

# Individual and Environmental Factors Influencing Questionable Development among Low-income Children: Differential Impact during Infancy versus Early Childhood

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**Purpose:** From the holistic environmental perspective, individual and environmental influences on low-income children's questionable development were identified and examined as to differences in the influences according to the child's developmental stage of infancy (age 0-35 months) or early childhood (age 36-71 months). **Methods:** This study was a cross-sectional comparative design using negative binomial regression analysis to identify predictors of questionable development separately for each developmental stage. The sample was comprised of 952 children (357 in infancy and 495 in early childhood) from low-income families in South Korea. Predictors included individual factors: child's age and gender; proximal environmental influences: family factors (family health conditions, primary caregiver, child-caregiver relationship, depression in primary caregiver) and institution factors (daycare enrollment, days per week in daycare); and distal environmental influences: income/resources factors (family income, personal resources and social resources); and community factors (perceived child-rearing environment). The outcome variable was questionable development. **Results:** Significant contributors to questionable development in the infancy group were age, family health conditions, and personal resources; in the early childhood group, significant contributors were gender, family health conditions, grandparent as a primary caregiver, child-caregiver relationships, daycare enrollment, and personal resources. **Conclusion:** Factors influencing children's questionable development may vary by developmental stage. It is important to consider differences in individual and environmental influences when developing targeted interventions to ensure that children attain their optimal developmental goals at each developmental stage. Understanding this may lead nursing professionals to design more effective preventive interventions for low-income children.

**Key words:** Child development; Environment; Poverty

## INTRODUCTION

Environment exerts a crucial influence on healthy development of human beings over the life course. A disadvantaged environment impairs human development from very early childhood, with adverse effects persisting into adulthood (Nicholson, Lucas, Berthelsen, & Wake, 2012). Poverty is known to be highly associated with negative mental, physical, psychological and developmental outcomes among children and adults

such as infant mortality, obesity, low academic achievement, adolescent delinquency, child maltreatment and depression (Komro, Flay, & Biglan, 2011). For the last few decades, there have been persistent efforts to reduce health inequities and improve developmental outcomes in children living in disadvantaged environments. Improving developmental outcomes requires integrated interventions early in life that target the many environmental risks of poverty to which vulnerable children are exposed (Engle et al., 2011). The returns on investment in young children are sub-

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stantial because infancy and early childhood are the most effective periods during which to intervene to ensure that children develop their full potential (Engle et al.). However, there is still a need to better understand which factors surrounding young children contribute to negative developmental outcomes and at which developmental stages those factors have significant effects. Understanding of holistic environmental influences on children's development may lead health professionals to design more effective interventions for young children in high-risk environments to prevent health and developmental disparities.

Young children live in interrelated environments that include family, institution, and community, and their developmental outcomes are affected by individual as well as environmental factors. Previous studies have found gender differences in development by age, with girls having better overall development (Drachler, Marshall, & de Carvalho Leite, 2007; Lung et al., 2011) and boys having greater risk of developmental delay (Tough et al., 2008). Research investigating social, emotional and motor development has also found gender differences in each domain of development (Drachler et al.; Richter & Janson, 2007), suggesting that a child's gender has significant effects on shaping his or her developmental trajectory.

Family provides most environmental stimuli for children in infancy and early childhood, and largely controls a child's contact with the distal environment (Richter, 2004). A large body of studies has established the significance of the family environment, which includes the primary caregiver and parent-child relationships (Irwin, Siddiqi, & Hertzman, 2007; Komro et al., 2011; Wachs, Black, & Engle, 2009). Research suggests that primary caregivers influence child development and outcomes by creating the home environment and establishing reliable caregiver-child relationships. Several studies also have highlighted the negative effects of health conditions affecting the primary caregiver or other family members. Health conditions can include either physical or mental health problems, such as chronic diseases in family members or maternal depression (Irwin et al.; Wachs et al.). Health conditions may influence development not only through increasing the child's genetic vulnerability but also by exposing the child to poor quality child care by a sick caregiver or one who is taking care of multiple family members with special needs. As a group, low-income children experience less consistent caregiving, less stable home environments, and more family health conditions than children in middle-class or wealthy families, which may be detrimental to children's development (Votruba-Drzal, Coley, & Chase-Lansdale, 2004).

