.

The second approach to mixed models was primarily used with a longitudinal study of 200 African American and European American children in low- and middle-income families in Durham, NC. A subset of the mothers participated in the qualitative study. We were interested in determining the extent to which mothers endorsed physical punishment of young infants and, if so, whether those beliefs appeared to be justified because the mothers believed that young infants were deliberately trying to manipulate their behavior. The qualitative interviews were analyzed first to determine if there were different patterns of beliefs regarding disciplining of infants. Two different patterns of maternal beliefs emerged which led to the quantitative analysis of measures to predict sensitivity and responsiveness of the mother during interactions with the infant.

The third approach to mixed model was primarily used with a longitudinal study of 1200 African American and European American children in rural low-income regions in the Appalachian Mountains in PA and the Black South in NC. In this study, quantitative analyses examined who endorsed using safety practices designed to prevent injuries, looking at the extent to which maternal knowledge about child development or maternal depression were related to reported use. Qualitative data provided case studies that exemplified these findings and provided a more meaning-oriented contextual approach to understanding the quantitative findings.

C. Nature of the findings

We have two types of findings, methodological and substantive. Methodologically, our experiences led us to understand more about the circumstances under which mixed modeling is more or less difficult. As anticipated, mixed model analyses were more successful when the overlap between the issues examined in the qualitative and quantitative data was high. It was not difficult to combine results from the two types of analyses when the interview protocols had been devised to correspond closely to constructs measured by the quantitative measures. It was more difficult when there was little overlap because it was not clear

whether disagreements were due to substantive or methodological differences. Furthermore, it was easier when a higher proportion of the same participants were assessed using both types of data collection. Furthermore, it became apparent that the lagged model for informing data collection is hard to institute because it is difficult for qualitative and quantitative data to be processed systematically in time to inform the next round of data collection. A longer lag would have been necessary for processing thoroughly either type of data for the data to be useful in making decisions at the next wave of data collection in all three of our projects. Finally, mixed model analyses were made more difficult when other investigators or reviewers of the papers wanted to use the qualitative data in ways that fit more with quantitative paradigms (e.g., assigning individuals in the qualitative component to groups for use in quantitative data analysis), or simply wanted a good story or quote to exemplify the quantitative findings. As is the case with most mixed methods papers, each submission of our integrated work to journals that mostly publish quantitative articles generated a critique or questions about the qualitative analysis. These questions were resolved through some clarifications and educating the reviewers to some extent about types and histories of certain kinds of qualitative analyses. It was clear that reviewers in psychology and education do not understand some of the qualitative terms (e.g., “culture”, “cultural models”) in the same way as do qualitative methodologists with anthropological training. There is still the predilection that all qualitative data need to be turned into quantitative data of some sort to be valid.

Substantively, our findings are quite disparate. We found that mothers who believe that their young infants can deliberately behave negatively are more likely to espouse physical punishment for them to prevent spoiling the child, and they tend to be responsive and supportive in interactions with the infant if they believe in negative infant attribution or physical punishment for infant. Low-income mothers preferred to use family members for child care because they feared for their child’s safety with strangers. Mothers with depression were less likely to adopt common safety processes because, in part, it appeared they believed that their actions would not prevent injuries that were meant to be. Scores on a widely-used measure of depression did correspond to women’s descriptions of their affective state. In contrast, scores on a widely-used measure of religiosity did not correspond closely individual women’s beliefs about God and religion for low-income women because the instrument focused on the role of church and the women focused on an individual relationship with God. In the Fragile X study, we found that a majority of mothers of children with FXS rely on religion not only for daily support but as an interpretive framework that gives meaning to their child’s disability and their lives. In the study on quality of life, we found that trait hope was related to a more positive perceived quality of life, whereas parenting stress was related to a more negative perceived quality of life. Increased child problem behavior and reduced social support was significantly related to parenting stress. Although the quantitative results provide information about which maternal, child, and family variables impacted women’s quality of life, the interview data provided insights into how women interpreted the meaning and import of these factors on their quality of life. The quantitative data indicated that stress was a predictor of quality of life, but interview data revealed what contributed to their stress, including how raising a child with fragile X syndrome impacted their lives. We concluded that quality of life is not necessarily global or stable, as is premised in most measures of it.

II. Review of the Literature

There is growing recognition that multi-disciplinary longitudinal research is needed to understand human development (Bronfenbrenner & Morris, 1998; Sameroff & MacKenzie, 2003). Individuals develop within complex environments, influenced by transactions between genetic, individual, family, community, and cultural levels; and they often display multiple pathways in the development of almost all capacities (Bronfenbrenner & Morris, 1998). Development takes place in the proximal contexts of immediate family and changing child care arrangements, and in the more distal contexts of extended family, community, and culture. To represent the developmental trajectory in one domain, levels of analysis must extend beyond the assessment of the child or mother-child dyad within one domain to include assessments of the child’s functioning in other domains (e.g., biological functioning, cognitive competence, personality and emotional development); his or her social relationships with individuals in proximal and more distal environments; the characteristics of those individuals; and the communities and

cultures in which people and interactions are embedded. Studying such complex phenomena requires careful measurement of all constructs of interest and analysis employing sophisticated methodologies. Methodologists have developed a wide battery of qualitative and quantitative methods for measurement and analysis, and have demonstrated their utility within applied research. Quantitative methods focus on issues such as sampling, measurement, and analysis that allow results to be generalized from the sample to the population. They tend to focus on identifying associations between variables (e.g., developmental trajectories), but in the absence of experimental designs, are less able to ascertain the processes underlying development. In contrast, qualitative methods typically provide rich and complex accounts of family dynamics and the broader environmental and cultural contexts in which they are situated, but are less able to address concerns about generalization. Each of the many sophisticated qualitative and quantitative methodologies offer insights into phenomena of interest, but integration of methods promises more comprehensive understanding than is possible using any approach alone (Newman & Benz, 1998).

Integration of qualitative and quantitative measurement methods.

Careful measurement of developmental outcomes, of characteristics of individuals important to the child, and relationships between the child and those individuals are needed to describe development. Quantitative longitudinal studies rely on either developing assessment instruments or selecting the most appropriate measurement tool available. The cultural inappropriateness of the instruments is one of the biggest threats to validity. Most large studies employ both qualitative and quantitative methods to address cultural appropriateness of measures, but few have combined advanced qualitative and quantitative methods to do so.

