

**Systematic Review of Cognitive Development
for
Child Health and Wellbeing:
Assessment of Concepts and Indicators**

**Prepared for
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APRIORI RESEARCH

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Introduction

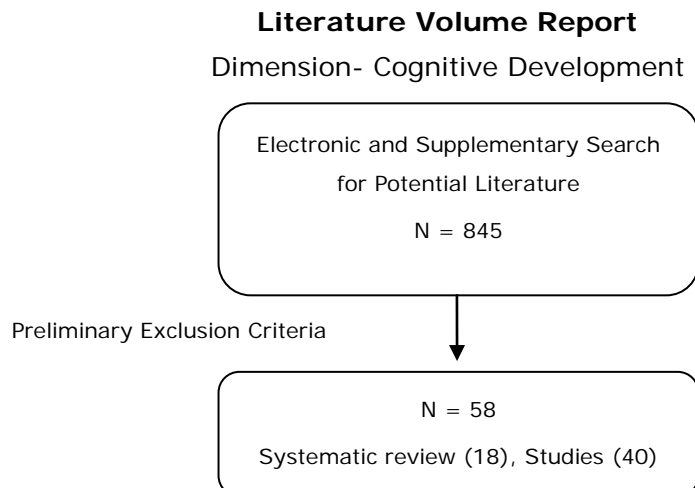
This systematic review of cognitive development and child health research for the last decade (2000-2010) fell into three themes: readiness to learn, learning performance and general/knowledge gaps. Each of these themes will be discussed separately and will include results from both the studies and systematic reviews. Cognitive and language development refers to the acquisition of literacy, numeracy and memory skills. In the early years, cognitive development is acquired through children's interactions with objects and stimuli in their environments, how social interactions influence their thinking and the ways in which children categorize and store information (de Villers & de Villers, 1999ⁱ). Cognitive development in early childhood is measured in Canada and abroad as an aspect of school readiness (SR). From a developmental perspective, Doherty (1997)ⁱⁱ identified the following criteria for school readiness based on her review of the research. These included: 1) physical well-being and appropriate motor development; 2) emotional health and a positive approach to new experiences; 3) social knowledge and competence; 4) language skills; and, 5) general knowledge and cognitive skills. Regarding the cognitive domain, she noted that the rate of development and the formation of the cognitive skills required for school readiness depend upon anatomical maturation of the central nervous system and the child's physical and social experiences. Thus, influences on school readiness consider: the health, social, intellectual and developmental aspects of the child; family functioning, practices and status; neighbourhood influences; community services, programs and opportunities; and societal influences and supports.

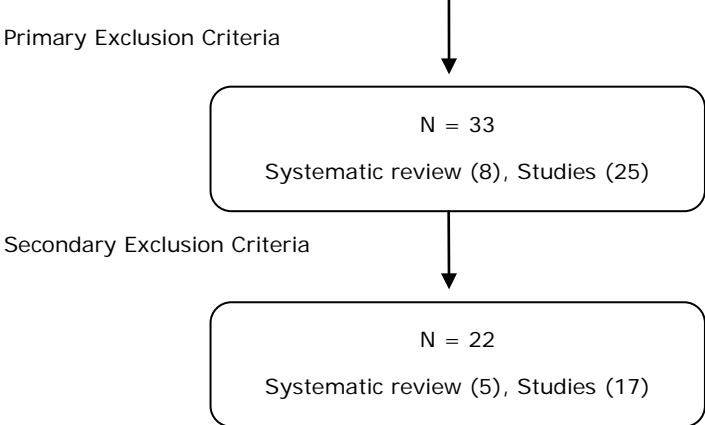
Methodology

A broad-base search was conducted to explore all research related to children's cognitive development and health in the past decade and to ensure inclusion of knowledge gaps within the scientific literature. Following an initial electronic database search, a supplementary search was conducted specific to systematic reviews for cognitive development and child health OR wellbeing. For both electronic searches, the following databases were used: Academic Search Complete, CINAHL, Education Research Complete, ERIC, Medline (including PubMed), PsychInfo, PsychARTICLES and PsychEXTRA. Limits for the electronic searches included: Date: 2000-2010; Language: English; Subjects: Human; and Age: 0-18 years. For the first search, article types were limited to: randomized control trial, meta-analysis, controlled clinical trials, systematic reviews and government

publications. Search terms for the first search included: “cognitive development” AND “school readiness”, resulting in 244 reviews for consideration. The second electronic search was conducted to ensure papers relevant to the following themes were included: readiness to learn, school systems, learning performance and general/gaps. This second search used the terms “cognitive development” and “child and youth health and well-being”, resulting in an additional 24 papers for review. Finally, a review of the grey literature, using Goggle Scholar with the same limits was conducted for the search terms “cognitive development” AND “systematic review” AND “school readiness” resulting in 577 titles for review. All together, 845 titles were identified.

Two reviewers independently scanned all titles for relevancy to children, health, and cognitive development. Sixteen discrepancies were noted between the reviewers (98% inter-rater reliability) which were then resolved through discussion until consensus was reached. Papers were excluded if they focused on populations not relevant to Canada, did not address outcomes associated with cognitive development or were not scientifically rigorous. In total, 58 papers were identified after the preliminary exclusion process. Abstracts of the 58 papers were then reviewed by both reviewers, resulting in a further reduction to 25 studies and eight systematic reviews remaining following the primary exclusion. Studies and systematic reviews that addressed the same topic, were of lesser quality or not applicable were then excluded during the secondary exclusion process, yielding a total of 17 studies and five systematic reviews for the following themes: Readiness to Learn (n= 13); Learning Performance (n=3) and General/Gaps (n=6). No studies or reviews were found for the “School System” theme applicable to child cognitive development for the years 2000-2010. See below for the volume report.





The list of review papers and studies are identified in the following tables.

Summary Table of Systematic Review Papers

Summary Table of Review Papers			
Author (s)	Review Title	Number of Studies Reviewed	Conclusions/Comments
Readiness to Learn- Children's competencies			
La Paro & Pianta (2000) ³	Predicting children's competence in the early school years: a meta-analytic review.	70 longitudinal studies	<p>Explored measures of children's competencies in preschool and kindergarten to outcomes in kindergarten, first and second grade.</p> <p>1) Effects sizes for predicting academic/cognitive measures from preschool or kindergarten to early school outcomes were moderate.</p> <p>2) Within the social/emotional domain, predictions across time were small, however the review consisted of a small number of studies.</p> <p>3) No differences in when measurement occurred, i.e., preschool-kindergarten and first grade or kindergarten and 1st or 2nd grade.</p>
Readiness to Learn- Language skills			
McCormack et al (2009) ⁴	A systematic review of the association between childhood speech impairments and participation across the lifespan.	57	<p>Explored the impact of childhood speech impairment on participation restrictions across the life span according to the World Health Organization's <i>International Classification of Functioning, Disability and Health</i>.</p> <p>The research indicated that speech impairments in childhood may be associated with the following: learning to read/reading, learning to write/writing, focusing attention and thinking, calculating, communication, mobility, relating to persons in authority, informal</p>

Summary Table of Systematic Review Papers

			<p>relations with peers and friends, parent-child relationships, sibling relationships, and higher rates of employment.</p> <p>The conclusions most supported by this review identified an association between speech impairment and activities related to learning and applying knowledge.</p>
Readiness to Learn- Early Childhood Education			
Burger (2010) ⁵	How does early childhood care and education affect cognitive development? An international review of the effects of early intervention for children from different social backgrounds.	32 studies (23 projects)	<p>Early childhood care and education can improve the cognitive development of children. Preschool programs had a significant positive short-term effect (school readiness) and moderate longer-term effects.</p> <p>The majority of the studies indicated positive effects of preschool on academic achievement tests, educational attainment and years of school attendance. Less clear was a positive the effect on special education or grade retention.</p> <p>Positive benefits found for both disadvantaged and affluent children.</p>
Gaps- Parental influences			
Eshel et al (2006) ⁶	Responsive parenting: interventions and outcomes	50	Focusing on results for developed countries in relation to cognitive development, results indicated that maternal responsiveness was most often associated with positive language, cognitive and psychosocial development.

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			<p>Specifically, increased IQ and cognitive growth at four and a half years; school achievement at 7 years; as well as higher IQ at age 12. Thought to be associated with secure attachment between primary caregiver and infant and particularly relevant for at-risk groups such as low birth rate infants or teen mothers. Interventions often combined health services and home visits that provided support and information to mothers. Both randomized and correlational studies of interventions aimed at promoting parental responsiveness such as home visitation indicated a modest effectiveness for child health and development (e.g., reducing the decrease in intellectual performance suffered by at-risk infants). Longer behavioral and psychosocial effects are also noted such as a lower antisocial behavior and criminal behavior at age 15 years.</p> <p>Interventions were most effective when targeted for at-risk groups and was focused on specific behavioral change. Authors suggest public health develop a package of resources to provide guidance on promoting responsive parenting through public health venues. It is recommended that this package contain training materials for health workers and families, and planning guidelines and materials to monitor and assess the program.</p>
Sarkadi et al (2008) ⁷	Father's involvement and children's developmental outcomes: a systematic review of longitudinal studies	24 papers from 16 longitudinal studies	Positive behavioral, social, cognitive or psychological effects were found in 17 of the 18 publications that controlled for SES. Specific to cognitive effects, a highly engaged father (one who played/cared for their child daily) predicted significantly higher IO tests in a sample

Summary Table of Systematic Review Papers

			of children born premature. In another large study, father engagement was associated with higher educational attainment. As well, father involvement was shown to reduce behavioral problems in boys and psychological problems in young women and enhance cognitive development while decreasing criminality and economic disadvantage in low SES families.
Learning Performance- English Language Skills			
Genesee et al. (2005) ⁸	English Language Learners in U.S. schools: an overview of research findings	200	<p>Genesee et al. (2005) conducted a review of 200 studies focused on oral language, literacy and academic skills of English Language students. They found that being bilingual can have positive cognitive effects, provided students are given time to master the second language. For children in grades K-3, students in bilingual education scored below group peers; however, by the end of elementary school and through to high school, educational outcomes of ELLs are comparable or higher than their non-bilingual peers. For example, they found a positive relation between oral language proficiency and English reading achievement for students in grades 1-9. Overall, the longer children participate in bilingual educational opportunities, the better their outcomes in relation to reading or mathematics achievement, GPA, attendance, high school completion or attitudes toward school and self.</p> <p>Related to the United States, mainly low-income native Spanish speakers and elementary school students.</p>
Gaps- Media effects			
Thakkar et al	A systematic review for the effects of	12	Thakkar et al. (2010) conducted a systematic review of

Summary Table of Systematic Review Papers

(2010) ⁹	television viewing by infants and preschoolers.		the literature on the effects of television viewing by children under the age of six years focusing on learning, racial preference, prosocial behavior, imaginative play, aggression and self-regulation. Educational programming was shown to have significant positive effects on cognitive development, specifically general knowledge, numbers, and reading letters and words. The authors also concluded that educational programming had a positive effect on increasing imagination and affecting racial attitudes but no effect on promoting children's' prosocial or aggressive behavior.
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Summary Table of Studies

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Citation	Study Objective	Study Description	Setting/ Participants	Design/Data Collection	Outcomes	Results	Conclusion/Comments
Readiness to Learn- Language Skills							
Justice et al. (2009) ¹⁰	Determine whether the timing of language difficulties is a significant determinant beyond any effects attributable to persistence of language difficulties when considering the relations between early childhood language difficulties and school readiness.	Participants were from the National Institute of Child Health and Human Development (NICHD) study. Language difficulties were assessed at 15, 24, 36 and 54 mos and compared to kindergarten teacher ratings of academic (ARS), social (SSRS) and behavioral skills (Teacher Report Form on externalizing and	Ten locations across USA. N=1064 (527 boys and 537 girls).	Population- based longitudinal survey. Data at 15, 24, 36 and 54 mos. (>10 th percentile) compared to school readiness measures.	Sequential regression approach with the 6 kindergarten outcomes as criterion variables and 3 predictor variables: persistence of language difficulty; expressive and receptive language difficulty at school entry.	Language difficulties at 15 mos. had no effect on school readiness. Language difficulties at 36 and 54 mos. significantly affected SR. Large effect sizes for academic domains and medium-small for social-behavioral indicators. Presence of receptive language difficulties at school entry was a significant predictor for literacy, math, academic competence, social skills and externalizing behavior whereas the presence of expressive language difficulties predicated poor language and literacy, mathematical thinking,	Identification of language difficulties at 54 mos predicts poorer school readiness for reading, mathematics and social-behavioral competency and represents a crucial point for identifying students who will need additional supports.