In addition to family, daycare is also very important in many young

children's lives, especially in low-income families. There has been an increased demand for accessible, affordable, and flexible child care that facilitates low-income mothers' employment and meets the developmental needs of their children (Votruba-Drzal et al., 2004). Heymann's (2006) research also demonstrates the importance of access to quality child care for low-income families, as millions of children in low-income families are being left at home alone, left in informal child care or brought to work and exposed to unsafe working conditions. Further evidence is needed about the role of daycare in meeting the developmental goals of young children in low-income families.

Income and resources may affect children's development in multiple ways. Inadequate family income imposes stress on parents, making it more difficult for them to be warm and consistently caring with their children (Komro et al., 2011). The longer children live in poverty, the more harmful its effect on their development, because their parents find it difficult to invest in children's learning (Komro et al.). However, social and personal support may enhance both parent and family resilience in the face of difficult situations imposed by economic hardships (McConnell, Breitkreuz, & Savage, 2011). Higher levels of social and personal support have been linked to more effective parenting, less stress, and better child development outcomes (McConnell et al.; Slykerman et al., 2005).

Community influences on developmental outcomes of older children living in disadvantaged neighborhoods have been examined in depth, and most studies agree that comprehensive community efforts are essential to promoting healthy child development (Fulkerson, Pasch, Perry, & Komro, 2008; Komro et al., 2011). However, previous research on community effects is mostly limited to school-age children and adolescents. Although it may seem that young children are not directly affected by the community during infancy and early childhood, they do experience community through their parents, who control their interactions with the distal world. In that sense, how parents perceive their community may be also influential on their children's developmental outcomes.

As the above review demonstrates, there is a large body of research into the harmful effects of environmental risk factors on development. In most current research into the associations of these risk factors with children's developmental outcomes, there is a general consensus that risk occurs in combination, not in isolation, and in multiple environmental contexts (Lanza, Rhoades, Greenberg, Cox, & Key, 2011). A number of studies identify the risk factors contributing to poor developmental outcomes for children and adolescence (Fulkerson et al., 2008; Komro et al., 2011). However, there has been little research to identify contributors to

developmental outcomes in young children during the stages of infancy and early childhood, taking into account their disadvantaged surroundings and considering their multiple environmental contexts.

Historically, many nursing theories underscore the importance of the interaction of environment with the client. Neuman (1995) defined environment as all of the internal and external factors that surround or interact with the human. The interaction of those environmental factors creates a new environment that influences human health outcomes (Neuman). Holistic nursing also recognizes that the well-being of the environment is a determinant of the well-being of humans (Levine, 1971). Even though nursing theories espouse the human-environment interrelationship, the holistic environmental affect on the development of children within high-risk environments has not been well studied in nursing research. Congruent with nursing environmental perspectives, Komro et al. (2011) developed a framework of nurturing environments that foster the health and well-being of children living within high-poverty neighborhoods. They described two categories of factors that create healthful and nurturing environments surrounding children: Proximal influences, such as family and daycare, and distal influences, consisting of income, resources, and the social and physical environment of the community.

Guided by Komro et al.'s framework and holistic nursing theories, our study was conducted to describe and understand which individual and environmental factors are contributing influences on child development of young children under 6 years old, in the stages of infancy and early

childhood. The conceptual framework is presented in Figure 1. These individual and environmental influences may increase or decrease young children's risk for manifesting developmental problems. In this study, we included the personal and environmental factors surrounding children to understand individual and holistic environmental influences on developmental outcomes. This study also differentiated factors that contribute to children's developmental outcomes at each stage of child development, infancy, and early childhood, based on this holistic environmental perspective.

## METHODS

### 1. Design

This study used a cross-sectional survey research design, conducting secondary analysis of screening survey data from a community sample of families with infant and young children who participated in 'Seesaws and Swings', a community project to provide comprehensive and integrated services for low-income families with children under the age of 6. This project used the screening surveys to identify to which services each family should be referred. The surveys contained a good deal of information which presented an opportunity for secondary data analysis to examine factors that predicted questionable development. The study received ethical approval from the Institutional Review Board of the Cath-