Types of methods used to address measurement issues typically include either qualitative or quantitative methods. Some studies use qualitative methods such as focus groups or detailed debriefing with pilot participants prior to data collection to determine whether proposed quantitative instruments or interview protocols are acceptable and understood by individuals similar to the anticipated quantitative sample. Many projects use standard psychometric procedures to address this question quantitatively, determining whether adequate measures of internal consistency or factor structures obtain within the sample. Confirmatory factor analysis can be used to test whether the hypothesized factors obtain for a specific instrument. A few studies ask the more relevant question about whether selected measures show good internal consistency within cultural, ethnic, economic, or age groups of interest or have the same indicators for latent constructs in a confirmatory factor analyses.

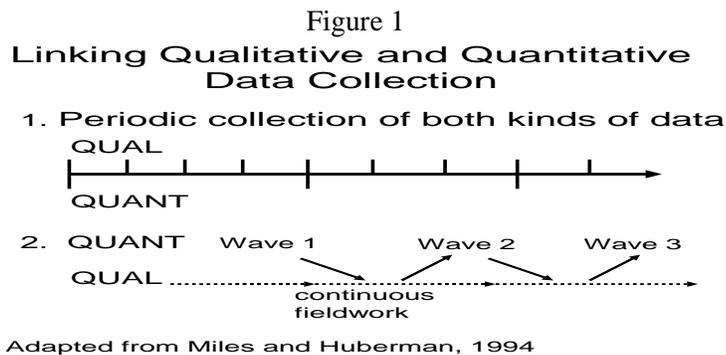
Integration of qualitative and quantitative analytic methods.

Most social scientists now recognize that combining qualitative and quantitative methods strengthens research projects, but few studies have made a serious attempt to collect and integrate both types of data (Buchanan, 1992). Integration of methods should allow investigators to approach research questions from both inductive and deductive perspectives, thereby increasing the reliability and validity of findings overall (Denzin, 1989). As Steckler et al. (1992) noted, one method's strengths compensate for weaknesses of the other. While reasons for integrating methods are largely recognized, there is less practical information and few exemplar models on how to integrate methods in the design, data collection, analysis, and writing phases of research projects (e.g., Creswell, 2003; Fielding & Schreier, 2001; Hugentobler et al., 1992; Reichardt & Cook, 1979; Tashakkori & Teddlie, 1998). The models and guidelines offered in mixed methods handbooks are typically general and not always well grounded in or illustrated by actual research experiences. Exemplar articles illustrating successful integration are few.

Integration of qualitative and quantitative data can be accomplished in many ways and along many dimensions, yet the most frequently used approaches tend to be simplistic. Quantitative studies may pull quotes or stories from interviews to illustrate quantitative findings, especially when preparing public or press reports, or use content analysis for frequency counts of responses. Few draw on other analysis techniques that have solid theoretical and empirical grounding in social science methodology (e.g., Bernard, 1995, 1998; Denzin & Lincoln, 1998; Miles & Huberman, 1994). Qualitative studies may rely on descriptive statistics from the larger quantitative sample or extant data bases to place their results in

contexts relative to a population of interest, but often fail to take advantage of rigorous quantitative sampling, assessment, and analysis to ensure that qualitative findings can be generalized beyond the participants to populations of interest. Whether it is a lack of experience or interest, researchers who attempt to integrate qualitative quantitative methods seldom employ the more advanced techniques to explore either method's full theoretical and methodological power.

Broad models for describing ways of integrating qualitative and quantitative methods have been proposed (Creswell, 2003; Fielding & Schreier, 2001; Steckler et al., 1992; Tashakkori & Teddlie, 1998). Miles and Huberman's (1994) models focus on the level of interaction between methods over the course of a longitudinal study. In the first model shown in Figure 1, both methods may proceed in parallel fashion, but have no interaction or influence on one another during the data collection phase. The second model shows a more interactive approach over the course of the study where the first quantitative assessments may draw attention to relationships that need exploration ethnographically and ethnographic findings may uncover variables and relationships that require attention in later assessments.



The extent to which the study includes feedback loops between methods will strongly influence the ability to use both sets of data to triangulate results. Three elements of mixed methods research design influence the ability to capitalize on intended integration: 1) what constructs are measured, 2) when assessments take place, and 3) who is assessed. Large longitudinal studies designed to employ both qualitative and quantitative methods vary along all three of these dimensions. Failure to collect data on the same domains or constructs eliminates the ability to influence later data collection across methods and makes integration of results difficult or irrelevant. The schedule of assessments may be concurrent or staggered (with one type always preceding the other). Concurrent data collection reduces the sources of discrepancy between findings from the two methods. However, staggering assessments can strengthen feedback between methods. For example, if qualitative assessments are intended to provide insight into the quantitative measures selected, conducting qualitative assessments well in advance of quantitative data collection is advised. Finally, both qualitative and quantitative data may be collected on none, some, or all of the same study participants. Most often qualitative data are collected on a small subset of subjects who are also participating in the quantitative assessments or on a smaller and completely separate sample selected to 'match' the larger sample on key variables. Rarely are both methods used to assess the same sample, although such a design provides for the optimal integration of qualitative and quantitative methods.

The biggest challenge in any multi-disciplinary team is often the relative weight assigned to each approach. This weight is often reflected in both the amount of resources devoted to collection of both types of data and in who is included in the decisions. It is often difficult to include methods different from those in which most investigators were trained. A longitudinal project is expensive, and there may be debates about the amount of money to allocate to ethnographic work. Decisions about the research protocol are often among the most contentious issues facing a longitudinal research team, and qualitative and quantitative methodologists must both be involved in that process if the team hopes to use both types of data to address research questions. Given these issues, successful integration is influenced by the extent to which the principal investigator and the entire research team is committed to and experienced in integrating data.

III. Study Design and Methods

A. Study design

The study design involved using data from three longitudinal projects housed at the FPG Child Development Institute. This study was designed to ‘piggy back’ onto three funded research projects. The projects were well suited to our purpose because they already contained extensive quantitative and qualitative assessments of parents with a child between birth and four years of age. Each project was longitudinal with multiple assessment points and each was designed to assess children’s development in multiple contexts. The Durham Child Health and Development Study (DCHDS) focused exclusively on African-American and European American families in an urban area in North Carolina. The Rural Children Living in Poverty Project (“Family Life Project”-FLP) focused on African American and European American families living in rural counties in Pennsylvania and North Carolina. Both of these samples included low-income, working, and middle-class families. The third project, Family Adaptation to Fragile X Syndrome (FAFXS) focused on families of children with a genetic disorder, fragile X syndrome (FXS), who varied by income as well as place of residence (any of the 50 states). Twenty percent of these families were African American.