Summary Table of Studies

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		internalizing behavior).				academic competence and social skills.	
Readiness to Learn- Social Behavior Skills							
Bierman et al. (2009) ¹¹	Examined the relationship between behavioral readiness (class participation, prosocial behavior and aggressive beh.) and cognitive readiness (academic knowl. and executive functioning skills).	Teacher and RA assessments taken after 3 weeks after start of preschool (Head Start).	Pennsylvania, USA Forty four Head Start centres N=365 (54% girls, 55% European Americans) 4-years- old.	Cross-sectional assessment of preschool children.	Correlations, ANOVAs and multiple regression between behavioral measures and cognitive readiness.	Classroom participation and prosocial behavior were significantly correlated with cognitive skills. Aggressive behavior was inversely correlated with executive functioning skills and the acquisition of cognitive skills when accompanied by prosocial deficits. Girls were more compliant/cooperative and prosocial and boys more aggressive but no sex differences found for cognitive readiness.	1) Preschool interventions designed to reduce aggression should emphasize emotional regulation and social problem-solving skills. 2) Programs designed to enrich peer play learning opportunities and social-emotional learning in a preschool setting may enhance behavioral and cognitive school readiness. 3) Although cross-sectional, the results validate the importance of attending to behavioral dimensions of school readiness, particularly in preschool programs serving socioeconomically

Summary Table of Studies

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							disadvantage children, in combination with focused attention to cognitive skill development.
Welsh et al. (2010) ¹²	Examine whether growth in working memory and attention control across the prekindergarten year would predict concurrent growth in emergent literacy and numeracy skills for low-income children.	Secondary analyses of longitudinal data with the addition of three assessments of attention and working memory: before and after preschool and after kindergarten.	Three Pennsylvanian counties- USA N=164; children in the control group of the Head Start REDI study (head start curriculum only). Age- \bar{X} =4.49 yrs., 57% girls; 14% Latino, 30% African American, 56% European American, 68% of families had income below the National	Longitudinal path analyses to predict literacy and math achievement from pre and post prekindergarten assessments of executive function, specifically attention control and working memory.	Correlations and path analyses exploring the transactional and developmental influences of executive functioning at 2 time points prior to kindergarten school readiness of literacy and math.	1) Working memory and attention control assessed at the start of the year significantly predicted growth in the child's literacy and numeracy skills over the course of the prekindergarten year, after controlling for initial domain-specific and language skills. 2) The growth in working memory and attention control skills during the prekindergarten year made unique contributions to kindergarten reading and math achievement,	1) Although a focus on Head Start, the article addresses a potential gap in the literature, i.e., executive functioning skills. EFS = working memory, attention set shifting and inhibitory control which develops substantially during ages 3-5 (preschool). Believed to support SR by enabling child to regulate emotions; supporting behavioral self-regulatory capacities and social competence. Working memory and attention control linked to reading and math ability. 2) Kindergarten reading and math achievement was

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			poverty line.			after controlling for initial domain-specific and language skills.	uniquely predicted by prekindergarten growth in emergent literacy and numeracy skills and thus enriching domain-specific academic curricula in prekindergarten classrooms is likely to enhance academic readiness. For example, providing children with repeated practice sessions on specific executive functioning tasks; and interventions designed to promote self-regulation and social-emotional development. 3) Design of the study does not allow conclusions of causation.
Bracken & Fischel (2007) ¹³	Research questions: 1) What level of social skills and behavior	Pre and post preschool (Head Start) assessments of cognitive	Southwestern New York, USA N=515 (X =4 yrs, 4 mos) attending full-	Randomized pre-post intervention. Intervention 1- Lets Begin with the Letter (n=187); 2)	Correlations and repeated measure ANOVAs to examine social skills and behavior problems	Overall, social skills improved across the year and behavioral problems remained unchanged. Significant	1) Children who have poorer social skills and more behavioral problems are more likely to demonstrate weaker school

Summary Table of Studies

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	problems are exhibited at preschool entry and exit and how are they linked; 2) What impact does a preschool literacy program have on social and behavioral skills? 3) What is the relsp. between children's sociobehavioral skills and their performance on SR measures of language, literacy, writing and math?	measures; behavioral and social assessments from 35 classrooms within six Head Start Centres over 3 year period. Along with regular program, classrooms were randomly assigned to one of two additional literacy interventions or no intervention.	day Head Start preschool, 5 days/week.	Waterford Early Reading Level (n=177) or control/comparison condition (n=151).	across year. Cluster analyses to examine combinations of social and behavior skills.	inverse correlations between social and behavioral measures. Significant difference between <i>Lets Begin</i> and Control Group in Spring. Intervention had more kids with higher social skills and lower behavioral problems. As well, they had higher cognitive scores than the students who did not have the additional literacy component.	readiness. 2) Social and behavioral skills need to be addressed in preschool and can happen within a framework of a program focusing on a social, emotional and academic curriculum. 3) The comprehensive and teacher-led literacy program enhanced social, behavioral and cognitive skills at the end of the preschool year.

Readiness to Learn- Motor Skills

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Grissmer et al. (2010) ¹⁴	Explore the link between motor skills and general knowledge on cognitive development.	Identify the predictive effect of kindergarten motor skills and general knowledge on later cognitive Grade 5 achievement from 3 national longitudinal data sets.	USA, Canada, UK	Longitudinal population-based data sets: ECLS-K, NLSY, and the BCS.	Multiple regressions exploring early cognitive, socioemotional and motor skills to later reading and math achievement.	1) Both attention and fine motor skills are important developmental predictors of later reading and math achievement; controlling for family, child and early math and reading scores. 2) Early general knowledge of the world (science and social science) was a stronger predictor of later reading and math than early reading ability.	1) Fine (but not gross) motor skills were a very strong and consistent predictor of later achievement. 2) Indicators of kindergarten attention, fine motor skills and general knowledge best predict later math, reading and science scores.
Readiness to Learn: Early Childhood Education- Home stimulation							
Nelson (2005) ¹⁵	1. How does participating in learning activities at home affect achievement in	Secondary analyses of the Early Childhood Longitudinal Study (2001). Subjects were	Nationally representative sample, USA based on stratified cluster	MANOVAs using reading, math and approaches to learning as outcome variables.	<u>Reading achievement-</u> assessment score represents knowledge of letter recognition,	1) Parents who engage in home learning activities have kids who score higher on math, reading and approaches to learning.	1) Parents who do activities such as: reading books, telling stories, singing songs, arts and crafts, play games, have children do chores, talk about nature or

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	<p>Kindergarten?</p> <p>2) How does preschool attendance affect achievement in kindergarten?</p> <p>3) What are the interaction effects on achievement in kindergarten between family risk factors and the home and preschool factors?</p>	<p>divided into: 1) <u>high/low risk</u> (based on SES, primary language, parent's education level); 2) Participating in home learning activities (yes/no); and 3) Preschool attendance at a centre (yes/no).</p>	<p>sampling. N=10,3407 (preschool); N=14,880 (kindergarten)</p>		<p>beginning sounds, ending sounds, sight words, and words in context (in Fall of K year).</p> <p><u>Mathematic achievement</u> represents knowledge of numbers and shape, relative size, ordinality, sequence, add/sub, multiplication/division in Fall of K year.</p> <p><u>Approaches to Learning</u> determines subjects' level of persistence, motivation and interest in learning activities according to parents and teachers.</p>	<p>2) Children with risk factors scored lower on math and reading.</p> <p>3) Students who attend preschool had higher math and reading scores than those who did not attend preschool.</p>	<p>science, play sports and build things with their children can have a significant influence on their children's cognitive development.</p> <p>2) Home learning was the only factor which led to higher scores on how children approach learning (how motivated and interested children are in learning).</p> <p>5) Even children with risk factors with enriched home environments and those who had attended preschool still performed lower than children from risk free environments.</p> <p>4) Policy aimed at providing funding to support parents to provide stimulating home environments; preschool for all children and ameliorate</p>

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							risk factors will have a positive influence on school readiness.
Votruba-Drzal (2003) ¹⁶	Examined whether relations between family economic resources and children's learning environments are an artifact of stable omitted differences between families or whether these links are also observed when examining changes in economic resources	Secondary analyses using ordinary least squares regression modeling of the influence of income on child's home environment, controlling for child, maternal and household characteristics.	USA Used merged mother-child data from the National Longitudinal Survey of Youth (NLSY and Child Supplement). Used 5 birth cohorts: Time 1 (children aged 3-4 years), Time 2 (aged 7-8 years); Nationally representative N=2,174	Longitudinal population-based fixed effects regression analyses. As well, used cognitive stimulation from Home in cross-sectional regression (aged 3-4 and 7-8) on average income since birth.	Used HOME (Home Observation for Measurement of the Environment) inventory – total score, cognitive stimulation and emotional stimulation score as dependent measures. Independent measure was income. Maternal, child and household characteristics were included in regression models as controls.	1) At both time points, income's influence on cognitive stimulation in child's home is modest but significant. 2) Also related to positively stimulating home environments were: maternal education and academic aptitude; mother employed part-time (vs. full-time). 3) Home learning environments of ethnic minority children, boys and higher number of children were associated with fewer home learning opportunities. 4) Income increases of	1) Improvements or reductions in families' economic resources have significant implications on children's early learning experiences in their home environments. 2) Programs providing income supplements targeted at the most vulnerable families may be part of an effective strategy (along with other inventions such as home visitation and/or parent education) to improve young children's home learning environments and reduce school readiness disparities.

Summary Table of Studies

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	within families over time.					even \$10,000 had beneficial effects on the home environment of the most vulnerable families.	
Readiness to Learn: Early Childhood Education- Child care							
Belsky (2006) ¹⁷	What are the effects of early child care on children's cognitive, socioemotional and linguistic development?	Repeated measures of: a) quality of child's family rearing environment; b) quality of non-maternal care (a and b at 6, 15, 24, 36 and 54 mos.); and c) child's cognitive, socioemotional and linguistic development (15, 24, 36 and 54 months).	USA N= 1364 (see above)	Longitudinal, prospective, repeated measures study- NICHD SECCYD (longitudinal study of child development and early child care) to 5 years	Cognitive-linguistic development assessed: Bayley's Scale of Infant Dev (15, 24 mos); Bracken School Readiness Scale (36 mos); and Woodcock-Johnson Achievement Battery (54 mos)	1) The more attentive, responsive and stimulating the early care, the better the child's cognitive linguistic performance at 15, 24, 36 and 54 months. 2) More time in non-maternal care across the first 4.5 years of life was found to predict at 54 months and across kindergarten, higher levels of problem behavior (assertiveness, disobedience/defiance and aggression).	1) 'Really poor' families not represented. 2) Similar results were seen in Britain and Ireland. 3) Effect sizes small. 4) Difficult to determine critical cut-off point of "too much time in non-maternal care" from article.

Summary Table of Studies

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Dearing et al. (2009) ¹⁸	Does higher quality child care during early childhood moderate associations between family economic status and children's achievement during middle childhood?	Secondary analyses of the NICHD SECCYD (longitudinal study of child development and early child care), exploring: 1) child-care quality during infancy and early childhood; 2) family economics across child's first 10 years; 3) early school readiness; and 4) math and reading scores in 3 rd and 5 th grades.	Ten urban/suburban sites in USA N=1364 (52% males). Data collected from 6 mos-11 yrs	Nonrandomized, prospective longitudinal study controlling for child, maternal and family characteristics.	Multiple regressions of reading, math and applied problems for family income, and episodes of high and low quality child care covaried with child, maternal and family characteristics.	1) Higher quality care during early childhood appeared to protect children in low-income families, promoting their reading and math achievements in middle childhood. 2) High quality care promotes achievement indirectly through early school readiness.	Higher quality early child care promotes the achievement of low income children in grades 3 and 5; suggesting a compensatory effect of impoverished home environments and the promotion of early cognitive skills for later achievement.

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<p>McCartney et al. (2007)¹⁹</p>		<p>Compared three nonrandomized groups: children in high quality care, low quality care and those not in (non-parental) care for: child care quality, income, cognitive and language outcomes and home environment.</p>	<p>USA, Ten sites. N=1364 (diverse SES and ethnically)</p>	<p>Prospective longitudinal selection focusing on 36 mos. from the NICHD SECCYD study (longitudinal study of child development and early child care. Regression modeling.</p>	<p>At 36 mos: 1) School readiness measure- (Bracken Basic Concept Scale. in child's home); 2) receptive language; and 3) expressive language (Reynell's Developmental Language Scale in lab)</p>	<p>1) Children from low income families in higher quality care performed better on school readiness and both language measures than those in low quality or no care. Low quality better than no care for language. 2) Quality of home at 36 mos. was predicted by income-to-needs x higher quality interactions; suggesting (but not proving) increased maternal knowledge and attitudes about child rearing as well as decreased parenting stress for parents using high quality care.</p>	<p>Vocabulary is one of the best predictors of literacy, thus practitioners in ECE should offer language rich activities such as reading, circle time and one-on-one discussions.</p>

Summary Table of Studies

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Citation	Study Objective	Study Description	Setting/ Participants	Design/Data Collection	Outcomes	Results	Conclusion/Comments
Adi-Japha & Klein (2009) ²⁰	Examined the relation between parenting quality and children's cognitive measures assessed at age 3 years who experienced different amounts of childcare.	Secondary analyses of NICHD SECCYD (see above). Children were grouped into: 1) those who experienced predominantly maternal care (PMC); children who experienced medium amounts of care (MA-CC) and those who experienced high amounts of care (HA-CC).	Ten sites in USA. Children (n=1,095) reflected a variety of SES and sociocultural backgrounds.	Prospective longitudinal selection focusing on 36 mos. from the NICHD SECCYD study (longitudinal study of child development and early child care). Included children who experienced moderate amounts of child care. Study controlled for major child and family selection factors as well as quality and type of child care. Used MANCOVAs, controlling for child, family and child care quality and type.	School readiness measured using Bracken Basic Concept Scale (knowledge of color, letter identification, number/counting, comparisons, and shape recognition). Language assessed with Reynell Developmental Language Scales for receptive and expressive language. Parenting quality based on: 1) mother's behavior videotaped at 6, 15, 24 and 36 mos.; and 2) stimulation and responsiveness of home environment based on HOME measure. Quality of	1) Different relations were found between parenting quality and cognitive outcome measures of school readiness and receptive language for children who experienced different amounts of child care. 2) Associations between parenting quality and child outcomes were stronger among children experiencing moderate amounts of childcare than those in HA-CC, and were not weaker for those in mainly maternal care for SR and receptive language skills.	Study does not allow inferences regarding causation due to correlational design. Replication required before policy implementation.

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					child care collected through phone interviews with mothers (every 3 mos) and observations of child's primary child-care setting at 1 and 36 mos. Child care = all non-maternal care for at least 10 hr/week (includes care by father or other relatives).		
Readiness to Learn: Early Childhood Education- Preschool							
Gormley et al. (2005) ²¹	1) Evaluated the effect of universal pre-K program on children's SR; 2) Measure program impact by	Design allowed for children who participated in pre-K and those who had not due to age at Sept. 1.	Tulsa Oklahoma, USA N=1567 (pre-K) and 3149 (K). Children were 4-5 years, diverse SES (49% female).	Quasi-experimental regression-discontinuity design. Looked at children who had just made the birthday cut-off	Examined 3 measures of the Woodcock-Johnson: letter-word identification (prereading/readier skills), spelling (prewriting and	1) Pre-K program had a significant effect on children's performance on cognitive tests of prereading and reading skills, prewriting and spelling skills and math reasoning and problem	1) Universal pre-K program financed by the state and implemented by public schools can improve prereading, prewriting and prenumeracy skills for a diverse cross-section of young children.