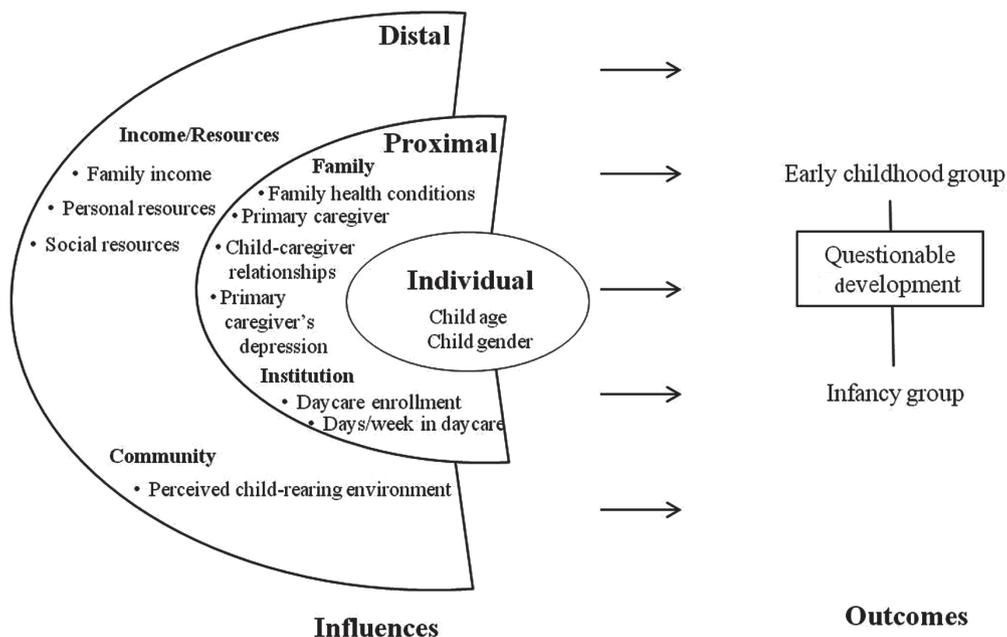


Figure 1. Conceptual framework.

olic University of Korea for this secondary analysis of the de-identified data. The secondary data analysis was limited to the variables assessed by the screening survey. The predictor variables that were selected were individual factors (child's age and gender); family factors (family health conditions, primary caregiver, child-caregiver relationships and primary caregiver's depression); institution factors (daycare enrollment and days per week in daycare); income/resources factors (family income, personal resources and social resources); and community factor (perceived child-rearing environment). The outcome variable was questionable development (a count of the items rated as delayed).

2. Sample

The study sample was 952 children of low-income families under the age of 6 years. We split the sample into two groups: infancy (0-35 months, n=357) and early childhood (36 to 71 months, n=495). Their data were collected from five community centers of South Korea. Chil-

dren's families qualified to receive national basic livelihood security benefits from the Korean government based on criteria for low-income families provided by the National Basic Living Security Act of South Korea. Characteristics of the study sample are presented in Table 1. Children who rated "untestable" in Korean Denver-II were excluded in this study. Based on power calculation using the G\*Power program, specifying  $p < .05$ , power of .80, base rate exponentiate of 0.8 (the mean number of questionable development problems), a sample size of 109 was required for the count regression model. Post hoc powers for both groups were 0.99. Thus, the sample of 357 in the infancy group and 495 in the early childhood group provided sufficient power to identify significant effects with a count regression model.

3. Measurements

1) Predictors of questionable development

Guided by a holistic environmental framework, we measured predic-

Table 1. Descriptive Statistics for Predictors and Outcome Variable

(N=952)

Category	Variable	Infancy (n=357)	Early childhood (n=495)	$\chi^2$ or t (p)
		n (%) or M $\pm$ SD	n(%) or M $\pm$ SD	
Predictors	Individual			
	Age (months)	19.84 $\pm$ 10.28	52.99 $\pm$ 10.16	0.04 (.843)
	Gender			
	Male	193 (54.1)	271 (54.7)	
	Female	164 (45.9)	224 (42.3)	
	Family			
	Family health conditions	0.47 $\pm$ 1.11	0.58 $\pm$ 1.24	-1.31 (.191)
	Primary caregiver			
	Mother	316 (88.5)	426 (86.2)	5.69 (.127)
	Father	24 (6.7)	60 (6.1)	
Grandparent	12 (3.4)	34 (6.9)		
Relatives	5 (1.4)	4 (0.8)		
Child-caregiver relationships	62.29 $\pm$ 11.82	60.26 $\pm$ 12.04	2.45 (.14)	
Primary caregiver's depression	31.85 $\pm$ 11.16	31.81 $\pm$ 11.39	0.05 (.957)	
Institution				
Daycare enrollment				
Attendees	239 (66.9)	477 (96.4)	133.80 (<.001)	
Non-attendees	118 (33.1)	18 (3.6)		
Days per week in daycare	3.28 $\pm$ 2.42	4.78 $\pm$ 1.20	-11.93 (<.001)	
Income/resources				
Family income (Korean Won)	128.51 (81.00)	122.63 (76.83)	1.08 (.282)	
Personal resources	5.40 $\pm$ 6.18	4.60 $\pm$ 6.18	1.86 (.063)	
Social resources	1.18 $\pm$ 0.93	1.18 $\pm$ 1.04	-0.05 (.962)	
Community				
Perceived child-rearing environment				
Good	139 (38.9)	189 (38.2)	0.05 (.823)	
Bad	218 (61.1)	306 (61.8)		
Outcome	Questionable development			
Absence	246 (68.9)	313 (63.2)	2.96 (.085)	
Presence	111 (31.1)	182 (36.8)		