B. Population studied and sampling

The first 5 years of the Rural Children Living in Poverty Project (FLP) was an interdisciplinary program project grant funded by NICHD/NIH. It was designed to study the ways in which community, employment, family economic resources, family contexts, parent-child relationships, and child characteristics interact over time to shape the development of competence in rural children during the first three years of life. The research team included psychologists who study language, family processes, temperament; psychologists and sociologists who study employment; a pediatrician; ethnographers trained in sociology and anthropology; and a statistician. For the core quantitative data collection, a representative sample of 1200 infants and their families were recruited from local hospitals between October, 2003 and October, 2004, from three rural poor North Carolina counties and three rural poor Pennsylvania counties, with over-sampling for poverty in both sites and for African-American families in NC. Partially crossing site, poverty, and ethnicity produces six cells: PA low-income (n=320), PA not poor (n=160), NC African-American and low-income (n=380), NC African-American and not poor (n=100), NC not African American and low-income (n=160) and NC not African American and not poor (n=80) (see Table 1). The counties were selected to represent two of the four rural areas of the country characterized as high poverty areas (Dill, 1999) – the Black South and Appalachia.

FLP also contained an ethnographic component with a different sample of families (“An Ethnography of Rural Communities, Families, and Young Children”—Linda Burton and Debra Skinner, co-PIs). The ethnographic sample consisted of 72 women (36 African American and 36 European American women) recruited when they were between 5-8 months pregnant. One-third also had a child 2-4 years of age. None of the 72 mothers was a participant in the FLP core sample, but they shared income, residence, and ethnicity characteristics of the larger sample. Recruitment began November 2002 and was completed in 2004.

The Durham Child Health and Development Project (DCHDP) is an ongoing center grant funded by the National Science Foundation. It is designed to create an interdisciplinary approach to studying infant and child development. The research team includes psychologists who study families, language development, memory, biological processes, and temperament and self regulation; an ethnographer who studies cultural contexts of child development; and statisticians. DCHDP recruited infants and their families who live in Durham, NC. The city of Durham has been growing in recent decades, and has had a large African-American middle-class population, thus making it possible to study ethnicity without totally confounding SES and race. For the core data collection, a sample of 207 infants and their families were recruited, and 199 are still enrolled. Children were recruited from birth records and from advertisements about the study listed in clinics and the local newspapers. Children were recruited when less than six months of age, with the goal of obtaining 50 families in 4 cells: 52 African-American poor families, 52 European-American

not-poor families participating, 43 African-American not-poor families and 35 European-American poor families also enrolled. A total of 24 families, representative of the larger sample in terms of ethnicity and income, were recruited for the ethnographic project.

The Family Adaptation to Fragile X Syndrome (FAFXS) is an ongoing center grant funded by NICHD to examine parents' experiences and adaptations to having children with fragile X syndrome (FXS), the most common inherited cause of mental retardation. The first five years of the longitudinal study was designed to provide important insights into the family consequences of FXS and show how genetic, family, child, cultural, and ecological variables mediate these outcomes. One hundred and eight families of children with FXS, including 58 boys and girls with full mutation FXS who are between 12 and 33 months of age at the first assessment, formed the core sample for this longitudinal investigation. All families were assessed three times over three years at 18 month intervals, beginning December, 2003, and qualitative and quantitative data were collected on all participants.

C. Instruments used

In each of the three projects, families were assessed multiple times with both quantitative and qualitative measures of child and family variables related to child health and development (see Table 2). To fulfill our specific aims, we had to add a quantitative measure of parents' practices related to child safety; a medical history that elicits childhood injuries and accidents; and a qualitative semi-structured interview that elicited parents' perceptions of risks for young children, beliefs about how to protect them, and where parents' get information on safety hazards and protective practices. These measures were added at the first possible data collection point (e.g., at 15 months for the FLP; at 24 months for the DCHDP; and at 24 months for the FAFXS center). Other measures related to self-regulation were already a part of each project's protocol. In addition, the three projects had considerable overlap of other qualitative and quantitative measures of interest to this study. These measures are depicted in Tables 1 and 2, and described below.

Table 1-- Quantitative Assessment Tools (Appendix A provides a description of each measure)

	Family Life Project					Durham Child Health and Development Project					Family Adaptations to FXS Center		
<u>Assessment ages in months</u>	2	6	15	24	36	3	6	12	24	36	24	42	60
<u>Accident prevention and reporting</u>													
Safety checklist			x	x	x			x	x	x	x	x	x
Accident History	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>Parenting</u>													
Mother-child Interaction		x	x	x	x	x	x	x	x	x	x	x	x
<u>Mat. Characteristics</u>													
Depression	x	x	x	x	x	x	x	x	x	x	x	x	x
Knowledge	x					x							
Religiosity	x		x										
Authoritarian Attitudes		x			x		x		x		x		
Social Network	x	x	x	x	x	x	x	x	x	x	x	x	x
Income	x	x	x	x	x	x	x	x	x	x	x	x	x
Family Composition	x	x	x	x	x	x	x	x	x	X	x	x	x

Table 3--Qualitative Measures

	Family Life Project	Durham Child Health and Dev. Project	Family Adaptations to FXS Center
<u>Assessment ages in months</u>	Every 6 weeks from 5-8 months prenatally	Every 4 months, beginning when the	Every 18 months beginning at average

	through 2 ½ years of age, then every 6 months until 4 ½ years	child is 4 months old until child is 3 years old	age of 18 months for 3 times
Semi-structured Interviews (including parental views of child-rearing and self-regulation)	Each assessment	Each assessment	Each assessment
Participant Observation of parenting practices related to child safety and self-regulation	Each assessment	Each assessment	

D. Statistical techniques employed

Data analysis involved careful qualitative and quantitative analyses. In some cases, the qualitative analysis followed the quantitative one and was designed to illuminate the quantitative findings. In other cases, the qualitative analyses preceded the quantitative ones and were designed to be hypothesis generating. In the final case, parallel analyses were conducted and then conclusions from both sets of analyses were compared.