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Summary Review of Studies							
Citation	Study Objective	Study Description	Setting/ Participants	Design/Data Collection	Outcomes	Results	Conclusion/Comments
	disaggregating results related to income and ethnicity; 3) Further disaggregate results for children enrolled in full-day and half day programs by racial-ethnic group.			qualification (treatment of pre-K) with those who just missed cut-off (control group).	spelling skills) and applied problems (early math reasoning and problem solving).	solving abilities. 2) The pre-K program was found to benefit all racial-ethnic groups. 3) Pre-K program was found to benefit children from all economic backgrounds. 4) Unable to conclude merits of full-time vs. part time due to potential selection bias.	2) Need to consider the following characteristics of the program: a) Pre-K teachers all required to have a college degree and be early childhood certified; b) Pre-K teachers were paid at the same level as elementary/high school teachers; c) there was a strong emphasis on academic instruction; and d) Woodcock-Johnson is standardized measure of assessment.
Learning Performance-Early SR associated with later achievement							
Duncan et al (2007) ²²	Assess the association between skills and behaviors that emerge during the preschool years and later	Examine early academic, attention and socioemotional skills to later achievement controlling for child gender,	Longitudinal data sets from the USA, Canada and Britain N=1756 (NLSY), 1346 (NICHD), 690	6 Longitudinal population level nonexperimental databases: NLSY, NICHD SECCYD, BCS, ECLS-K, IHDP, MLEPS. Used multiple	Academic achievement-7-8 yrs. and 13-14 yrs. using teacher reports, test scores and grade retention. Includes grade completion, reading and	1) Early school reading predicted later reading achievement 2) Early school math predicted later math achievement. 3) Early attention had moderate predictive	1) Math and reading skills at school entry are consistently associated with later achievement. 2) Only attention predicted later achievement. 3) SR measures given by trained personnel can

Summary Table of Studies

Summary Review of Studies							
Citation	Study Objective	Study Description	Setting/ Participants	Design/Data Collection	Outcomes	Results	Conclusion/Comments
	academic achievement.	SES, preschool cognitive ability and behavior and family background characteristics.	(IHDP), 767 (MLESP), 9000-10,000 (BCS).	regressions to determine whether school entry achievement, attention and socioemotional skills predict subsequent achievement controlling for child and family characteristics. A meta-analysis was conducted on the standardized regression coefficients.	mathematics achievement	effects on later achievement. NS for socioemotional skills. Results same for boys and girls and low and high SES. 4) From the meta-analysis, only reading/language, math and attention predicted reading and math achievement. Early math is predictive of math and reading. Early reading of later reading. Early attention predicts later reading and math.	reliably evaluate early skills. Highly quoted study.
Learning Performance- Children reading and writing FSA							
Lloyd and Hertzman (2010) ²³	Examined neighborhood socioeconomic conditions associated with language and	Compared language and cognitive development scores at kindergarten	B.C., Canada, N-5,022 children residing in 105 neighborhoods, Ages 5-6 and	Population-based longitudinal and cross-sectional analyses. Composite EDI and FSA scores; where	EDI scores at Age 5-6. (language and cognitive development, communication skills and general	1) Increased Index of concentration (measure of concentrated affluence and disadvantage) predicted better Grade 4	Study strength was representation of BC population and large sample sizes. Indicators of urban/rural

Summary Table of Studies

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Citation	Study Objective	Study Description	Setting/ Participants	Design/Data Collection	Outcomes	Results	Conclusion/Comments
	cognitive outcomes of rural and urban, measured longitudinally at kindergarten and grade 4.	and Grade 4 in relation to neighborhood characteristics, controlling for child and family variables.	9-10 yrs. (635-rural; 4,825 urban)	difference score is FSA –EDI. Neighborhood level measures included: level of affluence, immigration, Percent of Aboriginal status and urban/rural status. Controlled for child gender, ESL, Aboriginal status and family SES. Design: ANCOVA with random effects using hierarchical linear modeling.	knowledge). Foundation Skills Assessment at Grade 4 (age 9-10); used numeracy and reading comprehension (not writing).	outcomes in urban neighborhoods. 2) Increased concentrated immigration predicted better outcomes in all analyses. 3) In urban neighborhoods, higher % Aboriginal heritage predicted worsened EDI language and composite scores whereas in rural areas, higher % Aboriginal heritage predicted improvement, esp. FSA numeracy.	important contextual factor.
Lloyd et al. (2010) ²⁴	Using a population-based approach, investigate the relative effects	Compared language and cognitive development scores at kindergarten	B.C., Canada. N=2648 children living in urban settings. Ages 5-6 (K) and	Cross-classified random effects modeling on population level data. See above for neighborhood	Foundation Skills Assessment at Grade 7 (ages 12/13): used numeracy and reading comprehension (not	1) Higher concentrations of disadvantage in children's kindergarten neighborhoods predicted lower reading	1) Early neighborhood socioeconomic conditions exert a stronger effect on downstream reading comprehension outcomes than on numeracy

Summary Table of Studies

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Citation	Study Objective	Study Description	Setting/ Participants	Design/Data Collection	Outcomes	Results	Conclusion/Comments
	of early childhood versus early adolescent concentrated disadvantage on children's language and cognitive outcomes in early adolescence.	and Grade 7 in relation to adverse disadvantage associated with neighborhood characteristics, controlling for child and family variables.	12/13 (Grade 7). 46% Females; 3.5 % Aboriginal and 61 % spoke English as a second language.	level data.	writing).	comprehension and numeracy scores in Grade 7. 2) Grade 7 disadvantage levels did not predict outcomes.	outcomes (although both are significant). 2) Providing community level programs and resources (e.g., libraries) in economically depressed areas would support later literacy achievement. 3) Indicators should include early residential environment characteristics.
General-Media Effects							
Baydar et al. (2009) ²⁵	Turkey has a high percentage of children who do not have access to preschool (aprox. 4.5 million children). This study explored whether the	Compared the effect of a 13 week educational program (BOM) designed to enhance school readiness with an entertainment program of the	Turkey. Mothers who were not employed and children who were to start school the following Fall were recruited from low income families	Experimental, random assignment Collected information about exposure to BOM, family SES, cognitively stimulating activities available to the child and	Battery of five cognitive skills: basic arithmetic readiness, categorization, spatial analogies, syllabification and vocabulary: tested pre and post intervention.	1) Children who were exposed to BOM 3+ /wk showed significant gains in math, syllabification and vocabulary. Less than 3x. gains only seen in vocabulary. 2) Effects were stronger for lower SR skills prior to exposure, resulting in gains in math,	Educational programming targeting preschoolers and focusing on family relations, social development, emotional development, physical development (health), environmental awareness and cognitive development can enhance cognitive development after 13 weeks provided it was

Summary Table of Studies

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Citation	Study Objective	Study Description	Setting/ Participants	Design/Data Collection	Outcomes	Results	Conclusion/Comments
	use of an education television program designed to promote SR had an effect for children from low SES families.	same length, using prescreening cognitive scores as controls.	in the largest metropolitan area. Age range: 4 ys7mos-7ys3mos. \bar{X} =5yrs3mos E=139; C=127 Natural observation group (n=133)	outcome measures. Regression analyses used.		syllabification, spatial analogy and vocabulary.	viewed min. 3 x per week. Effective intervention for large groups of children without access to other ECE programs. Program name- "Will You Play with Me?"
Zimmerman & Christakis (2005) ²⁶	1) Is TV viewing among children < 3yrs harmful for children's cognitive development? 2) For children aged 3-5, for whom considerable educational programming exist- does TV	Secondary analyses of NLYS-CHILD (1986-2000) and NLSY '79, exploring effects of early childhood television viewing on children's cognitive scores at age 6-7 yrs.	USA N=11000 . Age range =5 yrs. 6 mos. – 7 yrs. 6 mos.	Data from a nationally representative sample was regressed for four measures of cognitive development at ages 6 and 7 years on television viewing before age 3 and at ages 3-5 years, controlling for parental	Peabody Individualized Achievement Test for mathematics, reading recognition and reading comprehension, accessed at or with 6 months of 6 years of age. As well, the Memory for Digit Span assessed from the Wechsler Intelligence Scale for	1) Overall a consistent pattern of negative associations between television viewing before age three and adverse cognitive outcomes at ages6- 7 (reading recognition, reading comprehension. 2) TV viewing between ages 3-5 years positively influenced reading recognition and short-term memory,	Study did not assess type of programming, i.e., general vs. educational. Greater publicity for Adherence to the American Academy of Pediatrics guidelines that TV viewing for children under 2 years not recommended. Effect size- moderate

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	viewing on average have positive effects for cognitive development at ages 6/7 yrs?			cognitive stimulation early childhood (HOME scale), maternal education and IG. Mother reports of amount of TV viewing.	Children was evaluated.	consistent with the literature regarding the positive effects of educational television.	

RESULTS

Readiness to Learn Theme

The readiness to learn theme addressed both children's capacities and the contexts that promote cognitive development and/or school readiness. Readiness to learn reflects the idea of a child's preparedness for school, encompassing skill-based academic competencies such as reading and social, behavioral and self-regulatory skills that are needed for socializing, attending to tasks and communicating effectively (Pianta & McCoy 1997).²⁷ Contextual factors identified in this review relate to efforts to promote or advance readiness such as quality child care, preschool, and home stimulation.

Children's Capacities

The review of the literature in children's capacity for readiness to learn resulted in a meta-analysis of 70 longitudinal studies exploring children's academic/cognitive and social/behavioral assessments at preschool or kindergarten compared to grades 1 and 2 (La Paro & Pianta, 2000). Since this review was published in 2000, a level B search was conducted which revealed studies focused on social behavioral skills and school readiness (Bierman et al., 2009; Bracken & Fischel, 2007; Welsh et al., 2010), a study on language skills and readiness to learn (Justice et al., 2009) and a study exploring the influence of motor skills on SR (Grissmer et al., 2010). A systematic review was also identified that examined the association between childhood speech impairments and participation across the lifespan (McCormack et al, 2009).

Cognitive/academic

Skills and abilities related to the academic/cognitive domain typically include general knowledge, intellectual development, language development and skills, literacy, numeracy and perceptual-motor skills. Paro and Pianta (2000) in their meta-analysis, identified a moderate effect size (.51) for predicting children's academic/cognitive school readiness for Grades 1 and 2 from assessments conducted in Kindergarten. In essence, 25% of the variance in early school academic/cognitive performance is predicted from preschool or kindergarten cognitive/academic status. This result suggests that attention should also be directed toward other factors which may be influencing children's performance such as family circumstances, neighborhood influences and community and societal supports. It is important to note that the cognitive skills that children have at the beginning of school not

only contributes to their learning in the early grades but also influences middle school performances. ²⁸

Language Skills

According to the *Encyclopedia of Early Child Development* ¹, “children with poor listening and speaking skills are referred to as having a language impairment. An estimated 8 to 12% of preschool children and 12% of children entering school in Canada and the U.S. have some form of language impairment. Studies also show that 25 to 90% of children with language impairment experience reading disorders, usually defined as poor reading achievement occurring after sufficient opportunity to learn to read. Reading disorders among school-aged children is estimated to be between 10 and 18%. When children have difficulty understanding others and expressing themselves, it is not surprising that psychosocial and emotional adjustment problems ensue. Children with delayed or disordered language are therefore at an increased risk for social, emotional and behavioral problems. As well, research shows that most children who have poor reading skills at the end of Grade One will continue to experience difficulties reading later on” (p.i).

McCormack et al. (2009) describe some of the ways that communication capacities may facilitate school readiness:

- Learning to read is preceded by the development of decoding or phonological awareness skills such as the ability to think about and manipulate sounds in words.
- Comprehension of written material requires efficient decoding skills.
- Learning to write involves the development of adequate spelling and grammatical knowledge as well as fine motor skills.
- Mathematical computational skills have been found to be associated with mastery of phonological memory and awareness.

McCormack et al. (2009) conducted a systematic review of the impact of childhood speech impairment on participation restrictions across the life span according to the World Health Organization's *International Classification of Functioning, Disability and Health*. ² The research indicated that speech impairments in childhood may negatively influence the

¹ Encyclopedia of Early Child Development. See <http://cedje2.dev.absolunet.com/pages/PDF/Language.pdf>

² World Health Organization's *International Classification of Functioning, Disability and Health* (2001). See <http://www.who.int/classifications/icf/en/>

following: learning to read/reading, learning to write/writing, focusing attention and thinking, calculating, communication, mobility, relating to persons in authority, informal relations with peers and friends, parent-child relationships, sibling relationships, and higher rates of employment. The conclusion most supported by this review identified an association between speech impairment and activities related to learning and applying knowledge.

Justice et al. (2009) explored whether the timing of language difficulties is a significant predictor of school readiness. They found that language difficulties (receptive and expressive) at 36 and 54 months significantly predicted, with large effect sizes, children's literacy, mathematics and academic competence during kindergarten, and to a lesser degree children's social-behavioral skills. Specifically, the presence of receptive language difficulties at school entry was a significant predictor for literacy, math, academic competence, social skills and externalizing behavior, whereas the presence of expressive language difficulties predicted poor language and literacy, mathematically thinking and academic competence. These authors recommend that 54 months is a crucial point for identifying students who need additional language support.

Motor skills

Grissmer et al. (2010) explored the association between kindergarten motor skills and general knowledge on Grade 5 achievement tests from three national longitudinal data sets (Canada, USA, and UK). The results indicated that both attention and fine motor skills are important developmental predictors of later reading and math achievement; controlling for family, child and early math and reading scores. Specifically, fine (but not gross) motor skills were a very strong and consistent predictor of later achievement and that indicators of kindergarten attention, fine motor skills and general knowledge best predicted later math, reading and science scores.

Screening to identify language difficulties and difficulties with motor skills are an important step in developing treatment efforts. Not identified in the review but an important aspect of children's readiness to learn are strategies for promoting literacy. Pivik (2009) ²⁹ reviewed the literature for evidence-based strategies for promoting literacy for children at risk. Accordingly, the research evidence overwhelmingly recommends that instructional approaches need to be systematically organized in response to diagnosed student need.