tors of questionable development including individual, proximal (family and institution) and distal (income/resources, and community) factors. All measures were taken from the screening survey used to identify families in need of comprehensive and integrated services for low-income families; responses were reported by the primary caregiver.

The individual factors were child's 'age' in months and child's 'gender' reported by the primary caregiver.

The proximal influences included family factors and institution factors. The family factors were family health conditions, primary caregiver, child-caregiver relationships, and primary caregiver's depression. For the assessment of 'family health conditions', the primary caregiver was asked to list all of the diagnosed disabilities and chronic illnesses for all family members who were living together. We counted the number of disabilities and chronic illnesses and used the total count as the measure of family health conditions. 'Primary caregiver' was identified as a person fulfilling the role of taking care of children at home. 'Child-caregiver relationships' was measured by the Parent-Child Relationship Inventory (PCRI) developed by Gerard (1994) and used with Korean populations by Kim (2007). It consists of the sum of 18 self-report items, with 5-point Likert rating scale. Higher total scores indicate more positive relationships between caregiver and child. Cronbach's alpha was .89 in this study. 'Primary caregiver's depression' was measured using the CES-D developed by Radloff (1977) and modified for use with a Korean population by Jun (2006). It consists of the sum of 12 self-report items, with a 5-point Likert rating scale. Higher total scores indicate higher feelings of depression. Cronbach's alpha was .95 in this study. The institution factors were assessed by two items; 'daycare enrollment,' whether or not the child went to daycare, and 'days per week in daycare,' the number of days per week children spent in daycare.

The distal influences included income/resources and community factors. The income/resources factor was assessed using three variables. 'Family income' was reported by the primary caregiver as the total amount of money received from any type of work and governmental benefits. 'Personal resources' was the composite number of people available to help the primary caregiver when needed, such as relatives, neighbors, friends, health and welfare professionals, and others. 'Social resources' was the composite number of kinds of support, including money and things received from institutions, whether private or government. The community factor comprised one variable, 'perceived child-rearing environment', assessing the primary caregiver's perception of the community as either a good or bad child-rearing environment.

## 2) Questionable development as outcome variable

'Questionable development' of the child was evaluated by the Denver Developmental Screening Test, developed by Frankenburg and Dodds (1967). The Korean Denver-II was tested for validity and reliability by Shin, Han, Oh, Oh, and Ha (2002) for use with Korean children. It consists of 125 items designed to screen for questionable development and developmental delays in children between birth and 6 years old. The Korean Denver-II assesses development across four domains; gross motor, fine motor adaptive, personal-social, and language. Prior to the screening, a developmental expert provided the evaluators two days of training on how to evaluate children's development using the Korean Denver-II. To assess questionable or delayed development, evaluators observed and scored the children's ability to correctly complete a number of developmental tasks presented in the Korean Denver-II. They also asked the primary caregiver to report whether or not their child could do certain developmental tasks that may be "passed by report of the primary caregiver. Based on the Korean Denver-II Manual, a failed item is suggestive of a questionable development and rated "caution" if 75% of children of that age would pass that item; a failed item is rated "delayed" if 90% of children of that age would pass the item (Shin et al., 2002). Because the Manual defines either two caution items or one delayed item as indicating "questionable development, in this study, two caution items were counted as one delayed item (Drachler et al., 2007). The total count of items rated as delayed was used as the measure of the outcome variable, 'questionable development' in this study. This was based on a previous study that found the total count of items indicating developmental failure or success provided more statistical power than binary scale ratings such as normal versus questionable development (Drachler et al.). In addition, results of a previous study by Cheung (2002) suggested that either continuous or count variables, rather than binary variables, contain more information and provide better prediction and insights into questionable development.