Most quantitative analyses involved either psychometric analyses to address questions of measures or general linear mixed models (aka hierarchical linear models) to test research hypotheses. The psychometric analyses involved confirmatory factor analysis within subgroups of interest to determine whether the anticipated structure held by SES and ethnic groups. Item response theory was used to look at differential item bias. These types of analyses were applied to measures of maternal depression, maternal religiosity, child safety practices, parenting, and children's social skills. Hierarchical linear model (HLM) examined change over time on parenting and use child safety practices as a function of social class, race, and parental characteristics

Qualitative analysis used procedures for designing questionnaires based on interview data (Weller, 1998). First, qualitative analysis examined the content validity of measures used in the quantitative studies. Interview data included prompts about the constructs being assessed by our measures of child safety practices, maternal depression, maternal religiosity, parenting, and discipline. Ethnographers analyzed the data to determine whether social class or ethnic differences emerged in the meaning of these constructs or in the interpretation of specific items.

Qualitative data analysis of substantive issues proceeded in three different ways, each of which will be used in various models of integration. First, all textual data from transcribed interviews and participant observations were coded in a systematic and rigorous manner through an analytic and iterative process (Miles & Huberman, 1994; Skinner, Rodriguez, & Bailey, 1999). For example, responses related to beliefs about what keeps young children safe or how and why one disciplines infants were coded as such for more in-depth analysis. Once coded, all data were entered into a powerful software program (NUD*IST-6) that was used to index (i.e., attach codes), search, and retrieve sections of data related to the topics of interest (e.g., beliefs about safety practices, perceptions of risk, style of parenting, beliefs about self-regulation). Powerful index searches enabled systematic content analysis of significant patterns, meanings, beliefs, relationships, and comparisons on the topics of interest within and across groups (Fielding & Lee, 1998). Skinner is experienced in using this program, and in developing systematic coding schemes. The second method of analysis was to write profiles of each family that included their patterns of beliefs, experiences, and reflections on their parenting strategies. Cultural models (sets of beliefs) were described for each family. A cultural models type of analysis was conducted on their accounts of why they believe what they do and why they do what they do in relation to child safety and self-regulation. Third, we used the profiles and the coded data collated on each specific topic to devise a matrix to reduce and display data for each family on the main topics of inquiry (e.g., safety precautions parents take; their understandings of what constitutes best parenting practices; where parents get information on safety precautions and best practices; other influences on their beliefs and practices; barriers to instituting safety precautions; perceptions of dangers and risk to the child in the home and larger environment; their feelings of control over the environment; cultural models of self-regulation;

style of parenting). The matrix allowed the researcher to compare systematically patterns and relationships within and across families and ethnic and socioeconomic groups (see Miles & Huberman, 1994, for examples) Any changes in beliefs and practices or changes in what influenced beliefs and practices was noted as well.

Triangulation of the qualitative and quantitative analyses involved separate analysis of the topics and relationships of interest and comparing findings to see if there was agreement as well as isolating findings that emerged in only one set of analyses. When convergence occurred, it was reassuring since the two methodologies are quite different. When convergence did not happen, further analysis was conducted to determine whether qualitative findings were supported by quantitative data or quantitative findings were supported by qualitative results. Remarkably, triangulation of the two types of data resulted in convergence for the analysis of all major substantive issues.

IV. Detailed Findings

We approached integrating qualitative and quantitative data using several different approaches and experienced varying levels of success across our papers and publications. These approaches included: using qualitative analyses to identify and focus research questions that were then examined quantitatively, using qualitative analyses to illustrate and deepen the understanding of the quantitative findings, and using quantitative analyses to broaden the understanding of the qualitative findings. Each of these approaches is discussed below with reference to the work we produced for this project, following a discussion of methodological contributions.

Methodological Papers. We published one methodological paper, presented several, and are preparing an integrative paper to submit this summer as either a monograph or methodological paper for a leading developmental journal. Our methodological paper, “Interdisciplinary research” was published in *The SAGE Encyclopedia of Qualitative Research Methods* and describes the various approaches to integrating qualitative and quantitative methods, the benefits of those methods, and the obstacles that make integration difficult. The methods and benefits are described above in some detail, but the major obstacles include lack of understanding of methods by “peer” reviewers and difficulties with having sufficient time to code and analyze data to allow for the hypothesized feedback loops. Both Drs. Burchinal and Skinner have presented locally at UNC seminars and nationally at invited conferences on integrating methods, and have greatly benefited from their experiences on this project in discussing issues and providing some of the relatively few examples on nontrivial integration of findings.

One important part of this methodological work will be to discuss obstacles to integrated work and solutions to these obstacles. One of the most commonly discussed benefits of integrated methods in longitudinal studies is the feedback loop. While this makes good sense theoretically, we discovered that it is challenging to process and analyze the data from one wave of data collection in time to inform data collection in the next wave. While we have some limited examples of this happening in the three studies (e.g., introducing new questions to the qualitative interviews in the FAFXS at Waves 2 and 3 to inform quantitative findings from Wave 1; introducing interview questions to the FLP to aid in validating measures and informing quantitative findings), this was mostly one-way: the qualitative component responding to quantitative findings. It was more difficult for the qualitative findings to influence the addition of new measures to quantitative data collection. However, in some cases the qualitative findings did influence how the quantitative analyses were done and led to some reconceptualization of concepts. One primary example was in the FLP where qualitative findings about the complexity of family composition led to different quantitative analysis models to ascertain the complexity of families in the larger sample. For the most part, though, it is our conclusion that use of the

feedback loops is very difficult in large longitudinal studies and succeeds only when the primary researchers make concerted attempts to communicate and discuss in depth creative ways to take into account insight and findings from both components. Because systematic feedback based on fully analyzed data is hard to achieve in the timeframes of research projects, a solution is to be clear about the research questions, concepts, and domains of particular interest and ensure that comprehensive data are collected in both the qualitative and quantitative components that address these areas. This allows for integration at the final analysis stage.