This entails that regular screening be used to identify need and to inform instruction. Current best practices recommend a *Response to Intervention (RtI)* approach that is comprehensive, incorporates early detection and serves as a preventative strategy that identifies struggling students and assists them before they fall behind. The research also shows that early intervention is very effective and works best with small groups or one-on-one instruction. Programs should include a variety of approaches, be culturally and developmentally appropriate for the ability level and include dedicated time for instruction. Finally, a holistic approach is required that: a) considers the social-emotional influence on school achievement; b) addresses family needs (e.g., family literacy); c) utilizes community programs and services that support literacy; and, d) addresses the needs of the child (sense of belonging, is enjoyable/fun, is applicable to their life).

Social Behavior Skills

Typically, the social-behavioral domain includes problem behavior, peer relations, and social competence and is measured using teacher or parent checklists. Difficulties in these social-behavioral areas are thought to be associated with poor school readiness or adjustment, whereas strengths in skills such as assertiveness, leadership and independence are associated with school success (Pianta & McCoy, 1997). However, La Paro and Pianta (2000) found in their meta-analysis, social behavioral skills measured in preschool or kindergarten did not strongly predict social behavioral skills in Grades one and two, meaning that social behavioral skills are amenable. Although social-behavioral skills may change in the early years, they have also been shown to influence cognitive development. Both Bierman et al. (2009) and Bracken and Fischel (2007) found that social behavioral skills were significantly associated with such cognitive skills as language, literacy and mathematics. Their recommendations were that preschools have a role to play in enhancing behavioral and cognitive school readiness, either through peer play learning opportunities and social emotional learning (Bierman et al., 2009) or a structured literacy program (Bracken & Fischel, 2007).

Welsh et al. (2010) provide a new perspective and potential gap in the literature around social behavioral influences on SR. They measured the effect of executive functioning skills which includes working memory, attention set shifting and inhibitory control on preschooler's SR. Executive functioning skills are thought to support school readiness by

enabling the child to regulate their emotions, thus supporting behavioral self-regulatory competence and social competence; allowing students to better engage with teachers and peers. The sample was ethnically diverse, however, all of the children came from low income families. Although the design of the study does not allow conclusions of causation, the authors did find that: 1) working memory and attention control assessed at the start of the year significantly predicted growth in the child's literacy and numeracy skills over the course of the prekindergarten year, after controlling for initial domain-specific cognitive and language skills; and 2) the growth in working memory and attention control skills during the prekindergarten year made unique contributions to kindergarten reading and math achievement, after controlling for emergent literacy, numeracy and language skills. Thus, enriching domain-specific academic curricula in prekindergarten classrooms, by providing children with repeated practice sessions on specific executive functioning tasks and interventions designed to promote self-regulation and social-emotional development, is likely to enhance academic readiness.

Measures and Candidate Indicators of Children's Capacities

School readiness in British Columbia actually measures 'readiness to learn', specifically, children's capacity to do well in school as measured with the *Early Development Instrument* (EDI; Janus and Offord, 2007).³⁰

In British Columbia, *The Human Early Learning Partnership* (HELP) collects data on all kindergarten children from 469 neighbourhoods and links that data with census, health and educational sources.³¹ This extensive population health data allows the mapping of school readiness across the entire province and provides information for researchers, policy makers, social, health and educational professionals and community organizations to determine needed services. The primary focus of the EDI is to provide information on school readiness based on the five early childhood development indicators. The EDI gathers data on the following five subscales of children's development:

- Physical health and well-being – child is healthy, independent, ready each day....
- Social competence – child plays, gets along with others and shares, is self-confident...
- Emotional maturity – child is able to concentrate, help others, is patient, not aggressive or angry...

- Language and cognitive development – child is interested in reading and writing, can count and recognize numbers, shapes....
- Communication skills and general knowledge – child can tell a story, communicate with adults and children, articulate themselves...

According to HELP’s assessment of school readiness across all school districts in British Columbia, the following table identifies the percentage of children vulnerable across the physical, social, emotional, language and communication domains. As well there is a category which identifies children who are vulnerable in one or more domains.

Table 1. EDI results, B.C., Human Early Learning Partnership

	Count		% Vulnerable			
	Physical	Social	Emotional	Language	Communication	One or more domains
BC Vulnerability Rates						
Wave 1 (01/02 - 03/04)	9.6	11.3	10.9	11.0	10.5	26.1
Wave 2 (04/05 - 06/07)	11.8	13.0	11.7	11.1	14.0	29.6
Wave 3 (07/08 - 08/09)	11.7	12.7	12.4	10.1	13.2	28.7

As well as the EDI, *The National Longitudinal Survey of Children and Youth (NLSCY)*, developed jointly by Human Resources Development Canada and Statistics Canada, is a comprehensive survey which follows the development of children in Canada and monitors the incidence of various factors that influence their development from birth to early adulthood. The study is designed to collect information about factors influencing a child's social, emotional and behavioral development and to monitor the impact of these factors on the child's development over time. The survey has indices that measure the following children's capacities:

Table 2. Children's Capacities as Measured by the NLSCY

The Motor and Social Development (MSD) scale consists of a set of 15 questions in the NLSCY that measure dimensions of the motor, social and cognitive development of young children from birth through 3 years of age; the questions vary by age of the child. These questions are asked of the PMK.

The Peabody Picture Vocabulary Test - Revised (PPVT-R) is designed to measure receptive or hearing vocabulary in either English or French. The test is administered by the interviewer directly to children 4 to 5 years of age. The PPVT-R is only administered to children who's PMK provided consent for the test to be administered to their child.

“Who Am I?” is designed to assess the ability to conceptualize and to reconstruct a geometrical shape (copying skill), and the ability to use symbolic representations (writing task) such as numbers, letters and words. Because “Who Am I?” assesses nonverbal language, it can be used to assess children whose knowledge of English or French is limited. These children could be allowed to complete tasks in their mother tongue as well as in English and French. The assessment consists of an appealing booklet in which the child completes the tasks as the assessor turns the pages and gives instructions.

Number Knowledge. Four developmental levels have been established for children’s understanding of numbers — predimensional (level 0), unidimensional (level 1), bidimensional (level 2) and integrated bidimensional (level 3). Knowledge at each level of the test is a prerequisite, or provides the conceptual building block, for knowledge at the next level of the test. As the NLSCY captures responses from children 4–5 years of age, only the predimensional and unidimensional levels are considered for this developmental stage. The predimensional level assesses children’s ability to count by rote and to quantify small sets, using concrete objects, and is important for the next level where children deal with changes in quantity without objects than can be touched or seen. The unidimensional level assesses children’s knowledge of the number sequence and ability to handle simple arithmetic problems. To solve the items, children must rely on a “mental counting line” in their heads. The test is administered orally by the assessor, and the child must respond verbally. The child may not use paper and pencil to figure out answers.

Emotional Problem-Anxiety, Hyperactivity and Physical Aggression-Conduct Problem measures are key behaviour scales examined in the NLSCY. For each behaviour, a set of questions is used and the answers combined into a scale to give a more valid representation of the different types of behaviour. The questions associated with the behaviour scales are asked of the PMK and do not represent professionally diagnosed problem behaviours.

Emotional Problem-Anxiety. Respondents were asked about the frequency with which their child appears to be unhappy, depressed, worried, nervous or anxious. A child classified as having high anxiety was, in the parent’s opinion, unhappy, fearful and tense.

Hyperactivity is characterized by restlessness, fidgeting, lack of concentration and inability to wait for his or her turn.

Physical Aggression-Conduct Problem. The PMK is asked a series of questions about the frequency with which his/her child engages in *physical aggression* such as fighting, bullying or threatening people. These responses were combined to form a global scale for this type of behaviour, which ranged from 0 (those with the lowest reported

Ages and Stages — Personal-Social Score is one of a number of behaviour scales examined in the Ages and Stages questionnaire, a supplement to the NLSCY. The Ages and Stages questionnaire is designed to identify children who show potential development problems. The scale for personal/social behaviour comprises several questions capturing different age-relevant aspects of this behaviour, such as how the baby interacts with him/herself, with strangers, with the parent and with objects such as toys. The questions associated with the behaviour scales are asked of the PMK and do not represent professionally diagnosed problem behaviours.

Conclusion on Children’s Capacities

The review of the literature indicates that measurement of children’s capacities is an important part of the puzzle for explaining early childhood learning. This includes the

following indicators: physical development (esp. fine motor skills), cognitive development (Who Am I? Test, Number Knowledge Assessment), language and communication skills (receptive vocabulary, communication skills, home stimulation efforts), and emotional and social development (physical aggression, indirect aggression, personal and social skills). However, other factors need to be included in the assessment of early cognitive development. These include early screening to identify potential health problems, an examination of other contextual factors which may be influencing children's capacities and the development of early interventions to assist children and families.

Early Childhood Screening Initiatives

According to B.C.'s *Early Year's Annual Report, 2008-09*,³ B.C. has implemented an integrated, cross-ministry early childhood screening initiative for children under six years. The initiative, which provides dental, hearing and vision screening services, is led by the Ministry of Healthy Living and Sport with partners from the Ministries of Health Services, Children and Family Development, Housing and Social Development, the First Nations Health Council and health authorities. Public dissemination of the number of children's receiving these services was not found but is recommended.

Early Childhood Education and Care

In an attempt to ameliorate the negative effects of at-risk families (e.g., teen parents, low SES) or at-risk-children (e.g., low birth weight, children with developmental delay and/or disabilities) on child development, health and social policy programs have introduced such childhood interventions as early health screening and interventions, family support programs and early childhood educational initiatives. Examples of effective newborn screening and support programs, identified by Pivik (2009),³² are the *Newborn Individualized Developmental Care and Assessment Program* (NIDCAP) and *The Infant Health and Development Program* (IHDP) which involve primary health care for low birth-weight babies as well as family support services such as home visiting and parent education using multidisciplinary teams and continued surveillance over an extended period. Positive

³ B.C.'s *Early Year's Annual Report, 2008-09*. see

http://www.mcf.gov.bc.ca/early_childhood/pdf/EarlyYearsAnnualReport2010_Web.pdf

cognitive effects (IQ, vocabulary, receptive language, and visual-motor skills) have been identified for the IHDP,^{33, 34} particularly in the heavier birth-weight babies.

Typically, family support services aim to enhance parental skills and behaviors and hence improve children's environments, experiences and developmental outcomes. An example of an effective parental education and support program is *The Nurse-Family Partnership Program* (NFP), which has the following goals: 1) to improve pregnancy outcomes by promoting health-related behaviors; 2) to improve child health, development and safety by promoting competent care-giving; 3) to enhance parent life-course development by promoting pregnancy planning, educational achievement, and employment; 4) to enhance families' material support by providing links with needed health and social services; and 5) to promote supportive relationships among family and friends. Through home visits with a registered nurse, the program has shown to be effective for better prenatal care (e.g., attended childbirth classes, accessing community services, and reduced smoking),³⁵ safer home environments and less emergency room visits for the child.^{36, 37} At age 15 years, the child whose mother participated in NFP had significantly fewer arrests, convictions, and violations of probation. As well, they were less likely to run away, had fewer sexual partners and drank less alcohol.^{38, 39}

Programs which incorporate quality early childhood care, education and family support have also been shown to be effective in enhancing the cognitive, emotional, and social development of preschoolers,^{40, 41} with longer-term gains seen in cognitive test scores, lower rates of grade retention, special education placement and higher rates of high school graduation.⁴² One well-known example is *The Carolina Abecedarian Project*, which provided a comprehensive early education program for young children at risk for developmental delays and school failure. Typical characteristic of evaluation families included young single African-American (98 percent) mothers with a low education and IQ level ($M = 85$). The preschool intervention component (available to infants from 6 weeks until entry into kindergarten) provided a stimulating daycare setting 6-8 hours a day, 5 days per week, and 50 weeks per year. The curriculum was focused on promoting school readiness, specifically enhancing cognitive and linguistic development while providing an enriched language environment that was responsive to children's needs and interests. In addition, children received nutritional supplements and disposable diapers, along with pediatric care and

supportive social work services. After the children turned 3 years old, they received a more structured set of educational curricula, which increasingly became similar to programs in the local public kindergarten. As well as the preschool intervention, some children were provided the opportunity for extended care to grade 3, which included a resource teacher who conducted home visiting, provided parent and child tutoring, developed an individualized set of home activities to supplement the school's basic curriculum in reading and math, and liaised and advocated for the family at school and in the community.

Children were followed for 21 years, with the evaluation focused on cognitive development, school performance, physical health, substance abuse and juvenile justice. The preschool intervention was shown to be effective for significantly increasing mental development, cognition, language, perceptual performance, memory, and IQ compared to controls after 12 months.⁴³ Significant IQ gains were still identified at 54 months even after controlling for maternal IQ and home environment.⁴⁴ Children attending both the early intervention and the after school enrichment program scored higher in academic achievement compared to the early intervention alone, while those in only the after school program did better than the controls but not as well as the centre-based program.⁴⁵ Perhaps the reason that this demonstration study is so often identified as exemplary is the fact that the preschool intervention has shown lasting effects on intelligence scores, reading, and math up to age 21 years.^{46, 47}

Summary of Results of Early Childhood Education and Care Search

In this review, research exploring interventions for promoting child cognitive development in the past decade identified the influences of home stimulation efforts (Nelson, 2005; Votruba-Drzal, 2003), child care (Dearing et al., 2009; Belsky, 2006; McCartney et al., 2007; Adi-Japha & Klein, 2009), and preschool (Gormley et al., 2005). As well, a systematic review was identified that examined the effect of early childhood care and education for children from different social backgrounds (Burger, 2010). Eshel et al. (2006) conducted a systematic review of the interventions and outcomes associated with responsive parenting, while Sarkadi et al. (2008) in their systematic review, focused on child developmental outcomes related to father involvement.

