



Modeling multiple risks during infancy to predict quality of the caregiving environment: Contributions of a person-centered approach

Stephanie T. Lanza^{a,*}, Brittany L. Rhoades^a, Mark T. Greenberg^a,
Martha Cox^b, The Family Life Project Key Investigators

^a The Pennsylvania State University, United States

^b The University of North Carolina at Chapel Hill, United States

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ABSTRACT

The primary goal of this study was to compare several variable-centered and person-centered methods for modeling multiple risk factors during infancy to predict the quality of caregiving environments at six months of age. Nine risk factors related to family demographics and maternal psychosocial risk, assessed when children were two months old, were explored in the understudied population of children born in low-income, non-urban communities in Pennsylvania and North Carolina ($N = 1047$). These risk factors were (1) single (unpartnered) parent status, (2) marital status, (3) mother's age at first child birth, (4) maternal education, (5) maternal reading ability, (6) poverty status, (7) residential crowding, (8) prenatal smoking exposure, and (9) maternal depression. We compared conclusions drawn using a bivariate approach, multiple regression analysis, the cumulative risk index, and latent class analysis (LCA). The risk classes derived using LCA provided a more intuitive summary of how multiple risks were organized within individuals as compared to the other methods. The five risk classes were: married low-risk; married low-income; cohabiting multiproblem; single low-income; and single low-income/education. The LCA findings illustrated how the association between particular family configurations and the infants' caregiving environment quality varied across race and site. Discussion focuses on the value of person-centered models of analysis to understand complexities of prediction of multiple risk factors.

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1. Modeling multiple risks during infancy: contributions of a person-centered approach

The identification of risk factors for early cognitive and behavioral development is important because a risk-focused approach provides a framework for understanding etiology as well as targeting at-risk individuals in order to improve developmental outcomes (Catalano & Hawkins, 1996; Hawkins, Catalano, & Miller, 1992). Historically, different methods have been used to model risk, each providing a somewhat different framework for understanding the risks associated with children's outcomes. However, most current theories agree that risk occurs in combination, not in isolation. It is this intersection or accumulation of risks, rather than any single risk factor, which accounts for the preponderance of negative developmental outcomes (Appleyard, Egeland, Van Dulmen, & Stroufe, 2005; Deater-Deckard, Doge, Bates, & Pettit, 1998;

* Corresponding author at: Penn State University, The Methodology Center, 204 E. Calder Way, Suite 400, State College, PA 16801, United States.
E-mail address: SLanza@psu.edu (S.T. Lanza).

Flouri & Kallis, 2007; Sameroff, Seifer, Baldwin, & Baldwin, 1993). According to cumulative risk theory, this accumulation of risks may overwhelm the individual's capacity to adaptively negotiate their environment (Gutman, Sameroff, & Cole, 2003; Gutman, Sameroff, & Eccles, 2002; Sameroff et al., 1993). In this view, it is the total number of risks, not the specific combination of risks that is most important in predicting outcomes. This view has come under debate in recent years, however, as more sophisticated methodological techniques have become available and researchers have turned to identifying specific subgroups of individuals in need of preventive interventions.

There are two primary goals of this study. First, we use variable- and person-centered approaches to examine how family/parent risk factors in infancy predict the quality of caregiving environments in the Family Life Project, a large naturalistic study of non-urban children followed from birth. As discussed below, the quality of the caregiving environment in infancy is a key factor in the prediction of child competence later in life (Bradley & Corwyn, 2001; Bradley, Caldwell, & Rock, 1988; Bradley, Corwyn, McAdoo, & Garcia Coll, 2001b; Carlson & Corcoran, 2003; Downer & Pianta, 2006). Here we focus on structural/demographic and maternal psychosocial risks in the earliest months of life that predict the quality of the caregiving environment. Second, we assess the conclusions that can be drawn using different statistical models of risk, highlighting the value of a person-centered approach.

Modeling multiple risks typically involves a variable-centered framework, where the influence of one or more variables on an outcome is assessed. Variable-centered approaches are used to examine the relations between variables and/or to identify processes common to a group of individuals (Laursen & Hoff, 2006). However, these approaches often assume that all individuals at a certain level of the predictor are at equal risk for an adverse outcome regardless of other risk factors or individual characteristics, and that the relation between a risk factor and outcome is the same across the entire population.

A person-centered framework, on the other hand, assumes that development is a result of multiple, interacting factors at various levels of the person-environment system (Bergman & Trost, 2006). Whereas variable-centered analyses describe the mythical "average person," person-centered analyses identify particular constellations of characteristics, in our case risk factors, that describe real sub-groups of children (Lewin, 1931; Magnusson & Bergman, 1990; von Eye & Bogat, 2006). The person-centered approach is vital in studies like the present one where the goals are (1) to understand how constellations of multiple, interacting risk factors are associated with the quality of children's caregiving environments, and (2) to identify groups of children who are at highest risk for later poor outcomes.

1.1. Variable-centered methods for modeling multiple risks

Three common variable-centered approaches to modeling multiple risks are bivariate methods, multiple regression analysis, and the cumulative risk index. The most straightforward way to explore risk associated with a set of factors is a *bivariate approach* which tests for associations between each risk factor and outcome (e.g., Reinherz, Giaconia, Carmola Hauf, Wasserman, & Silverman, 1999). This approach can provide valuable descriptive information, but falls short in several ways. First, the likelihood of Type I errors of chance findings increases as each variable is considered separately. Second, risk factors are assumed to be equal regardless of how many or which other factors are present (i.e. interactions of risk factors are disregarded). Third, and perhaps most importantly, the variable-centric information produced is difficult to utilize alone because it provides no further insight into a person's true risk based on other risk factors (Bergman & Magnusson, 1997).

Perhaps the most common multivariate approach is *multiple regression analysis*, in which each factor is weighted according to the strength of its relation with the outcome (e.g., Luthar, Cushing, Merikangas, & Rounsaville, 1998). Although the differential impact of individual risk factors can be examined, interactions are often not examined due to a lack of statistical power. Without interaction terms, a regression approach assumes that risk associated with one factor is homogenous across levels of all other factors. In addition, the high levels of multicollinearity that often exist among risk factors can mask the role of important factors.

Another approach, first introduced by Rutter (1979), is the *cumulative risk index*. In this approach the quantity of risk factors to which a child is exposed is captured by summing across a set of risk factors coded 1 for risk or 0 for no risk (e.g., Lengua, 2002; Seifer et al., 1996). This approach lends itself well to theories of risk where the quantity of risk is emphasized rather than specific risk factors. Findings based on a cumulative risk index have some limitations. First, individual risks often potentiate each other such that the risk of a particular factor is increased when it occurs in conjunction with other factors. A cumulative risk index assigns equal weight to each factor and does not allow for the exploration of interactive effects. Perhaps more importantly, risk factors are seen as interchangeable. For example, an index score of three provides no information about *which* three factors are present for that child; all children with a score of three are assumed to be at equal risk. Finally, because an index score does not describe which risks are present for an individual, this approach is not conducive to developing preventive programs aimed at mitigating specific risk factors. Despite these limitations, numerous empirical studies report that the accumulation of risk rather than any single, specific risk is often a better predictor of a variety of developmental outcomes (Appleyard et al., 2005; Deater-Deckard et al., 1998; Flouri & Kallis, 2007; Sameroff et al., 1993).

1.2. Person-centered methods for modeling multiple risks

Although the variable-centered approaches to risk have been informative, the field may benefit from approaches that identify subgroups of individuals who are characterized by particular combinations of factors associated with the highest

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