Another barrier has been the reviewers and editors of peer-reviewed journals. Journals primarily publish either studies based on quantitative data or on qualitative data and their reviewers generally are only accustomed to one method or the other. Few reviewers are “bi-method.” What this means for integrated articles is that reviewers are seldom familiar with standards for qualitative data collection, analysis, and writing. Quantitative reviewers expected comparable data collection methods for the qualitative and quantitative data. For example, they expected or were only aware of “coding” as a method of analysis and invariably the most important question then becomes “what is the inter-coder reliability”. Yet there are multiple ways of doing qualitative analysis and writing up the results. The requirements for “coding” effectively limit the range of possible ways to do qualitative analysis to content analysis. Qualitative researchers often have to compromise and water down their interpretative analysis to succeed in getting published in a primarily quantitative journal. There is much to be written about coding as actually limiting analysis. Also, a problem is the use of terms. For example, a qualitative researcher means sometime entirely different by the word “culture” than what this term means for quantitative researchers. There is much work to be done educating quantitative reviewers about the methods and the terms used in qualitative research. There were also criticisms of the quantitative analyses in the papers that more carefully focused on the qualitative data. In the paper on religion as a support for families of children with FXS, for example, initial reviewers did not like the full reporting of both methods. It did not work because the genres of reporting were too distinct. In this case, we “watered down” the quantitative analysis to incorporate the findings in ways that did not disrupt the narrative flow of the qualitative analysis (Michie & Skinner, under review). The hardest barrier to overcome was the prejudices among some editors who wanted to include only one type of data in a given paper and who suggested that we write separate papers.

Another methodological contribution involved examining the validity of quantitative instruments using mixed methods. We examined the validity of a widely used measure of depression, the BSI, which was not showing anticipated levels of depression among the low-income African American mothers. The FLP mothers in the qualitative study were interviewed about depressive symptoms and given the BSI. There was relatively good correspondence between the mother’s self-report and the BSI scores, suggesting that cultural bias did not account for the low levels of depression in our quantitative data on this instrument. A similar approach was used to examine our measure of religiosity in the FLP study. This mixed model analysis suggested that the instrument was not measuring the aspects of religious beliefs and practices that the mothers reported were very important to them, typically stated in terms of their personal relationship with God. Instead the questionnaire tended to focus on the role of the church in the daily lives of the respondents rather than their personal relationship with God. In the FAFXS, as part of the quality of life (QOL) analysis (Wheeler, Skinner, & Bailey, 2008), we examined interview data on mothers’ perceptions of their quality of life and the factors that enhanced or impeded QOL, and compared the meanings and dimensions of QOL in their responses with the domains and items of the Quality of Life Inventory (QOLI). We concluded that although the scores from the QOLI provided a basis by which we could examine predictor variables, items on this Inventory did not fully capture the depth or dimensions of the women’s experiences. For example, the item

on the QOLI related to children did not tap into how important caregiving is to these mothers and how their ability to provide care figures into their quality of life. In addition, children may be very important for a mother's happiness, but standardized measures have not assessed how the child's problems and other people's responses to the child can decrease one's quality of life and create stress. Women sometimes felt overwhelmed by their child's delays or behaviors and day-to-day responsibilities, which in turn influenced their day-to-day perceptions of their quality of life. The qualitative data indicated that quality of life was not necessarily global or stable, and can vary by the day or even hour, depending on what is going on with the child.

Qualitative Analyses Focuses Research Questions for Quantitative Analyses. In several papers the qualitative analysis identified and focused the research questions that were examined more broadly in the quantitative analyses. The paper on parenting (Burchinal, Skinner, & Reznick, in review) addresses one of the primary substantive questions addressed in the proposal. Ethnographers asked mothers in the DCHD qualitative study about their beliefs and strategies related to rearing infants. Almost all mothers reported that they believed that infants needed warmth and stimulation, but a small proportion of the mothers reported that infants needed to be taught to obey. These mothers believed that their infants were intentionally testing them to gain dominance, and that failure to punish the infants would spoil them. Spoiled infants were likely to become children with behavior problems so good mothers needed to teach their infants to obey. We then used these findings to look at the extent to which mothers in the much larger quantitative studies expressed concerns about spoiling their 6-12 month-old infants, thought their infants were intentionally misbehaving, and had traditional attitudes about the need for children to obey adults. These attitudes were then used to predict parenting behaviors, finding that mothers who expressed more concerns about spoiling infants and who believed infants were intentionally misbehaving showed substantially less positive parenting toward their babies.

We are also using this approach in a paper on parenting styles of children with fragile X syndrome (Skinner & Warren, in preparation). Findings from the qualitative data about parenting styles, beliefs, and differences in these between typically developing and affected children will inform the quantitative analysis plan.

Qualitative analyses illustrate and explain the quantitative findings. A second approach involves conducting quantitative analyses first and then using qualitative analyses to provide illustrative examples or to further the understanding of the quantitative findings. This approach was used in two papers, one of which addressed one of the central substantive issues in our proposal. The paper by Zolotor et al., (2008) examined the extent to which mothers of infants implemented recommended safety practices in rural NC and PA. We found that maternal knowledge about child development and maternal depression predicted the use of these practices, with knowledge increasing the likelihood of implementing practices that involved installing equipment among mothers who reported more depressive symptoms. In addition, mothers were more likely to implement more safety practices when they reported their child was more active. An examination of the qualitative interviews indicated that mothers were aware of household hazards and reported that close supervision was the most common practice to avoid injury. Child proofing the house and educating their infants through scolding were also noted. Perhaps most interestingly, the major obstacles included a belief that there was only a limited amount one could do to prevent injuries as well as lack of money or living in someone else's house. The interaction between maternal depression and knowledge about child development was illustrated in the interviews with two women with depression. One woman child proofed her house after

attending a program on injury prevention offered by her pediatrician. The other women relied on instructing her infant to stay away from things.

A second paper, Burchinal et al., (in review) examined child care use in these rural families in NC and PA. The quantitative analysis revealed that use of informal care setting (e.g., care by friends and family) was the most common when mothers worked part-time but that use of centers was the most common when mothers worked full-time. The qualitative interview revealed that mothers preferred to have family or friends care for their infant due to concerns about health and safety, but needed to rely on dependable formal care settings when they worked full-time. Those mothers also expressed concerns about health and safety in centers, but realized that informal providers were too likely to be unavailable at the last minute and lack of child care could threaten their ability to remain employed.

A third paper also used ethnographic data to explain quantitative findings. The Flowers et al. (2008) paper combined both sets of data to identify beliefs about and practices regarding breastfeeding. Quantitative findings indicated how many women (55%) initiated breastfeeding and continued (18%) for at least 6 months, and the factors associated with these practices (e.g., maternal employment at 2 months and receiving WIC were associated with decreased breastfeeding initiation and continuation). Ethnographic data indicated the reasons why women had never even considered breastfeeding and often discontinued breastfeeding (e.g., discomfort, embarrassment, and lack of assistance).