Home Stimulation

Factors which may influence cognitive development in the home environment include the frequency of parent-child interactions such as reading to the child, teaching them the alphabet, visiting libraries, playing with numbers and letters, or teaching children songs or nursery rhymes. A systematic review was identified that explored the outcome of responsive parenting (Eshel et al., 2006) and another which focused on the influence of father involvement in children's development (Sarkadi et al., 2008). As well, two studies were identified that addressed home stimulation in relation to attendance in preschool (Nelson, 2005) and the effect of a family's economic resources in relation to home stimulation and children's development (Votruba-Drzal, 2003).

Parental responsiveness and child development has been explored in a systematic review of studies in developed and developing countries by Eshel et al. (2006). Focusing on the results for developed countries in relation to cognitive development, maternal responsiveness was most often associated with positive language, cognitive and psychosocial development for children. For example, one study indicated increased IQ and cognitive growth at four and a half years; higher school achievement at 7 years; as well as higher IQ at age 12. The results are thought to be associated with secure attachment between primary caregiver and infant and particularly relevant for at-risk groups such as low birth rate infants or teen mothers. Interventions in developed countries often combine health services and home visits that provided support and information to mothers.

Both randomized and correlational studies of interventions aimed at promoting parental responsiveness such as home visitation indicated modest effectiveness for child health and development (e.g., reducing the decrease in intellectual performance suffered by at-risk infants). Longer behavioral and psychosocial effects were also noted such as a lower antisocial behavior and criminal behavior at age 15 years. Interventions were most effective when targeted for at-risk groups and when focused on specific behavioral change. Authors suggest public health develop a package of resources to provide guidance on promoting responsive parenting through public health venues. It is recommended that this package contain training materials for health workers and families, and planning guidelines and materials to monitor and assess the program.

Traditionally, most of the research exploring parent-child interaction effects has focused on the mother. Sarkadi et al. (2008) explored the effect of father's involvement in their children's development. In this systematic review, father's involvement is defined as accessibility (presence and availability), engagement (direct contact such as playing, reading, outing or care-giving activities) and responsibility (participating in decision-making on childcare, health visits...). Positive behavioral, social, cognitive or psychological effects were found in 17 of the 18 publications that controlled for SES. Specific to cognitive effects, a highly engaged father (one who played/cared for their child daily) predicted significantly higher IQ tests in a sample of children born premature. In another large study, father engagement was associated with higher educational attainment. As well, father involvement was shown to reduce behavioral problems in boys and psychological problems in young women and enhance cognitive development while decreasing criminality and economic disadvantage in low SES families.

Nelson (2005) looked at children in high vs. low risk families (based on SES, primary language and parent's educational level), home learning activities and preschool attendance, in relation to their reading and mathematics achievement and approaches to learning in kindergarten. She found that what parents do in the home has a significant influence on children's cognitive development. Specifically, activities such as: reading books, telling stories, singing songs, arts and crafts, play games, have children do chores, talk about nature or science, play sports and build things with their children, resulted in kids who had significantly better scores in reading, math and approaches to learning. Interestingly, home learning was the only factor which led to higher scores on how children approach learning (how motivated and interested children are in learning). Unfortunately, even children with risk factors with enriched home environments and those who had attended preschool still performed lower than children from risk free environments. The author recommends that policy aimed at supporting parents in providing stimulating home environments be developed for preschool children. As well, the results showed that preschool attendance led to higher scores on reading and mathematics achievement tests in kindergarten, supporting the recommendation of accessible preschool for all children. Finally, the author concluded that providing aid and support for parents at risk (and not just their children) will have a positive influence on school readiness.

Votruba-Drzal (2003) found that improvements or reductions in families' economic resources have significant implications on children's early learning experiences in their home environment. Analyses of the *National Longitudinal Survey of Youth* indicated that the parents' income influenced how stimulating the home environment was for children at 3-4 years and 7-8 years. Related to positively stimulating home environments was maternal education and academic aptitude and if she worked part-time (vs. full-time). Home learning environments of ethnic minority children, boys and higher number of children were associated with fewer home learning opportunities. Income increases of even \$10,000 had beneficial effects on the home environment of the most vulnerable families. The author suggests that programs providing income supplements targeted at the most vulnerable families may be part of an effective strategy (along with other interventions such as home visitation and/or parent education) to improve young children's home learning environments and reduce school readiness disparities.

Measures and Candidate Indicators for Home Stimulation

Currently, the *National Longitudinal Survey of Children and Youth* (NLSCY), measures home stimulation efforts (see Table 3). The Government of Canada's most recent report describing this data, *The Well-being of Canada's Young Children* (2008)⁴, indicated that for 2004/05, the percentage of parents indicating positive interactions with the family was 94.3%; and the percentage of children read to daily was 64.8%.

Table 3. Home Stimulation efforts as measured by the NLSCY

Family Functioning. The family functioning scale provides a global assessment of family functioning (including problem-solving, communication, roles, affective involvement, affective responsiveness and behaviour control) and indicates the quality of relationships between family members. This scale is administered to either the PMK or spouse/partner of the PMK. The scale ranges in value from 0 to 36 with higher scores indicating family dysfunction. The scale does not reflect a clinical diagnosis. To identify the presence of family dysfunction, thresholds (or cut-off points) were established by taking the scale score that is closest to the 90th percentile based on NLSCY Cycle 3 data for children in all provinces. The variable represents the proportion of children whose family exhibits higher levels of family dysfunction and those whose family does not.

Positive Parenting. Positive interaction is a parenting style that is captured in the NLSCY. The purpose of the parenting scales is to measure certain parental behaviours. The scale ranges in value

⁴ *The Well-being of Canada's Young Children* (2008) see www.socialunion.ca.

from 0 to 20, with high scores indicating positive interaction with the child. The questions assessing parenting styles were administered to the PMK or spouse/partner of the PMK.

Reading by an Adult. This indicator refers to the exposure of the child to reading activities with a parent or another adult. Therefore, this indicator should not be interpreted to refer specifically to parent-child interactions.

Child Care

The influx in the number of women returning to work in the late 1990's prompted a national investigation of the effects of child care on children's development in the United States. In Canada, the numbers have increased as well. Statistic Canada ⁵ reports that 54% of Canadian children aged six months to five years were in some form of child care in 2002-2003. High quality child care is defined by the *National Institute of Child Health and Human Development (2000)*⁶ as having: 1) high levels of language stimulation; 2) access to developmentally appropriate learning materials; 3) a positive emotional climate with sensitive and responsive caregivers; and 4) opportunities for children to explore their environments. The following studies explore various aspects of this investigation-- the National Institute of Child Health and Human Development's Study of Early Child Care Study (NICHD-SECCYD).

Summary of Results for Childcare

Belsky (2006) explored the relationship between early child care and children's cognitive, socioemotional and linguistic development at 15, 24, 36 and 54 months of age. This sample of 1,364 children and their families was somewhat unique in that it was ethnically and economically diverse; however, 'really poor' families were not well represented. Focusing on the child's home environment, their child care environment and children's outcome measures, this repeated measures design found that the more attentive, responsive and stimulating the early child care, the better the child's cognitive-linguistic performance at all ages. As well, language stimulation in the second year was most predictive of language development at two years of age.

⁵ Statistics Canada. Child care: An eight-year profile, 1994-1995 to 2002-2003. The Daily April 5, 2006. Available at: <http://www.statcan.ca/Daily/English/060405/d060405a.htm>. Accessed November 1, 2010.

⁶ Child Health and Human Development's Study of Early Child Care Study (NICHD-SECCYD). See <http://www.nichd.nih.gov/research/supported/seccyd.cfm>.

The question of whether high quality child care may serve as a protective factor for children from low SES families was explored by McCartney et al. (2007). Three groups were compared at 36 months: those in high quality child care, those in low quality child care and those not in child care. Children from low income families in higher quality child care performed better in school readiness, receptive language and expressive language tests than children in low quality child care and children not in formal child care arrangements. Further, the home environments of children of poorer families who were in the higher quality child care group were more positive (e.g., nurturing relationships, more cognitively stimulating materials), suggesting increased maternal knowledge about positive child rearing.

Using the same database, Dearing et al. (2009) explored the question of whether high quality child care during early childhood moderated the association between family economic status and children's achievement during middle childhood (Grades 3 and 5). These authors found that for low-income families, high quality early child care promoted school readiness skills which in turn promoted reading and mathematics achievement through to middle childhood.

The final study exploring the NICHD-SECCYD longitudinal database, looked at children's school readiness, receptive language and expressive language at 3 years in relation to the amount of time spent in child care and parenting quality (Adi-Japha & Klein, 2009). Children were grouped into: 1) those who experienced predominantly maternal care; 2) those experienced medium amounts of care; and 3) children who experienced high amounts of care. Controlling for major child and family factors, as well as the type and quality of the child care, the focus was on exploring whether different relations exist between parenting quality and cognitive outcome measures for children spending different amounts of time in child care. Associations between parenting quality, school readiness and receptive language were stronger for children in medium amounts of child care compared to those in high amounts of child care (more than 30 hrs/wk) or those in low amounts of care.

Measures and Indicators for Child Care

According to The NLSCY ⁷, slightly more than half of children in Canada from 1 to 5 years of age, with parents who were working or studying, were in non-parental childcare in 2004/05. Further, 35.9 % of children under 5 years of age spent 40 hours per week or more in non-parental care arrangements. British Columbia puts out an annual report on the health and well-being of its young children, in accordance with the *The Early Childhood Development Agreement*. All provincial governments (except Quebec) collect information on 11 indicators of well-being in four key areas of action: 1) promotion of healthy pregnancy, birth and infancy; 2) improvement in parenting and family supports; 3) strengthening of early childhood development, learning and care; and 4) strengthening of community supports.

In the First Ministers' Communiqué on Early Childhood Development (2000), governments committed to report annually to Canadians on investments and progress in the area of early childhood development. Specifically, Ministers agreed to report on all early learning and child care programs and services as defined in this communiqué. Reports include:

- Descriptive and expenditure information on all early learning and child care programs and services;
- Indicators of availability, such as number of spaces in early learning and child care settings, broken down by age of child and type of setting;
- Indicators of affordability, such as number of children receiving subsidies, income and social eligibility for fee subsidies, and maximum subsidy by age of child; and
- Indicators of quality, such as training requirements, child/caregiver ratios and group size, where available.

Governments agreed to publicly release baseline information by the end of November 2003, with annual reports released beginning in November 2004. British Columbia's baseline report and subsequent annual reports can be found at the Ministry of Children and Family Development website. ⁸ According to numbers for 2008/2009, ⁹ the following data is available for B.C.:

⁷ *The Well-being of Canada's Young Children* (2008) see www.socialunion.ca.

⁸ Ministry of Children and Family Development web site: www.mcf.gov.bc.ca/early_childhood/publications.htm

⁹ British Columbia's Early Years Annual Report. see http://www.mcf.gov.bc.ca/early_childhood/pdf/EarlyYearsAnnualReport2010_Web.pdf

- Percentage of children in some form of non-parental care = 46 % of families for children under 6 years.
- Ratio of adults to children (1:4 for 0-36 months, 1:8 for 3-5 yrs., 1:10 preschool and out of school groups)
- Average number of children receiving subsidy per month = 27,251
- Number of new early childhood educators certified = 683
- Number of new infant/toddler certified early childhood educators = 221
- Number of new special needs educator certifications to early childhood educators = 170
- Number of courses provided to support early child developmental learning = 1,197; number of course participants = 18,694.

Preschools

As the research on the importance of early education and quality care has emerged, more formalized preschool programs are emerging. These include: child-care centres, nursery schools, preschools, pre-kindergarten, child development centres, and playgroups.

Preschool programs are focused on providing care and educational opportunities that support young children's learning and development. Like the child care research, the quality of the experience is what influences child development. According to Kagan and Kauzer (2006)¹⁰, effective preschool programs have a curriculum with the following characteristics:

- *Children are active and engaged.* Children learn best by exploring and thinking about all sorts of phenomena. As such, children need to be active in their learning, not just cognitively, but also physically, socially, and artistically. Effective curriculum ensures that important concepts are taught through projects, every day experiences, collaborative activities, and an active curriculum.
- *Goals are clear and shared by all.* Curriculum goals should be clearly defined, shared, and understood by all adults who have a stake in children's learning (e.g., families, teachers, program administrators). The curriculum and related teaching strategies should be designed to help achieve goals in a unified, coherent way.
- *Teachers have frequent, meaningful interactions with children.* As already noted, curriculum and the content of what young children need to learn, know, and be able to do is closely linked with pedagogy and how such content is delivered. As a consequence, curriculum implementation relies primarily on teachers and the nature of teacher/child interactions. Teachers' engagement with children also allows them to

¹⁰ Kagan S, Kauzer K. Preschool programs: effective curricula. Encyclopedia on Early Childhood Development. 2006. See <http://www.child-encyclopedia.com/pages/PDF/Kagan-KauzerANGxp.pdf>. Accessed November 1, 2010.

regularly assess each child's progress and make adjustments in the classroom as necessary. Effective pedagogical and assessment strategies rely to a large extent on teachers' experience levels and educational backgrounds. To support effective teaching, curriculum should be linked to on-going professional development for teachers.

- *Curriculum is evidence-based.* The curriculum should be based on evidence that is developmentally, culturally, and linguistically relevant for the children who will experience the curriculum. It should be organized around principles of child development and learning. When subject-specific curricula are adopted, they should also meet the standards of relevant professional organizations (e.g., the National Council of Teachers of English or the National Council of Teachers of Mathematics).
- *Curriculum builds on children's prior learning and experiences.* The content and implementation of the curriculum should build on children's prior individual, age-related, and cultural learning and be inclusive of children with disabilities. In addition, curriculum should support the knowledge that children gain from their families and communities and support children whose home language is not English in building a solid base for later learning. Effective curricula offer guidance, adaptations, and specific strategies to differentiate teaching and classroom activities according to the characteristics and backgrounds of the children.
- *Curriculum is comprehensive.* In spite of pressures to emphasize language, literacy, and mathematics, the curriculum should encompass all areas of development including children's physical health; well-being and motor development; social and emotional development; approaches to learning; language development, and cognition and general knowledge. Rather than adopting a didactic, school-based approach in which each subject is taught distinctly and at separate times, curricula in early care and education should explicitly integrate learning across domains.
- *Curriculum is aligned with learning standards and appropriate assessments.* Increasingly, policy-makers and practitioners alike are concerned with improving children's learning experiences. This concern is manifest in the increased attention to a systemic and systematic approach to accountability that sets specific learning outcomes (i.e., early learning standards), guidance on what content to deliver to young children (i.e., curriculum), and assessment procedures that document children's progress. However, attending to each independently is insufficient; effective curriculum is well aligned with standards and assessments.