## 4. Procedure

Secondary data were obtained from the screening surveys conducted at five 'Seesaws and Swings' community centers providing low-income families with health, education, and welfare services from November, 2008 to March, 2009. Prior to the screening surveys, each community center trained evaluators on how to administer the Korean Denver-II to children and questionnaires to primary caregivers. Evaluators telephoned

the family to ask them to participate in a survey to gather information needed to offer appropriate services for their family. After the family agreed to participate in the survey, evaluators visited their home, obtained written informed consent from the primary caregivers, and distributed the questionnaires. Children's questionable development was evaluated by evaluators' observation and primary caregivers' report. Primary caregivers were interviewed and completed the questionnaires; questionnaires included items on individual, family, income/resources, and institution and community factors. The community centers used the screening data to identify which services each family should be provided with or referred to. The data from the questionnaires were used for this secondary data analysis study. The study flow diagram is presented in Figure 2.

## 5. Data analysis

Statistical analysis was conducted using STATA 12.0. Descriptive statistics were used for presenting descriptive data of subjects and variables. The  $\chi^2$ -test and independent t-test were conducted to test group differences on descriptive data for predictors and the outcome variable. To identify the association between predictors and the outcome variable before conducting the regression model, correlations between continuous predictor variables and the outcome variable were analyzed by Pearson's correlation coefficient; associations between categorical predictor variables and the outcome variable were analyzed by independent t-test and one-way ANOVA.

In order to decide which modeling approach was most appropriate for use with this study data set (Long& Freese, 2006), we first considered the normality in the distribution and measurement type of the outcome variable: number of questionable development items. If the outcome

variable is normally distributed, multiple linear regression models are appropriate in many cases. However, because many children had no (zero) developmental problems, this study outcome variable showed a highly skewed distribution (skewness of the questionable development variable in the data for the infancy group was 10.30; in the data for the early childhood group, it was 9.75). Either Poisson or negative binomial regression analysis was appropriate for a count variable dataset with highly skewed distribution. To choose between Poisson and negative binomial regression, we checked for the existence of over dispersion, in which the variance is larger than the mean. In this case, the mean number of questionable development problems was 1.39, and the variance was 31.58, in the infancy data ( $\chi^2 = 231.91, p < .001$ ). The mean was 1.77 and the variance was 32.44 in the early childhood data ( $\chi^2 = 521.07, p < .001$ ). Over dispersion was present in these datasets, so the Poisson regression assumption of equidispersion was violated. In this situation, negative binomial modeling was well suited to this dataset. We visually inspected the predicted count with the actual count and confirmed the appropriateness of negative binomial regression to this data set. Therefore, we conducted negative binomial regression to identify and compare individual and environmental factors that influence questionable development in the infancy group and the early childhood group.

## RESULTS

### 1. Descriptions of participants and variables

Descriptions of participants and variables are presented in Table 1. There were significant differences between the infancy and early childhood groups in child-caregiver relationships, daycare enrollment, and days/week in daycare. Caregivers of the infancy group perceived their relationships more positively than did those of the early childhood group ( $t = 2.45, p = .014$ ). The early childhood group was more likely to go to daycare; only 67% of the infancy group went to daycare, but 96% of the early childhood group went to daycare ( $\chi^2 = 133.80, p < .001$ ). Children in the early childhood group went to daycare significantly more days per week than those in infancy ( $t = -11.93, p < .001$ ). No significant group differences were found in any other variables.

### 2. Association between predictors and outcome variable

The associations between predictors and the outcome variable ana-

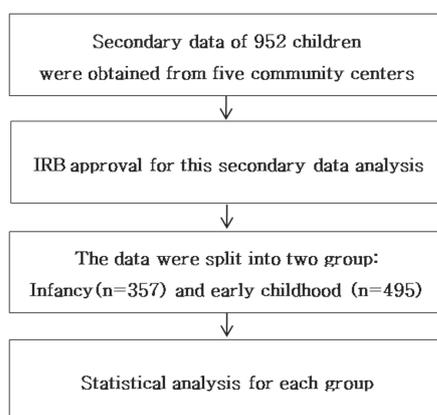


Figure 2. Study flow.

lyzed by Pearson’s correlation coefficient, independent t-test, and one way ANOVA are presented in Table 2. According to the analysis of Pearson’s correlation coefficient, age in months, family health conditions, and personal resources were significantly correlated with questionable development of children in the infancy group. Family health conditions, child-caregiver relationships, and days/week in daycare were significantly correlated with questionable development of children in the early childhood group. There were no significant differences of questionable development according to child gender, primary caregiver, daycare enrollment, perceived child-rearing environment in the result of independent t-test and one way ANOVA. Based on the result of Pearson’s correlation coefficient, no significant correlations were also found between questionable development and, primary caregiver’s depression, income and social resources. However, we included these variables in the count regression analysis, because they have been identified by previous research as important contributors to children’s developmental outcomes, as described above in the introduction.