Quantitative analyses to broaden the understanding of the qualitative findings. In the paper, “Narrating disability, narrating religious practice: Reconciliation and fragile X syndrome” (Michie & Skinner, under review), we presented a narrative analysis of how 60 mothers of children with FXS combined narratives of religious practice with illness narratives, interpreting their children’s disabilities within a religious framework. We found that a majority of these mothers articulated a “reconciliation” narrative to describe their transition from viewing disability as a burden or challenge to seeing it as a blessing, or as a part of God’s purpose or plan for their lives. Initially reviewers were skeptical of the degree to which families espoused these kinds of religious beliefs but quantitative data from a scale that measured religion as support substantiated this finding and convinced reviewers of the validity of the qualitative analysis.

V. Discussion and Interpretation of Findings

A. Conclusions to be drawn from findings (with reference to data supporting each).

Most of our mixed model analyses yielded complementary findings (see all papers). As anticipated in our review of methods, all three approaches were useful in providing a more comprehensive understanding of each specific topic. The ethnographic interviews provided insights into people’s beliefs and motivations. These insights were then linked with the results from the quantitative analyses of the larger study samples. For example, the ethnographic interviews revealed that some mothers thought punishing their infant was necessary because the infant was behaving badly deliberately. This finding generated hypotheses about relations among concerns about spoiling infants, attitudes toward punishing infants, and parenting practices. We believe these findings demonstrate how mixed methods can enhance the understanding of findings from research studies.

In contrast, our experiences also identified barriers. As anticipated, we struggled with editors and reviewers who are used to either solely quantitative or qualitative analyses. They preferred single method rather than mixed method papers. We did not anticipate

the problems with using a feedback loop. It was not possible for us in all projects and for all topics to conduct systematic analyses of data from one wave in time to provide feedback either within or across methods for the next wave of data collection.

Finally, we believe we have made substantive contributions to our understanding of diverse issues including implementation of child safety practices among low-income rural parents of infants, use of punishment for infants, selection of child care for infants, and understanding dimensions of quality of life and parenting among parents of children with Fragile X.

B. Explanation of study limitations

There were several limitations to this study. First, we used existing studies that had all been designed to have both qualitative and quantitative data collection and analysis components. However, none of them was designed to optimize the integration of methods. Therefore, the generalizability of our findings is somewhat limited. We were probably much more successful than we would have been with studies that did not deliberately plan on and endorse collecting both types of data. In contrast, we were probably less successful than we would have been if we had designed the study to optimally integrate the two types of data and have been totally in charge of study implementation.

Second, all three studies focused on infants and toddlers which limited our ability to examine longitudinal issues. Most developmental outcomes emerge at the end of infancy or during the preschool years. Therefore, there were limited opportunities for collecting repeated measures on the children in these studies in the quantitative part of the study.

Third, we had planned an ethnographic study of our co-investigators on the selected studies. We had concerns about studying and interviewing our colleagues since they were friends and collaborators. We certainly documented the process of integration, what PIs and others said about the integration of methods, and the content and discourse of research meetings related to mixed methods, but we did not do the individual interviews in a formal sense with PIs about their attitudes toward mixed methods research. We do have ethnographic notes about what worked and why, and what did not work and why, and some of this was incorporated into Skinner & Burchinal (2008). We will also use findings from these ethnographic fieldnotes in the article that is in preparation about large-scale mixed methods research.

C. Comparison with findings of other studies

I know of only one other study that conducted mixed model analyses with a large child development project. A mixed method analysis of Project New Hope data was conducted to determine how their welfare-reform experiment changed families in an effort to understand why it was successful in improving child outcomes (Yoshikawa, Weisner, & Lowe, 2006). As in one of our studies (the Durham Project), a subset of the mothers involved in the larger quantitative study were interviewed regularly. Those interviews focused on questions linked directly to the issues examined in their quantitative analysis. This close linkage between the issues examined in ethnographic interviews and in quantitative interviews and assessments allowed them to draw conclusions about the mechanisms accounting for their successful intervention. We believe their methodological findings are consistent with ours, and that Project New Hope offers one type of exemplar model of how to do mixed methods research.

D. Possible application of findings to actual MCH health care delivery situations

Our findings regarding the use of safety practices and the use of physical punishment with infants might have implications for MCH health care delivery situations. If our findings regarding who implements safety practices to prevent injuries are causal, they suggest that pediatricians can play a critical role in communicating to mothers what infants are and are not capable of doing or thinking, especially if those mothers show depressed symptoms. Similarly, if our findings regarding the extent to which the use of punishment with infants is linked to a belief that infants can deliberately misbehave are causal, then pediatricians might attempt to educate mothers of young infants regarding the infant's limited ability for intentional misbehavior and the possible negative consequences of severe punishment.

E. Policy implications

None

F. Suggestions for further research

Further research is needed to determine the extent to which our methods of integrating methods can be carried out in a variety of studies and, ideally, in studies that can better address issues of selection bias. Ideally those studies would also include both qualitative and quantitative data collection and analysis.

VI. List of products (peer reviewed articles, books, chapters in books, master and doctoral dissertations, conference presentations, etc.).

Completed Papers

- Brady, N., Skinner, D., Roberts, J., & Hennon, E. (2006). Communication in young children with fragile X syndrome: Mothers' perspectives. *American Journal of Speech-Language Pathology, 15*, 353-364.
- Flowers, K., Willoughby, M., Cadigan, J., Perrin, E., Randolph, G., & Family Life Project Investigators. (2008). Understanding breastfeeding initiation and continuation in rural communities: A combined qualitative/quantitative approach. *Maternal and Child Health Journal, 12*(3), 402-414 ; (doi 10.1007/s10995-007-0248-6).
- Skinner, D., & Burchinal, M. (2008). Interdisciplinary research. In L. Givens (Ed.), *The SAGE Encyclopedia of Qualitative Research Methods*. Sage.
- Wheeler, A., Skinner, D., & Bailey, D. B. (2008). Perceived quality of life in mothers of children with fragile X syndrome. *American Journal on Mental Retardation, 113*(3), 159-177.
- Willoughby, M., Cadigan, J., Burchinal, M., Skinner, D. (2008). An evaluation of the psychometric properties and criterion validity of the religious social support scale. *Journal of the Scientific Study of Religion, 47*(1): 147-159. (doi 10.1111/j.1468-5906.2008.00398).
- Zolotor, A., Burchinal, M., Skinner, D., & Rosenthal, M. (2008). Maternal psychological adjustment and knowledge of infant development as predictors of home safety practices in rural low-income communities. *Pediatrics, 121*, 6, pp. e1668-e1675 (doi:10.1542/peds.2007-1255).