Summary of Results for Preschools

This review of the research associated with the effect of preschool programs on cognitive development found a systematic review looking at children from different social backgrounds (Burger, 2010) and a study evaluating a universally available preschool program on school readiness (Gormley et al., 2005). These recent studies add to the existing literature by exploring the cognitive impact of preschool on children from diverse SES backgrounds (Burger, 2010; Gormley et al., 2005).

Unlike reviews of studies that explore the value of 'model' preschool programs which have shown equivocally to be effective for supporting children's cognitive development, such as the *Perry Preschool Program*, Burger's (2010) review attempted to identify 'real world examples' of studies that varied in study population (e.g., not just disadvantaged children) or study quality (including quasi-experimental designs) or programs that had both higher quality standards (e.g., accredited teacher training and a minimum staff-to-child ratios) and those which did not. Burger explored the cognitive development of children who attended an early care and education program compared to children attending alternate programs or those not attending a preschool program. According to this author, early childhood education and care referred to centre-based, child-focused settings, whose aim was to promote children's cognitive and socioemotional development in children aged 2-6 years. Examples of the type of setting explored included daycare settings, nursery schools, pre-kindergarten and kindergarten designed to foster school readiness. Burger found across 32 studies (23 projects) internationally, the majority of programs had a strong positive effect on cognitive development. Out of the 26 studies which examined the effect of the family's socioeconomic status, seven studies documented a positive benefit of preschool for disadvantaged children and 10 studies identified advantages for both disadvantaged and more privileged children. Overall, the preschool programs had a significant positive short-term effect on school readiness and a moderate longer-term effect. Specifically, the majority of the studies indicated positive effects of preschool on academic achievement tests, educational attainment and years of school attendance. Less clear was the effect on special education or grade retention.

In an evaluation of a preschool program available to all children in Oklahoma, Gormley et al. (2005) was able to control for program effects by including in the study children who just made the birthday cutoff qualification (treatment group) with those who just missed the cut-off date (controls). The large sample size allowed the authors to explore the impact of the preschool program on SR as well as the influence of income/ethnicity and full vs. part time attendance. Similar to the results in the systematic review above, the preschool program had a significant effect on children's performance on cognitive tests of prereading and reading skills, prewriting, spelling skills, math reasoning and problem solving abilities. Further, the program was found to benefit all racial-ethnic groups and children from all economic backgrounds. However, the authors were unable to conclude the merits of full-

time vs. part time due to a potential selection bias. The authors provide the following policy recommendations:

- 1) Universal pre-K program financed by the state and implemented by public schools can improve prereading, prewriting and prenumeracy skills for a diverse cross-section of young children.
- 2) Need to consider the following characteristics of the program: a) the pre-K teachers were all required to have a college degree and be early childhood certified; b) The pre-K teachers were paid at the same level as elementary/high school teachers; c) The curriculum placed a strong emphasis on academic instruction.

Measures and Indicators for Preschools

The British Columbia *Early Learning Framework*¹¹ describes the vision, pedagogical principles, and key areas of learning for children birth to five years (before school entry). According to B.C.'s Ministry of Education, Early Learning Initiatives web-site,¹² the document was designed to be applicable to all early learning environments, including child care, StrongStart BC programs, and any other pre-school and early childhood development or child health program. The Framework helps programs build on their strengths and encourages in depth reflection on their practices and the development of children. Broadly speaking, the intended purposes of the Framework are to:

- Support dialogue and reflection on the critical importance of development and learning of young children.
- Serve as a tool for reflecting on and guiding early learning programs and activities.
- Support discussion with and between families about their children's early learning.
- Guide professional development activities and investments.
- Serve as a basis for discussion among community partners with respect to the early years.
- Create a shared image of the child that can guide efforts to promote early learning at the local and provincial levels.

¹¹ The British Columbia Early Learning Framework. see http://www.bced.gov.bc.ca/early_learning/pdfs/early_learning_framework.pdf

¹² B.C.'s Ministry of Education, Early Learning Initiatives. see http://www.bced.gov.bc.ca/early_learning/

The Framework complements and builds on the *BC Program Standards for Early Childhood Settings* and the *Child Care Licensing Regulations* that requires child care facilities to provide a comprehensive program of activities that address all areas of child development

To address early learning in B.C., the following programs are available:

1. Full Day Kindergarten - As Government announced in the 2009 Speech from the Throne, British Columbia is making full day kindergarten available to all five year olds in the province. Full day kindergarten will be available for up to half of B.C.'s eligible students in September 2010. By September 2011, full day kindergarten will be available across the province. It is still up to parents to decide whether to enroll their children in kindergarten, but by the 2011/12 school year it will be available to all who want it.
2. StrongStart BC - StrongStart BC early learning programs are offered in a number of school facilities across British Columbia. StrongStart BC programs offer preschool-aged children quality early learning experience. At no cost to the family, these programs offer play-based early learning opportunities and demonstrate for parents and caregivers how they can help their children develop.
3. Ready, Set, Learn - Ready, Set, Learn is a school readiness initiative that helps families get their children ready for school. Families attending Ready, Set, Learn events in schools receive an age appropriate book for their three-year old and information to influence school readiness.

The Ministry of Children and Families Development of B.C. is responsible for the Child Care Resource & Referral Program¹³. The Child Care Resource and Referral Program provides support, resources and referral services for child care providers and a registry for parents. In 2008, an evaluation of the Child Care Resource & Referral Program was conducted.¹⁴ Although this report indicated that staff collect statistics on the quality and quantity of programs four times a year, publically available indicators of the number of children attending these initiatives and their value was not found.

¹³ Child Care Resource & Referral Program. see http://www.mcf.gov.bc.ca/childcare/cc_resource.htm

¹⁴ Child Care Resource and Referral (CCRR) Program Evaluation 2008: Highlights Report. see <http://www.mcf.gov.bc.ca/childcare/pdfs/CCRR%20Program%20Report%20Highlights%20FINAL.pdf>

Learning Performance Theme

Learning performance relates to a relatively permanent change in or acquisition of, knowledge, understanding or behavior. The literature in this review identified a seminal study that explored early school readiness measures to later achievement using national longitudinal data from Canada, the US and Britain (Duncan et al., 2007). As well, two British Columbia studies were identified that explored SR in relation to Grade 4 Foundation Skills Assessments (Llyod & Hertzman, 2010) and Grade 7 Foundation Skills Assessments (Lloyd et al., 2010). Finally, a systematic review was identified that addressed learning performance and English language skills.

Early School Readiness Measures Associated with Later Achievement

Duncan et al. (2007) assessed the association between academic, attention and socioemotional skills during the preschool years on later reading and math achievement. This study was laudable because of its breadth; using six national longitudinal databases from three countries. The authors found that math, reading and attention skills most strongly predicted reading and math achievement in Grades three and seven. Socioemotional behaviors associated with internalizing and externalizing problem behaviors and social skills were not predictive of later academic performance. No differences were found between girls and boys or between low and high socioeconomic status. Although assessment at school entry by trained personnel can be used to assess later achievement, the authors caution that most of the variation in later achievement scores were not predicted by the SR assessments; suggesting the potential for implementing early interventions.

The next two studies focus on SR scores and later achievement in British Columbia. In the first study, Llyod & Hertzman (2010), compared language and cognition measures from the *Early Development Instrument* (Janus & Offord, 2007) to numeracy and reading comprehension scores of the Grade 4 Foundation Skills Assessment of children in rural and urban neighborhoods. The authors found that greater affluence in urban neighborhoods predicted better Grade four outcomes. As well, increased concentrated immigration predicted better outcomes overall, even after controlling for English as a Second Language status. Further, residential instability resulted in worsened FSA scores in rural neighborhoods. Finally, in urban areas, higher percentages of persons of Aboriginal heritage

predicted lower EDI language and composite scores whereas in rural neighborhoods, higher percentages of persons of Aboriginal heritage predicted improved outcome measures, particularly FSA numeracy scores. This study underscores the importance of including the neighborhood context when evaluating children's SR and later cognitive achievement.

The second British Columbia study looking at SR and later achievement from Grade 7 Foundation Skills Assessments (Lloyd, et al., 2010). The authors compared language and cognitive development scores in Kindergarten and Grade 7 in relation to adverse disadvantage associated with neighborhood characteristics, controlling for child and family variables. Focusing on urban neighborhoods, the authors found that higher concentrations of disadvantage in children's kindergarten neighborhoods predicted lower reading comprehension and numeracy scores in Grade 7. As concentration of disadvantage in Grade 7 neighborhoods did not predicted worsen outcomes, the authors concluded the importance of early neighborhood socioeconomic conditions when considering factors important for later reading and numeracy outcomes. This study supports the need to provide community level interventions (e.g., libraries) in economically disadvantaged areas in order to support later literacy achievement. Finally, the study supports the idea of including indicators associated with early residential environment characteristics when tracking Grade 7 achievement scores.

English Language Skills

According to the British Columbia's Ministry of Education, 64,687 or 10% of students had English as a Second Language (ESL) status for 2009/2009. Overall, high school graduation rates for ESL students are higher than non-ESL students; however a study presented by the Canadian Council in Learning, shows that students of Chinese and Korean origin in Vancouver B.C. are doing much better than Spanish, Vietnamese, and Philippino first language speakers.¹⁵

Genesee et al. (2005) conducted a systematic review of 200 studies focused on oral language, literacy and academic skills of English Language students. They found that being

¹⁵ Canadian Council on Learning. Understanding the academic trajectories of ESL students, October 2, 2008. See <http://www.ccl-cca.ca/CCL/Reports/LessonsInLearning/LinL20081002ESLStudents.html>

bilingual can have positive cognitive effects, provided students are given time to master the second language. For children in grades K-3, students in bilingual education scored below group peers; however, by the end of elementary school and through to high school, educational outcomes of ELLs are comparable or higher than their non-bilingual peers. For example, they found a positive relation between oral language proficiency and English reading achievement for students in grades 1-9. Overall, the longer children participate in bilingual educational opportunities, the better their outcomes in relation to reading or mathematics achievement, GPA, attendance, high school completion or attitudes toward school and self.

High School Completion

Not identified by this systematic review but relevant to student achievement is the rate of high school completion. In B.C., 21 % of students are not expected to graduate high school within the normal six years in 2009-2010. ¹⁶ According to The Canadian Council on Learning's *State of Learning in Canada 2009-2010*, ¹⁴ 11% of male and 7 % of female students dropped out of high school in 2008, which has negative implications in terms of social services, education and increased criminality.

As well, school dropout is associated with worse health, employment and social relationships according to Freudenberg (2007) ⁴⁸. He provides an extensive list of individual, neighborhood and school factors associated with high school dropout based on a review of the literature. Reported individual family factors include:

- Low family socioeconomic status
- Racial or ethnic group
- Male
- Special education status
- Low family support for education, less opportunity for nonschool learning, few study aids and resources in the home
- Low parental educational attainment
- Residential mobility
- Low social conformity

¹⁶ British Columbia, Minister of Education, see FSA website at <http://www.bced.gov.bc.ca/assessment/fsa/welcome.htm> --

- Low acceptance of adult authority
- High levels of social isolation
- Behaviors such as disruptive conduct, truancy, absenteeism, and lateness
- Being held back in school
- Poor academic achievement, low grades or test scores
- Academic problems in early grades
- Not liking school
- Feelings of "not fitting in" and of not belonging
- Perceptions of unfair or harsh disciplines
- Feeling unsafe in school
- Not engaged in school
- Being suspended or expelled
- Conflicts between work and school
- Having to work or support family
- Substance use
- Pregnancy

Neighborhood or community factors include: living in a low-income neighborhood, having peers with low educational aspirations, and having friends or siblings who are dropouts.

School or school system factors include:

- Low socioeconomic status of school population
- High level of racial or ethnic segregation of students between schools in a district or within tracks or classes in a building
- High proportion of students of color in school
- High proportion of students enrolled in special education
- Location in central city
- Large school district
- School safety and disciplinary policies
- High-stakes testing
- High student-to-teacher ratios
- Academic tracking
- Discrepancy between the racial or ethnic composition of students and faculty
- Lack of programs and support for transition into high school for 9th and 10th graders

Measures and Candidate Indicators for Student Achievement

The B.C. Ministry of Education ¹⁷ tracks and reports the following achievement measures: Foundation Skills Assessments, Provincial Required Examinations, Provincial Optional Examinations, Grade-to-Grade Transitions, Six-Year Completion and Graduation Rates,

¹⁷ B.C. Ministry of Education. See <http://www.bced.gov.bc.ca/reporting/>

Examination Scholarships and Awards, Transition to BC Public Post-Secondary and School Satisfaction Survey. Accordingly, Table 5 presents student achievement on Grade 4 and Grade 7 Foundation Skills Assessment Tests in Reading, Numeracy and Writing and Table 6 presents high school completion rates.