### 3. Factors that influence questionable development

The factors influencing questionable development are presented in Table 3. The negative binomial regression model for the infancy group was significant ( $\chi^2 = 65.08, p < .001$ ). The model for the early childhood group was also significant ( $\chi^2 = 69.88, p < .001$ ). In the infancy group, older age, more family health conditions, and fewer personal resources were significant contributing factors to a higher number of questionable development problems. In the early childhood group, male gender, more family health conditions, poor child-caregiver relationships, fewer days/week in daycare, and fewer personal resources had contributed significantly to a higher number of questionable development problems. The primary caregiver being a grandparent was predictive of fewer questionable development problems in the early childhood group. Primary caregiver’s depression, income, daycare enrollment, social resources, and perceived child-rearing environment did not significantly predict the number of questionable development problems in either infancy or early childhood.

**Table 2.** Association between Predictors and Outcome Variable

(N=952)

Variables	Questionable development			
	Infancy (n=357)		Early childhood (n=495)	
	M ± SD	r, t, or F (p)	M ± SD	r, t, or F (p)
<b>Individual</b>				
Age (months)*		.12 (.026)		.00 (.993)
Gender†				
Male	0.77 ± 2.49	0.57 (.571)	1.06 ± 2.36	1.49 (.137)
Female	0.60 ± 3.15		0.68 ± 3.38	
<b>Family</b>				
Family health conditions*		.16 (.003)		.18 (<.001)
Primary caregiver‡				
Mother	0.68 ± 2.93	0.26 (.852)	0.90 ± 2.95	0.49 (.686)
Father	1.04 ± 1.95		1.10 ± 2.73	
Grandparent	0.42 ± 0.55		0.44 ± 0.89	
Relatives	0.00 ± 0.00		1.88 ± 3.11	
Child-caregiver relationships*		-.01 (.927)		-.12 (.007)
Primary caregiver’s depression*		.05 (.344)		.02 (.592)
<b>Institution</b>				
Daycare enrollment†				
Attendees	0.66 ± 2.79	-0.27 (.789)	0.84 ± 2.83	-1.65 (.099)
Non-attendees	0.75 ± 2.84		1.97 ± 3.18	
Days per week in daycare*		-.04 (.463)		-.10 (.021)
<b>Income/resources</b>				
Family income*		.03 (.598)		-.05 (.313)
Personal resources*		-.11 (.032)		-.08 (.092)
Social resources*		.02 (.714)		.05 (.283)
<b>Community</b>				
Perceived child-rearing environment†				
Good	0.68 ± 2.32	-0.05 (.963)	0.88 ± 3.21	-0.07 (.966)
Bad	0.70 ± 3.44		0.90 ± 2.13	

\*Analyzed by Pearson correlations; †Analyzed by independent t test; ‡Analyzed by one-way ANOVA. Means (SDs) were presented in the analysis of independent t test and one-way ANOVA according to the subgroup of each variable.

**Table 3.** Individual and Environmental Factors Influencing Questionable Development in Infancy and Early Childhood ( $N=952$ )

Predictors	Infancy ( $n=357$ )	Early childhood ( $n=495$ )
	Coefficient ( $p$ )	Coefficient ( $p$ )
Individual		
Age (months)	0.04 (.001)	-0.01 (.192)
Gender (female)	-0.41 (.099)	-0.64 (.001)
Family		
Family health conditions	0.42 (.001)	0.33 (<.001)
Primary caregiver*		
Father	0.28 (.532)	-0.15 (.708)
Grandparent	-0.62 (.367)	-0.85 (.037)
Relatives	-22.94 (.999)	1.49 (.102)
Child-caregiver relationships	0.01 (.749)	-0.03 (<.001)
Primary caregiver's depression	0.01 (.862)	-0.02 (.078)
Institution		
Daycare enrollment (non-attendees)	-0.81 (.385)	-1.76 (.069)
Days per week in daycare	0.25 (.177)	-0.54 (.002)
Income/resources		
Family income	-0.01 (.547)	-0.01 (.763)
Personal resources	-0.09 (.001)	-0.06 (.003)
Social resources	0.18 (.154)	0.07 (.451)
Community		
Perceived child-rearing environment (bad)	0.37 (.145)	-0.05 (.785)
$\alpha$	2.33	2.53
LR $\chi^2(p)$	65.08 (<.001)	69.88 (<.001)
Log likelihood-ratio test of $\alpha : \chi^2(p)$	231.91 (<.001)	521.07 (<.001)

\*Reference group of primary caregiver is mother.  
LR=Likelihood-ratio.

