

Commentary: Environmental Influences: Issues of Timing and Type

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Long-term neurodevelopmental outcome is frequently considered the benchmark in determining the natural sequelae of biologic risks, or the efficacy of various medical interventions in infants born at extremely low birth weight (ELBW; Aylward, 2005). Initially, primary emphasis in outcome studies was placed on major disabilities: moderate/severe intellectual disabilities, sensorineural hearing loss/blindness, cerebral palsy, and epilepsy. However, increasing numbers of “non-disabled” survivors subsequently were found to display problems at later ages. These high prevalence/low severity dysfunctions include learning disabilities (written expression, math, reading), borderline/low average IQ scores, neuropsychological deficits (e.g., visual motor integration, executive function) and behavior problems (Aylward, 2002, 2005). These dysfunctions occur in 50–70% of those born at ELBW, and 70% of these children require special education services (Taylor, Klein, & Hack, 2000). High prevalence/low severity dysfunctions tend to aggregate and work synergistically (Aylward, 2002, 2005).

While major disabilities can be identified early, high prevalence/low severity dysfunctions often become more obvious as the child grows older. Therefore, the social, ethnic, and educational backgrounds of parents have a greater likelihood of influencing these problems in longitudinal follow-up. This situation has an impact on casual inferences by introducing risk and protective factors as mediators and moderators of ELBW and later outcomes (Rose, Holmbeck, Millstein Coakley, & Franks, 2004).

Environment contains “process” (proximal aspects experienced most directly; mother–infant interactions, stimulation in the home) and “status” features (distal or broader, involving aspects that the child experiences more indirectly; socioeconomic status, neighborhood) (Aylward, 1992). Process or proximal environmental variables are more predictive early on, while status factors are more influential later (Brooks-Gunn, Duncan, & Aber, 1997). Sociodemographic factors are associated with verbal, academic, and general cognitive abilities; both biomedical and

environmental risks affect learning disorders (Aylward, 1992, 2002). Brofenbrenner’s “microsystem” incorporates these factors and includes various aspects of the immediate environment (family, school, peer group, neighborhood, and childcare milieu).

The paper by Andreias et al. (2009) has many strengths: a control group, use of a theoretic model, a multilevel modeling approach, adequate follow-up compliance, and inclusion of various measures of the microsystem. At 8 years of age, family environment had a greater influence on academic achievement than did neighborhood characteristics (poverty rate, high school dropout rate). Neighborhood had an effect over and above that of individual and family variables, indicating a unique contribution. However, the model that included individual, family, and neighborhood factors accounted for the most explained variance.

The current data raise the possibility of an evolving proximal–distal locus of environmental influence; however, qualitative influences of each level of environment change over time. At the specific age of 8 years, family influences are greater than those of the neighborhood, although there is still some unique neighborhood explanatory power. Had measures been taken in adolescence, it is feasible that neighborhood influence would overshadow that of the family. Conversely, in early childhood, neighborhood influences could have been minimized.

This raises the issues of timing and type of assessment. Different variables have varying levels of impact on specific outcomes at different ages. This is a critical issue in longitudinal studies. Moreover, interactions among socio-demographic variables themselves differ, depending on time of assessment (Kato Klebanov, Brooks-Gunn, & McCarton, 1998). Environmental exposures are additive, and unfavorable environmental characteristics tend to cluster. The cumulative effects of poverty have a negative, potentiating influence on other determinants. Add to this genetics, nutrition, exposure to toxicants, and chronic stress. It is virtually impossible to measure all of these

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environmental components; hence, there is a need to carefully select proper environmental “marker variables” and acknowledge possible unidentified interrelationships.

Andreias et al. (2009) provide a snapshot of environmental risks at 8 years, and the levels of environmental influence (proximal–distal) on achievement may be specific to that age. A related contemporary environmental influence model was reported earlier in a classic paper by Bradley, Caldwell, and Rock (1988): experiences occurring nearer in time to the measurement of outcome are more influential. In addition, the interplay among variables is dynamic and not fixed over time, arguing for repeated measurement of various environmental factors at the time of outcome assessment, and strong consideration of the effects of the milieu into which the child at biologic risk is placed, particularly with respect to academic achievement. On a broader scale, this dynamic interplay issue also is relevant to many other topics in pediatric psychology such as adjustment to chronic medical conditions, adherence issues, or targeting interventions.

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