Table 4. Foundation Skills Assessment Tests in Reading, Numeracy and Writing - February 2010

	Performance unknown		Not Yet Meeting		Meeting		Exceeding	
	#	%	#	%	#	%	#	%
FSA Reading Grade 4- N= 43,098								
All Students	7,173	16	7,123	16	24,171	56	5,012	12
Male	4,046	18	4,032	18	12,126	54	2,128	10
Female	3,127	15	3,091	15	12,045	57	2,884	14
Aboriginal	908	21	1,241	28	2,042	46	204	5
ESL	2,057	24	2,060	24	4,037	48	344	4
Special Needs*	825	40	468	23	696	34	74	4
FSA Writing Grade 4- N= 43,098								
All Students	7,755	18	5,756	13	27,411	63	2,557	6
Male	4,391	20	3,767	17	13,354	60	820	4
Female	3,364	16	1,989	9	14,057	66	1,737	8
Aboriginal	995	23	1,005	23	2,294	52	101	2
ESL	2,190	26	1,314	15	4,772	56	222	3
Special Needs*	883	43	474	23	690	33	16	1
FSA Numeracy Grade 4- N=43,098								
All Students	7,221	17	8,558	20	23,661	54	4,039	9
Male	4,058	18	4,152	19	11,895	53	2,227	10
Female	3,163	15	4,406	21	11,766	56	1,812	9
Aboriginal	940	21	1,486	34	1,831	42	138	3
ESL	2,036	24	2,189	26	3,748	44	525	6

Systematic Review of Cognitive Development and Child Health for 2000-2010

	Performance unknown		Not Yet Meeting		Meeting		Exceeding	
Special Needs*	815	40	592	29	621	30	35	2
FSA Reading Grade 7- N= 47,378								
	Performance unknown		Not Yet Meeting		Meeting		Exceeding	
	#	%	#	%	#	%	#	%
All Students	8,123	17	8,701	18	25,609	54	5,372	11
Male	4,417	18	5,052	21	13,056	53	2,106	9
Female	3,706	16	3,649	16	12,553	54	3,266	14
Aboriginal	1,077	22	1,549	31	2,085	42	212	4
ESL	1,062	31	913	27	1,261	37	145	4
Special Needs*	1,163	34	1,034	31	1,106	33	83	2
FSA Writing Grade 7- N= 47,378								
All Students	8,943	19	6,390	13	29,837	62	2,635	6
Male	4,906	20	4,314	18	14,550	59	861	3
Female	4,037	17	2,076	9	15,287	66	1,774	8
Aboriginal	1,244	25	1,251	25	2,319	47	109	2
ESL	1,140	34	521	15	1,661	49	59	2
Special Needs*	1,291	38	866	26	1,200	35	29	1
FSA Numeracy Grade 7- N=47,378								
All Students	8,300	17	9,767	20	25,603	54	4,135	9
Male	4,507	18	4,901	20	12,952	53	2,271	9
Female	3,793	16	4,866	21	12,651	55	1,864	8
Aboriginal	1,164	24	1,849	38	1,827	37	83	2
ESL	977	29	675	20	1,359	40	370	11
Special Needs*	1,224	36	1,211	36	909	27	42	1

Note: Special Needs includes Sensory Disabilities, Learning Disabilities and Behaviour Disabilities.

Source: British Columbia, Minister of Education, see FSA website at <http://www.bced.gov.bc.ca/assessment/fsa/welcome.htm> --

Table 5. Six-Year Completion and Graduation Rates

**Six-Year
Completion**

**Eligible Grade 12
Graduation Rate**

		Rate	Total	Graduates		Honours
		%	Gr 12 #	#	%	Graduates %
All Students	2008/09	79.2	46781	44326	95	42
Female	2008/09	82.1	23304	22264	96	50
Male	2008/09	76.5	23477	22062	94	35
Aboriginal	2008/09	48.8	2877	2585	90	17
ESL	2008/09	81.6	864	763	88	36
Special Needs	2008/09	44.4	1963	1789	91	12

Source: British Columbia, Minister of Education, see FSA website at
<http://www.bced.gov.bc.ca/assessment/fsa/welcome.htm> --

General Theme

Effect of Media on Children's Cognitive Development

The American Academy of Pediatrics has set guidelines for the amount of television viewing that they consider healthy for children. Specifically, children under the age of two years should watch no television and those over two years should watch no more than 2 hours per day. Excessive screen time has been attributed to the increase in childhood obesity, aggression and attentional problems.¹⁸

Summary of Results for Media Influences

Thakkar et al. (2010) conducted a systematic review of the literature on the effects of television viewing by children under the age of six years focusing on learning, racial preference, prosocial behavior, imaginative play, aggression and self-regulation. Educational programming was shown to have significant positive effects on cognitive development, specifically general knowledge, numbers, and reading letters and words. The authors also concluded that educational programming had a positive effect on increasing imagination and affecting racial attitudes but no effect on promoting children's' prosocial or aggressive behavior.

¹⁸ American Academy of Pediatrics: Children, Adolescents, and Television: Policy Statement. See
<http://aappolicy.aappublications.org/cgi/content/full/pediatrics;107/2/423>

The positive effects of educational programming was supported by Zimmerman and Christakis (2005) and Baydar et al, (2009); however with qualifications. Zimmerman and Christakis (2005) found that television viewing for children younger than three years had a negative effect on their reading recognition and comprehension skills at age 6-7 years. However, for children ages 3+, educational programming positively influenced their reading recognition and short-term memory. Baydar et al. (2009) tested the idea of using educational programming as a mass intervention for promoting SR in children from low SES families in Turkey. Using a controlled experimental design, the authors found that those children who viewed the educational program at least three times per week, showed significant gains in math, syllabification and vocabulary. As well, the effects were stronger for children with lower school readiness skills prior to exposure. The authors concluded that the educational program was an effective intervention for large groups of children without access to other early childhood educational opportunities.

Measures and Indicators for Media Effects

The Canadian Council of Learning's *Survey of Canadian Attitudes toward Learning (SCAL): Results for Learning throughout the Lifespan* is an annual assessment of the opinions, perceptions and beliefs of Canadians about various aspects of learning in Canada.¹⁹

Measures of early learning and school achievement based on Statistic Canada's *NLSCY* are presented annually. The following table describes the data collected by the Canadian Council of Learning. Included in this assessment is an indicator associated with 'exposure to media'.

Table 6. Composite Learning Index Indicators, Canadian Council on Learning

¹⁹ Canadian Council of Learning's *Survey of Canadian Attitudes toward Learning (SCAL): Results for Learning throughout the Lifespan*. See www.ccl-cca.ca/CCL/Reports/SCAL/

Learning to Know

Student skills (reading, mathematics, and problem solving)

High-school dropout rates

Young adults' participation in post-secondary schooling

Post-secondary attainment among working-age Canadians

Learning to Do

Participation in job-related training

Availability of work training

Access to learning institutions

Learning to Live Together

Charitable giving

Volunteerism

Participation in social clubs and other organizations

Access to community institutions, such as social clubs

Learning to Be

Exposure to media

Exposure to sports and recreation

Exposure to cultural events and activities (e.g., museums)

Festivals and the performing arts

Access to resources, such as libraries

According to The SCAL 2008 ²⁰, the proportion of parents who allow their young children (ages 2-5 years) 'screen time' :

- Less than 1 hour per day: 25% of TV/Videos/DVDs; 77% of Video/computer games
- 1 to 2 hours per day: 43.5% of TV/Videos/DVDs; 16% of Video/computer games
- 2 to 3 hours per day: 21.4% of TV/Videos/DVDs; 3% of Video/computer games

This data applies to all Canadians, not just B.C. residents. The number of parents who allow children access to either TV/Videos/DVDs or Video/computer games for over 2 hours per day can be estimated by adding the numbers together, that is 24.5 %. Note however, this data does not differentiate educational vs. non-educational material.

²⁰ Canadian Council on Learning- Survey of Canadian Attitudes toward Learning-2008. See http://www.ccl-cca.ca/pdfs/SCAL/2009/SCAL2008_EN.pdf

CONCLUSIONS

Many of the programs and services recommended for promoting cognitive development in children from this systematic review of the literature are being addressed in British Columbia, at least to a degree. The review reinforced the finding that how well prepared students are in kindergarten has an influence on their later performance, especially in the cognitive domain. Strengthening and supporting these capacities starts with early screening.

According to the 2008/2009 *British Columbia's Early Years Annual Report*,²¹ early childhood screening initiatives include hearing, vision and dental screening. *The Early Intervention Therapy Program*, also provides screening and therapy (physiotherapy, occupational therapy and speech-language pathology) for children at risk for developmental delay and/or disability. The review highlighted the importance of assessing and treating speech and language difficulties which result in negative consequences not only in learning (Justice et al., 2009) but throughout the lifespan (McCormick et al., 2009). Regarding screening children's capacities for influencing later school achievement, B.C. is fortunate to have a comprehensive population-based program through the *Human Early Learning Partnership*. This program provides educators, communities and policy makers with information for addressing potential problems or highlighting successful strategies. This is important since most of the early childhood initiatives in B.C. are community-based.

Parental information and support is an important part of early childhood development initiatives. In this review, positive home environments and stimulating parent-child activities were found to promote children's cognitive development, particularly language, cognition and psychosocial development (Eshel et al., 2006). Involvement of fathers in the daily activities of a child's life was also shown to have positive social, cognitive and psychological effects on children (Sarkadi et al., 2008). Home visiting programs, informational material for families and places to meet and allow parents and children to play and learn are methods B.C. uses to support parents. B.C. has various community based programs such as LEAP BC, Ready, Set, Learn, and StrongStart BC, which provide drop-in learn and play opportunities. Home visiting programs are also available such as The Infant Development Program, the HIPPY Program, The Aboriginal Infant Development Program and the

²¹ *British Columbia's Early Years Annual Report 2008/2009*. See http://www.mcf.gov.bc.ca/early_childhood/pdf/EarlyYearsAnnualReport2010_Web.pdf

Supported Child Development Program for children at risk. B.C. also provides some parent information publications (e.g., *Baby's Best Chance: Parent's Handbook of Pregnancy and Baby Care*) and resources (e.g., *Books for Babies*). Another recommendation from this review, for vulnerable families, is to provide income supplements, (e.g. \$10,000); which was shown to have a beneficial effect on home environments (Votruba-Drzal, 2003).

Providing quality child care and preschool opportunities was shown in this review to be extremely important for supporting all children's cognitive development, but especially for children from vulnerable families. Quality child care promoted better school readiness, receptive language and expressive language (Belsky, 2006; McCartney et al., 2007), with lasting effects on reading and mathematics' achievement in middle childhood (Dearing et al., 2009). In B.C., there are only enough regulated child care spaces for 15% of the children under 12 years; with long wait times and a prohibitive cost for many families.²²

One solution, identified in this review, is a universally available, accessible preschool program for children 3-4 years. Lynch (2007) describes the value of pre-kindergarten education and care, "Early childhood education provides a multitude of benefits to children. In general, children who participate in high-quality prekindergarten programs need less remedial education and special education, and are less likely to require child welfare services. They have higher educational attainment, graduating from high school and attending college in greater numbers. Once these children enter the labor force, their incomes are higher, along with the taxes they will pay back to society. Both as juveniles and as adults, these children are less likely to engage in criminal activity" (p.7). His cost-benefit analysis found that a voluntary, high quality, publically funded, universal prekindergarten education program serving all three- and four-year-olds would benefit governments in terms of spending on K-12 education, child welfare and the criminal justice system.

In this review, preschool programs which were centre-based, child-focused and aimed at promoting children's socioemotional and cognitive development, had a strong positive effect on school readiness and a moderate longer-term student achievement effect (Burger, 2010). Gromely et al. (2005) in their evaluation of a universally available preschool

²² Coalition of Child Care Advocates of BC. See <http://www.cccabc.bc.ca/res/factsheets.html>

program, found significant effects for prereading, prewriting and numeracy skills for a diverse cross-section of children. They recommend that the program have college trained teachers who are early child certified, and that the teachers are paid the same as all other teachers. By 2011, British Columbia is expected to offer full-time Kindergarten for all 5 year-olds. Preschool programs are subsumed under the child care umbrella of the Ministry of Children and Family Development and the statistics on usage and quality are not publically available.

The research shows that licensed, quality, accessible preschool for 3 to 4 year old students will benefit the students, their families and the wider society. Further, "hubs" as envisioned by the Coalition of Child Care Advocates of B.C. and for First Nation's students, the intersectoral service delivery "Hook and Hub",²³ are models that would address all of the identified issues from this review. These centres would combine early childhood care and development programs with health screening, educational and play opportunities, information centres for families and a centralized resource centre. Integrated early childhood service models have been developed in Toronto (*Toronto First Duty*), Britain (*Sure Start*) and The United States (*Smart Start*). They are comprehensive in nature; addressing the whole child's needs such as physical, mental and dental health, nutrition, developmental screening, and early intervention. They include the opportunity for early childcare and education as well as family education and supports services. Based in the community, these centres or hubs are often more accessible to the people they serve and tailored to the specific needs of a community. Finally, these programs have many different groups working together and have developed networks to support the child and family. Evaluations of all of these programs have indicated increases in children's cognitive, language and social skills. Further, according to a review of 40 child development research initiatives,⁴⁹ comprehensive early childhood education programs that had a health surveillance component resulted in children with improved health and dental status, fewer emergency visits, improved behavioral skills, increased cognitive and social skills, improved maternal education and fewer incidents of juvenile delinquency, special educational placement and grade retention.

²³ Ball, J. (2005). Early childhood care and development programs as "hook" and "hub" for inter-sectoral service delivery in First Nations communities. *Journal of Aboriginal Health*, 2, 36-53 (see <http://www.ecdip.org/docs/pdf/jah.pdf>)

This review confirmed the association between early learning and later school performance. Early math, reading and attention skills predicted reading and math achievement in Grades 3 and 7 (Duncan et al., 2007). Lloyd and Hertzman (2010) showed that the type of neighborhood had an influence on achievement scores in Grade 4 (urban vs. rural). Lloyd et al. (2010) showed that consideration must be given to the neighborhood a child grew up in during the early years and not just the one they are living in at Grade 7. These studies support the need to include assessments of school achievement as indicators. Further, as Genesse et al. (2005) found, ESL status influences school achievement, both positively and negatively, across elementary through to high school. Finally, tracking high school completion, and particularly the reasons that students drop out, may provide information for developing interventions and informing health policy.

Three important mediators to these results need to be mentioned, the influence of: poverty, Aboriginal status and children in care, on school readiness and achievement. A large body of evidence from the population health research has identified poverty as one of the greatest predictors of child well-being and school readiness.^{50, 51, 52, 53} Children living in poor neighbourhoods have a multitude of disadvantages facing them and their families. These include poorer physical health, increased social stressors, greater incidences of emotional, behavioral and cognitive problems and more difficulties in school.^{54, 55, 56, 57, 58} A recent report, entitled *Growing Up in B.C.*²⁴, highlights the difficulties encountered by students of economically disadvantage families, those of Aboriginal heritage and those of children in care. Likely these three factors are both inter-related (large numbers of Aboriginal children in care; living in poverty) and separate. This report indicates that Aboriginal children test in reading, writing and numeracy on Grade 4 and 7 Foundation Skills Assessment tests between 15-23 % lower than their peers. The gap seen for children in custody is about the same or wider than the gap for Aboriginal children. This trend extends to high school completion rates as well, with less than half Aboriginal students and about 30% of children in custody completing high school within six years.