## DISCUSSION

In this study, we explored how holistic environmental factors surrounding children in poverty exerted differential influences on questionable development in the infancy group and the early childhood group. Overall, questionable development of children in the infancy group was influenced by one individual (age), one proximal (family health conditions), and one distal factor (personal resources), while contributors to questionable development in the early childhood group also included one individual (gender) and one distal factor (personal resources), but expanded to include more of the proximal environment (family health conditions, primary caregiver, child-caregiver relationship, and days/week in daycare).

Our findings showed that age in months predicted a higher number of questionable development problems in the infancy group, while gender predicted a higher number of questionable development problems in

the early childhood group. The two individual influences, age and gender, have significant effects, but their effects were seen at different developmental stages. The age effect in the infancy group may reflect that older children who are delayed in development will show greater, more noticeable delays over time. This age effect suggested the need for professionals to pay careful attention to the early detection of questionable development, especially in the infancy period, even in children with previously normal development. Early detection is important in developing children's full potential in a high-risk environment such as poverty.

Our study found a gender difference: boys were more likely than girls to show questionable development in early childhood. This was consistent with earlier research demonstrating that males have a higher risk for developmental delay which begins to manifest in the early childhood stage (Drachler et al., 2007; Lung et al., 2011; Tough et al., 2008). In a longitudinal study of children from 6 to 60 months, Lung et al. found that gender had an effect on three of the four dimensions (fine motor, language, and social) in early childhood; boys showed greater delays in all dimensions except gross motor. Drachler et al. found no evidence of a gender difference in development in the youngest age group (6-11 months), but beyond this age, the development of girls was faster than that of boys, reaching a gender difference of approximately 4.2% of the child's age in favor of girls by 36-59 months. However, it is possible that findings of more questionable development problems in boys may reflect normal gender differences in developmental trajectories. To prevent misdiagnosis of developmental problems, different gender norms may need to be established for boys and girls to account for normal differences in development (Lung et al.).

Of the family factors examined, having more family health conditions significantly predicted a larger number of questionable development problems in both the infancy and the early childhood groups. This poses the question of whether family health conditions may be a genetic foundation of developmental vulnerability. Alternatively, the association between family health conditions and questionable development may be due to inadequate child care from a sick or tired caregiver who is caring for family members with multiple special health needs (Irwin et al., 2007). Our study found other significant influences of other familial factors that varied according to the child's developmental stage. In the early childhood group, primary caregiver and child-caregiver relationships were additional predictors of questionable development. Although in the infancy group, there was no primary caregiver effect on questionable development, having a grandparent as primary caregiver had a positive

effect on questionable development in the early childhood group. This suggests that grandparents can be a good substitute for mothers in caring for children when mothers are unable to provide the care, especially in early childhood.

Our study finding that primary caregiver's depression was not a predictor of questionable development in either the infancy or early childhood group was inconsistent with that of Tough et al. (2008), who reported that the risk for developmental problems was reduced if the child's mother had good mental health. This may be related in part to the differences in the measures of maternal mental health problems and child development between the two studies. Our findings of no association between primary caregiver's depression and questionable development may be because primary caregiver's depression is more specifically correlated with children's emotional development, rather than overall development. In our findings, child-caregiver relationship had a significant effect on questionable development; this may be because active and direct interaction with their caregivers stimulates children's gross motor, adaptive, social/personal, and language development. This effect was found only in the early childhood group, but not in the infancy group. However, it is possible that we would see a significant effect of child-caregiver relationship on questionable development in the infancy group if we used a more age-specific measurement to evaluate the child-caregiver relationship.

Among the institution factors, fewer days at daycare predicted a higher number of questionable development problems only for the early childhood group. Low-income children may face multiple risks at home, including lack of learning material and play things, poor home environment, and unsafe neighborhoods (Irwin et al., 2007). The negative influences of these multiple risks may be more substantial with greater exposure, unrelieved by time away from home spent at daycare. Heymann's (2006) research reported that millions of children worldwide are being left at home alone, left in informal child care, or brought to work and exposed to unsafe working conditions. This suggests that public provision of quality, affordable child care is a worthwhile investment given the negative developmental consequences of poor quality child care. As Anderson et al. (2003) suggested, center-based, early childhood development interventions will be useful and effective as part of a coordinated system of supportive services for children in low-income families.