Papers in Review:

- Burchinal, M., Skinner, D., & Reznick, S. European American and African American mother's beliefs about parenting and disciplining infants: A mixed-method analysis (Revised and resubmitted)
- Burchinal, M., Skinner, D., Vernon-Feagans, L., & the Family Life Project Investigators. Infant child care in rural, low-income communities. (Revised and resubmitted)
- Michie, M., & Skinner, D. Narrating disability, narrating religious practice: Reconciliation and fragile X syndrome (Manuscript under review).
- Raspberry, K., & Skinner, D. Negotiating desires and options: How mothers who are carriers of FXS experience reproductive decisions. (Manuscript under review).

Manuscripts in Preparation:

Garrett-Peters, P., Mills-Koonce, R., & Skinner, D. Mothers' beliefs about their children's emotion display and socialization: A mixed methods approach.

Skinner, D. Family communications about fragile X syndrome.

Skinner, D., & Warren, S. Parenting styles of parents of children with fragile X syndrome.

Skinner, D., Burton, L., & Burchinal, M. Large-scale mixed methods research.

Presentations:

Burchinal, M. R., & Skinner, D. (March, 2007). Infant child care in rural low-income communities: An integrated quantitative and qualitative analysis of family life project data. Poster presentation at the Biennial Meeting of the Society for Research in Child Development, Boston, MA.

Burton, L., Cherlin, A., Skinner, D. & Destro, L. (2006). Multi partner fertility patterns in low-income urban and rural families. Paper presented at the annual meeting of the American Sociological Association. Montreal, Canada. August 2006.

Burton, L., Matthews, S., & Skinner, D. Structuring discovery: A model and method for multisite team ethnography. Methodological Seminar. American Sociological Association Meetings, Philadelphia, PA, August 16, 2005.

Burton, L.M. & Skinner, D. (2005). Big science ethnography and exploring life course health in low-income minority populations. Paper presented at the annual meeting of the Gerontological Society of America, Orlando, FL, November 2005.

Skinner, D. "Large-scale qualitative research." Workshop to be presented at Research Talk Qualitative Research Summer Intensive. Long Island, NY, June 24-25, 2009.

Skinner, D. "Longitudinal qualitative research." Workshop to be presented at Research Talk Qualitative Research Summer Intensive. Long Island, NY, June 26, 2009.

Skinner, D. Bioethical and sociocultural issues in family communications about fragile X syndrome. Presentation at the Center for the Integration of Genetic Healthcare Technologies (Penn CIGHT), University of Pennsylvania, Philadelphia, PA, April 17, 2009.

Skinner, D. "Large-scale qualitative methods." Two-day intensive workshop presented at Research Talk's 6th Annual Qualitative Research Summer Intensive, Long Island, New York, August 9-14, 2008

Skinner, D. "Longitudinal qualitative methods." Seminar presented at Research Talk's 6th Annual Qualitative Research Summer Intensive, Long Island, New York, August 9-14, 2008

- Skinner, D. et al. (2008). Families' lived experiences of fragile X syndrome. Presented at the 11th International Fragile X Conference, St. Louis, Missouri, July 23-27, 2008.
- Skinner, D. (2008). Parents' cultural models and cultural productions of intellectual disabilities. Paper presented at the Society for Applied Anthropology, Memphis, Tennessee, March 25-29, 2008.
- Skinner, D. (2007). Family communications about fragile X syndrome. Paper presented at the International Society on Early Intervention (ISEI). Zagreb, Croatia, June 14-16, 2007.
- Skinner, D. (2006). Parents' perspectives on newborn screening for fragile X syndrome. Presented at the 10th International Fragile X Conference. Atlanta, GA, July 19-23, 2006.
- Skinner, D. (2006). Parents' perspectives on newborn screening and family communications. Presented at the CDC collaborative project Focused Advisory Meeting on Screening and Ethical Issues in fragile X syndrome. Chapel Hill, North Carolina, March 5, 2006.
- Skinner, D., Schaffer, R., & Bailey, D. (2005). Family communications about fragile X syndrome. Presented at the Vth European Congress Mental Health in Mental Retardation, Barcelona, October 6-8, 2005.
- Skinner, D. "Using mixed methods in social and educational research." Seminar/workshop at the University of Porto, Portugal, May 15-18, 2006.
- Wheeler, A., & Skinner, D. (2006). Perceived quality of life in mothers of children with FXS. Presented at the 10th International Fragile X Conference. Atlanta, GA, July 19-23, 2006.
- Zolotor AJ, Burchinal M, Skinner D, Rosenthal M. Maternal Knowledge of Infant Development and Psychological Adjustment as Predictors of Home Safety Practices. Presented at the Pediatric Academic Societies Meeting. Toronto, ON. May 6, 2007.

Appendix A Measures

Quantitative measures

Children's development-

Observed temperament. For the assessment of emotional reactivity and regulation of state, a series of challenge task procedures are used that are designed to increase the child's potential to display emotional and physiological reactivity. The challenge task procedures have been validated in multiple studies (e.g., Buss & Goldsmith, 1998; Stifter & Braungart, 1995; Kochanska et al, 1998) and two of them are a part of a standardized observational battery for the assessment of temperament known as the Laboratory Temperament Assessment Battery (Lab-TAB) (Goldsmith & Rothbart, 1988). Each of the tasks to be utilized in this study have been used reliably and effectively in the home environment in previous studies (Kochanska et al., 1998). Tasks last approximately 3 minutes, and include an arm restraint and barrier task to induce anger/frustration, and masks and mechanical spider to induce fear. These tasks are videotaped for later coding of child behavior.