Among the distal environmental influences, family income was not a significant contributor to increased number of questionable development problems at either infancy or early childhood, in contrast to the

findings of previous research that reported family income predicted child outcomes (McConnell et al., 2011). Another study by Komro et al. (2011) suggested that economic stressors make it more difficult for parents to provide their children with high-quality parenting, which in turn may cause children to be less likely to master age-appropriate developmental tasks. It may be that income does not have a direct effect on questionable development at infancy and early childhood because other variables such as child-caregiver relationship or unidentified variables may mediate or moderate the association between income and questionable development. This is an area for future research.

Personal resources were found to be an important determinant of questionable development for both the infancy group and the early childhood group. This was consistent with McConnell et al. (2011)'s finding that parental appraisal of social support directly influenced child outcomes. They measured perceived social support with items such as *I have family and friends who help me feel safe, secure and happy*, which is similar to personal resources as operationalized in our study. In general, resources are viewed as a protective mechanism with main and buffering effects that can affect family well-being, quality of parenting, and child resilience (Armstrong, Birnie-Lefcovitch, & Ungar, 2005). When children are very young, their primary caregivers need support from other people for caregiving, because caring for young children is more demanding than for school-aged children and adolescents. Young children, especially those in infancy and early childhood, are more dependent on their primary caregiver, compared to older children. Personal resources may increase children's developmental outcomes for these reasons.

Among the other distal influences, caregiver's perception of the community as a negative child-rearing environment did not significantly predict questionable development of children less than 6 years old. It may be true that young children do not seem to be directly influenced by the community at infancy and early childhood, because their parents control their interaction with the distal world. However, Komro et al. (2011) and many previous studies suggested that negative developmental outcomes are concentrated among children and adolescents living within high-poverty and disadvantaged neighborhoods. The effect of a disadvantaged community on child outcome may be cumulative over a long period, with effects that appear later in childhood and adolescence rather than in infancy or early childhood. Therefore, community-wide efforts to improve the social and physical environments within families, daycare, and neighborhoods are vital to reducing cumulative, negative effects on child outcomes from the beginning of life (Engle et al., 2011).

There are some limitations of this study. This is a cross-sectional study, so caution is needed in interpreting the causal relations between predictors and outcome variable. There is a need for future longitudinal research to test causal effects of individual and holistic environmental predictors on developmental outcomes. This study investigated the total number of questionable developmental problems overall, not in each domain, such as gross motor, adaptive, social/personal, and language development. We need to conduct future research to identify differential factors that influence the questionable development problems in each domain of development, because previous research has suggested that there may be different influences on each domain. Additionally, there has been a controversy in the reliability of Korean Denver-II even though many developmental research are still being conducted using DDST-II in both Korean and other countries (Drachler et al., 2007; Ga & Kwon, 2011; Guedes, Primi, & Kopelman, 2011). Further research is needed to establish the reliability and the validity of Korean Denver-II and develop more appropriate developmental instrument for Korean children. There is another limitation. The measures of community included in the survey did not provide information about important aspects of community that might influence child development. Therefore, future research should include more specific community variables: for example, location and safety of community playgrounds. We recommend that future study should be conducted using multi-level analysis to identify the multi-level effects on questionable development of children in low-income families. A further limitation was imposed by the use of existing secondary data obtained from the community centers; the researchers did not have control over the choice of variables that were measured. On the other hand, accessing these data allowed us to conduct a very cost-effective study, which has increased our understanding of the factors that influence questionable development in young children. Additionally, we cannot exclude a possible measurement error due to multiple evaluators measuring the children's development; however, the evaluators were given training and consultation at the beginning of the screening to improve their ability to detect questionable development validly. Despite these limitations, our findings provide understanding of individual and holistic environmental influences on the number of questionable development problems in young children of low-income families. We also increased the body of evidence about the factors that differentially influence questionable development at the developmental stages of infancy and early childhood.

## CONCLUSION

It is important to consider differential environmental influences when developing interventions to ensure that children attain their optimal developmental goals at each developmental stage. We suggest that interventions be differentially targeted to address the main factors that contribute to development at each stage. Future research is needed to develop targeted interventions and assess their effectiveness based on a holistic environmental perspective of individual and environmental influences on children in low-income families. By targeting interventions to the main influences on development at each stage, we can save money and resources. Infancy and early childhood is the most effective time to intervene and ensure that children reach their optimal development. The findings of this study can provide evidence of the need for effective, stage-appropriate, targeted interventions to reduce the incidence of questionable development in the early stages of life for children of low-income families.

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