Stress reactivity -Stress reactivity is assessed through the collection of salivary cortisol at three times per visit: prior to challenge tasks, immediately following the completion of the "challenge tasks", and 30 minutes post challenge. Prior to immunoassay for cortisol, samples are screened by immunoassay or the presence of blood proteins not normally in concentrations above 0.5 mg/dl in saliva, and the sample's pH are checked and corrected if outside the acceptable range (pH 4-9)

Behavior questionnaire The Infant Behavior Questionnaire (Rothbart, 1981), Toddler Behavior Assessment Questionnaire (Goldsmith, 1996), and the Child Behavior Questionnaire (Goldsmith and Rothbart, 1996) are parent-report measures designed to assess child temperament. They are based on an empirically validated psychobiological theory of temperament (Derryberry & Rothbart, 1988). The infant scale contains 98 items measuring 6 dimensions of temperament (activity level, smiling and laughter, distress to novelty, distress to limitations, duration of orienting, & southability), and the toddler scale and child scales measure 5 subscales (activity level, pleasure, social fearfulness, anger proneness, and interest/persistence). Overall, the scales have been widely used, show high longitudinal stability, and good psychometric properties.

Cognitive Skills. Mullen Scales of Early Learning is a comprehensive, standard measure of development for children from birth to 68 months (Mullen, 1995). It consists of five scales: visual reception, gross and fine motor, and receptive and expressive language. Scores for each scale include t scores, percentile ranks, and age equivalents. The test has demonstrated strong concurrent reliabilities with other developmental tests and has been used successfully with children in the Carolina Fragile X Project.

Family Characteristics

Family demographics and household composition Household composition are obtained in an interview with the mother, and includes a list of who lives in the child's household (resulting in coding families at each time as nuclear two-parent family, extended family, single-parent family, blended family, etc. as well as recording stability of the child's living situation). Parental education, employment, income, marital status, etc. are also obtained in an interview with the mother.

Social Support. The QSS (Crnic, et. al., 1983) is comprised of 5 subscales corresponding to different ecological levels of social support: 1) Community, 2) Friendship, 3) Extended family, 4) Intimate, and 5) Workplace. These five subscales are scored independently. Items for each type of support involve two levels of information: one which asks about the presence or amount of support available, and one which asks for the respondent's satisfaction with the amount of support they perceive from that source. Validity of this instrument has been well established across numerous studies (Crnic et. al., 1983, 1986; 1988; 1990; 1997).

Child rearing attitudes Mothers' and fathers' beliefs about child-rearing and education are measured using The Parental Modernity Scale of Child-rearing and Educational Beliefs (Shaefer & Edgerton, 1985). The 30 items on it are scored on a five-point scale from 1 ("Strongly agree") to 5 ("Strongly disagree") yielding a total score and two subscale scores reflecting 1) beliefs favoring self-directed child behavior (child-centered) and 2) beliefs that child behavior should follow adult directives (adult-centered). The total score was used in the current analyses. Internal consistency ranges from 0.88 to 0.97, and validity has been demonstrated in the Abecedarian (Burchinal et al, 1997) and NICHD Study of Early Childcare (NICHD ECCRN 2000).

Parental depression. Parents' symptoms of depression are assessed at each time period using the CES-D scale (Ensel, 1986), a short self-report scale designed to measure depressive symptoms in the general population. Respondents are asked how often they experienced each of 20 symptoms during the past week on a 4-point scale ranging from none of the time to most of the time. The CES-D was tested in household interview surveys and clinical settings and has been found to have high internal consistency and adequate test-retest reliability.

Parent-child interaction. Mother-child and father-child interactions are observed in a 10-minute free play interaction using a standard set of toys. Age-appropriate, but challenging toys are used. The coding system developed for NICHD Study of Child Care (NICHD ECCRN, 1999) is being used in the FLP and DCHDP, and an almost identical coding system (Landry et al, 1998) is proposed for the Fragile X study. The observations are videotaped and coded later. The global 7- point scales are coded for parent behaviors: parental sensitivity/supportiveness, detachment/disengagement, intrusiveness, stimulation of development, positive regard for the child, negative regard for the child, and flat affect. Child scales include positive mood and negative mood. One dyadic scale, dyadic mutuality, is also scored. Reliabilities in using these parenting scales in both the NICHD Study and in research by Cox (Cox et al, 1999) have been .80 or higher.

Additional Measures for Study 1. All three projects have agreed to add the following measures to Study 1:

Accident prevention and reporting

Child Safety Practices. An extensive survey instrument developed to assess maternal childhood injury health beliefs and social influences (Russell, 1991) is the bases of our instrument (see Appendix B). A single scale from the original survey is used to assess maternal self-report of her ability to perform injury prevention practices. The scale consists of 25 items specific to burns, falls, poisoning, suffocation, laceration and firearms. Responses are recorded on a 5-point Likert scale: 1.Never, 2. Hardly ever, 3.Half of the time, 4. Most of the time, and 5. All of the time. The items were originally developed from literature and educational materials previously developed by Bass, Mehta, Ostrovsky and Halperin (1985). The scale was found to be internally consistent (Cronbach's alpha =.86) and reliable (test-retest correlation=.30).

Medical History. At each assessment, the mother or primary caregiver is asked, in three separate questions, the number of times since the last assessment that the child experienced accidents requiring 1) treatment at a hospital, 2) treatment at the emergency department, or 3) treatment in the doctor's office. These questions were used successfully in prior studies of safety education (Kelly et al., 1987). Since the sample includes participants with meager resources and perhaps little access to medical facilities, additional questions ascertain since the last assessment the number of times the child experienced an accident which required treatment at home (excluding very minor scratches or bruises).

Qualitative Interviews.

All three studies include semi-structured, ethnographic interviews that are designed to elicit information on the same constructs as are measured quantitatively, including mother's perceptions of child's temperament, expectations for the child, social supports, and parenting practices. In each interview, a general question about a domain of interest is followed by specific probes and requests for examples. Interviews typically last for 90 minutes and are tape recorded and transcribed for data analysis.

For this study, an interview modeled after the interview protocols used in the three projects will be devised to elicit what parents know about safety; what strategies they use to keep their children safe; where they get information about safety practices (e.g., pediatrician, Internet, relatives, teachers, magazines); perceptions of dangers and risks in the home and community; any barriers to instituting safety practices; and conceptions of child development that coincide with perceptions of safety and risk (e.g., When is a child old enough to not need supervision; Is a young child's non-compliance with verbal instructions viewed as volitional?). A set of questions will also focus on the cultural and environmental influences on these beliefs and practices.