²⁴ *Growing Up in B.C.* Representative for Children and Youth and the Office of the Provincial Health Officer. 2010: Victoria, B.C.

RECOMMENDATIONS

This final section of the report is intended to efficiently pull together the large volume of information identified for the dimension of cognitive development and child health and well-being. The ultimate purpose of this report and the others in this series is to support the overall project in recommending a set of high leverage indicators of child health and well-being. "High-leverage" reflects a combination of: (i) the population magnitude or prevalence of the risk-generating condition(s) of most interest for each candidate concept; and (ii) the level of health effects caused in individuals by such conditions. Feasibility of application in the real world is another important consideration; it comprises both prevention potential and the ability to populate the indicator with valid data and thereby track prevention progress.

There are four evaluation categories which are used to determine applicability: magnitude; significance/impact; modifiability; and data availability. The latter three evaluation categories were assessed qualitatively in terms of a high-level rating of Low, Medium, or High; the meaning of these ratings is provided in the following table.

Key to Summary Assessments by Evaluation Category

	Magnitude <i>Estimated prevalence of affected B.C children</i>	Significance/Impact <i>Physical, Mental, Emotional or Social effects</i>	Modifiability <i>Expert assessment of prevention potential</i>	Data <i>Availability/Validity B.C. specific information sources</i>
Low	< 19,000 (<2% of total pediatric cohort)	Minimal effects and/or little proof of direct causation	Underlying risk factor not amenable to prevention	Data not routinely collected or reported
Medium	19,000 - 97,000 (2-10% of total pediatric cohort)	Moderate effects, Evidence of positive impact	Underlying risk amenable to prevention	One source of data available or data not readily available
High	>97,000	Substantial effects,	Underlying risk	Multiple sources of

(>10% of total pediatric cohort)	including potential for death, suicide, PTSD, serious cognitive/mental/physical health consequences	amenable to prevention, effective intervention(s) are available and feasible	data available or administrative sources readily available
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Two quantitative measures are included in the final summary table: applicable age group related to the indicator and estimated prevalence among BC children. For the prevalence data, the absolute number of cases was calculated by applying that rate to the pertinent 2010 age cohort (see the table below from Statistics Canada).

BC Population by Gender and Age, July 2010				
Age	Male	Female	Total	Cumulative %
<1	22,994	21,522	44,516	
1	23,403	21,845	45,248	89,764
2	23,476	22,010	45,486	135,250
3	22,920	21,548	44,468	179,718
4	22,788	21,153	43,941	223,659
5	22,578	21,093	43,671	267,330
6	22,819	21,265	44,084	311,414
7	22,931	21,246	44,177	355,591
8	22,921	21,184	44,105	399,696
9	23,239	21,673	44,912	444,608
10	23,687	22,298	45,985	490,593
11	24,204	22,915	47,119	537,712
12	24,498	23,123	47,621	585,333
13	25,677	23,887	49,564	634,897
14	26,510	25,022	51,532	686,429

15	27,484	25,613	53,097	739,526
16	27,888	26,447	54,335	793,861
17	28,878	27,472	56,350	850,211
18	30,094	28,160	58,254	908,465
19	32,214	29,749	61,963	970,428
Total	501,203	469,225	970,428	

Table 7. Concept, Magnitude, Impact, Modifiability and Availability

Concept/Indicator	Magnitude	Significance/Impact	Modifiability	Data Avail.
Children's Capacities				
Health Screening % of children who have identified problems in vision, hearing, language, cognitive and emotional capacities at 36 months.	High	High	Medium	Low
School readiness % of B.C. children aged 4-5 years delayed; EDI, HELP results, Wave 3-2008/09)	High 30% vulnerable in one or more domains of the EDI.	High	Medium	High HELP; EDI Annual, BC
Positive parenting				
Positive Parenting % of parents reporting positive family functioning, positive parenting and reading by an adult on the NLSCY.	High Positive parenting = 94.3 %; High Reading by an adult = 64.8%;	High Medium	Medium Low	High NLSCY, National High
Media influences	High	High	Medium	High

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% of children under 2 years exposed to "screen time"; Over 2 years, number of hours per day exposed to media on CCL.	24.5 % of children exposed to more than 2 hours per day			Canadian Council on Learning, Annual.
Father's involvement % of fathers reporting daily involvement in their children's care.	n/a	High	Medium	Low
Early Childhood Care				
Child care	High 46% for children under 6 years,	High	Medium	Medium B.C. Early Year's annual report
Preschools	n/a	High	Medium	Low
Learning Performance				
FSA- Grade 4	High G4R-16 %, G4W-13%, G4N-20%	Medium	Medium School support for at-risk students	High B.C. Ministry of Education, annual
FSA- Grade 7	High G4R-18 %, G4W-13%, G4N-20%	Medium	Medium School support for at-risk students	High B.C. Ministry of Education, annual
6-year high school completion % Graduates	High 79.2 % 95 %	Medium	Medium School support for at-risk students	High B.C. Ministry of Education, annual
Mediator variables				
Poverty level	High 10.4 % (2008)	Extremely High	Medium Income supports for parents for educational; Greater supported	Moderate Stats Canada LICO; not annual

			daycare	
Aboriginal heritage FSA G 4 & 7 High school completion	High G4 FSA - R=28%, N=34%; G7 FSA -R =31%, N=38%; HS Com =48.8%	High	Medium School support for at-risk students; Curriculum culturally supportive	High B.C. Ministry of Education, annual
Children in Care FSA G 4 & 7 High school completion	High Six Year High school completion rate = 26.8 %; FSA scores n/a	High	Medium School support for at-risk students	High Child & Youth Representative, Office of Provincial Health Officer

Key Indicators for Cognitive Development and Child Health and Well-being

Thus, this systematic review of factors important for cognitive development for child health and well-being recommends the following indicators:

- 1) **Health screening**- % of children who have identified problems in vision, hearing, language, cognitive and emotional capacities at 36 months.
- 2) **School Readiness**- % of children vulnerable in the following domains: physical health and wellbeing; social competence; emotional maturity; language and cognitive development; and communication skills and general knowledge, at 54 months.
- 3) **Positive Parenting**- % of parents reporting positive family functioning, positive parenting and reading by an adult.

Media influences- % of children under 2 years exposed to "screen time"; Over 2 years, number of hours per day exposed to media.

Father's involvement- % of fathers reporting daily involvement in their children's care.

- 4) **Early Childhood Care**- % of families in licensed, quality child care or preschool.
- 5) **Learning Performance**- % of children meeting expectations on Grade 4 and 7 Foundation Skills Assessments
- 6) **High school Completion**- % of students completing high school within six years and those graduating.

Appendix A

Intermediate Results after Applying Primary Exclusion

Systematic Reviews

Title	Author(s)	Year	Journal	Journal Impact Factor	Year Range of Studies	Number of Studies Reviewed	Main Reason for Secondary Exclusion
The Effectiveness of Early Childhood Development Programs: A Systematic Review	Anderson et al.	2003	American Journal of Preventative Medicine	4.235	1981-1998	16	
Effective Early Childhood Education Programs: A Systematic Review	Chambers et al.	2010	Best Evidence Encyclopedia, John Hopkins	n/a	1968-2009	40	Focus is on specific educational programming. e.g., Curiosity Corner
How does Early Childhood Care and Education Affect Cognitive Development?	Burger	2010	Early Childhood Research Quarterly	1.92	1987-2010	32 studies (23 projects)	

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An International Review of the Effects of Early Interventions for Children from Different Social Backgrounds							
Early Childhood Education Programs	Currie	2001	The Journal of Economic Perspectives	3.557	1983-1999	13	Not systematic review; studies out of range

Studies

Title	Authors	Year	Journal	Journal Impact factor (2009)	Type of Study	Sample size	Sample population	Location	Reason for secondary exclusion
Readiness to Learn									
Effects of a two-generation preschool programme on receptive language skill in low-income Canadian	Benzies et al.	2010	Early Child Dev. & Care	n/a	Intervention study Within	112	\bar{X} =3 years 9 mos.	Canada	Small sample Note: SD for kids

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Title	Authors	Year	Journal	Journal Impact factor (2009)	Type of Study	Sample size	Sample population	Location	Reason for secondary exclusion
children					subject pre-post				who are Aboriginal
School Readiness Among Children With Varying Histories of Language Difficulties	Justice et al.	2009	Dev. Psy.	3.55	Population-based longitudinal	1064	Data at 15, 24, 36 and 54 mos.	USA	
Behavioral and Cognitive Readiness for School: Cross-Domain Associations for Children Attending Head Start	Bierman et al.	2009	Social Dev.	1.72	Cross-sectional	365 From 44 centres	4 years olds	USA	
Relationships between Social Skills, Behavioral Problems, and School Readiness for Head Start Children	Bracken & Fischel	2007	NHSA Dialog: A Research-to-Practice Journal for the Early Intervention Field	n/a	Randomized pre-post	515	4 year olds	USA	
Fine Motor Skills and Early	Grissmer	2010	Dev. Psy.	3.55	Longitudinal	n/a	5, 6, 9, 11 yrs.	USA, UK	

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Title	Authors	Year	Journal	Journal Impact factor (2009)	Type of Study	Sample size	Sample population	Location	Reason for secondary exclusion
Comprehension of the World: Two New School Readiness Indicators	et al.				population: ECLS-K, NLSY, BCS				
Does Higher Quality Early Child Care Promote Low-Income Children's Math and Reading Achievement in Middle Childhood?	Dearing et al.	2009	Child Dev.	3.63	Nonrandomized longitudinal study	1364	6 mos-11 yrs	USA	
The Development of Cognitive Skills and Gains in Academic School Readiness for Children from Low-Income Families	Welsh et al.	2010	Journal of Ed. Psy.	2.73	Longitudinal study	164	\bar{X} =4.49 yrs. Head Start	USA	
First grade school readiness of former child participants in a South Carolina replication of the Parent-Child Home Program.	Levenstein et al.	2002	J. of Applied Dev. Psy.	1.15	Intervention study-longitudinal	84	\bar{X} =32 mos. – 56 mos.	USA	Small sample, extreme poverty

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Title	Authors	Year	Journal	Journal Impact factor (2009)	Type of Study	Sample size	Sample population	Location	Reason for secondary exclusion
Early child care and early child development: Major findings of the NICHD study of early child care	Belsky	2006	European J. of Dev. Psy.	1.018	Longitudinal intervention	1364	1 mo. -5 yrs.	USA	
Quality Child Care Supports the Achievement of Low-Income Children: Direct and Indirect Pathways through Caregiving and the Home Environment.	McCartney et al.	2007	J Applied Dev. Psy.	1.15	Prospective longitudinal plus randomized selection	1364	1 mos. to 3 yrs. Diverse SES	USA	
The Effects of Universal Pre-K on Cognitive Development. Developmental Psychology	Gormley et al.	2005	Dev. Psy.	3.55	Regression-discontinuity Pre-post Controlled	1567 (pre-K)-3149 (K)	4-5 years, diverse SES	USA	
The Impact of Ready Environments on Achievement in Kindergarten.	Nelson	2005	Journal of Research in Childhood Education	n/a	Cluster, population-based	10,3407 (preschool); 14,880 (home	Age 5 yrs.	USA	

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Title	Authors	Year	Journal	Journal Impact factor (2009)	Type of Study	Sample size	Sample population	Location	Reason for secondary exclusion
						activity)			
Relations Between Parenting Quality and Cognitive Performance of Children Experiencing Varying Amounts of Childcare	Adi-Japha & Klein	2009	Child Development	3.631	Longitudinal population based	1,095	Age 3 yrs.	USA	
Parental Involvement in Young Children's Computer Use and Cognitive Development	McCarrick et al.	2007	NHSA Dialogue	n/a	Survey	136	Head Start (95% African American)	USA	Small sample, not representative
Income Changes and Cognitive Stimulation in Young Children's Home Learning Environments.	Votruba-Drzal	2003	J of Family and Marriage	1.553	Longitudinal population-based and cross-sectional	2,174	3-4 years, 7-8 years; Nationally representative	USA	
Learning Performance									
How neighborhoods matter for rural and urban children's language and	Lloyd and Hertzma	2010	J of Community Psy.	1.048	Population-based longitudinal	635-rural; 4,825	Ages 5-6 and 9-10 yrs.	BC, Canada	

Systematic Review of Cognitive Development and Child Health for 2000-2010

Title	Authors	Year	Journal	Journal Impact factor (2009)	Type of Study	Sample size	Sample population	Location	Reason for secondary exclusion
cognitive development at kindergarten and Grade 4.	n				and cross-sectional analyses	urban			
Early experiences matter: Lasting effect of concentrated disadvantage on children's language and cognitive outcomes	Lloyd et al.	2010	Health and Place	2.99	Cross-classified random effects modeling on population level data	2648	Urban population ages 5-6 and 12-13 yrs	BC, Canada	
School Readiness and Later Achievement	Duncan et al	2007	Developmental Psychology	3.555	6 Longitudinal population level databases	1756 + + +	Academic achievement- 7-8, 13-14; achievement and behavior- 5-6 yrs.	USA, Canada, UK	
General									
Effects of an Educational Television Program on Preschoolers: Variability in	Baydar et al	2009	Journal of Applied Dev. Psy.	1.155	Experimental, random assignment	E=139; C=127	\bar{X} =5 yrs. 3 mos.	Turkey; Low SES	

Systematic Review of Cognitive Development and Child Health for 2000-2010

Title	Authors	Year	Journal	Journal Impact factor (2009)	Type of Study	Sample size	Sample population	Location	Reason for secondary exclusion
Benefits.									
Children's Television Viewing and Cognitive Outcomes: A Longitudinal Analyses of National Data	Zimmerman & Christakis	2005	ARCH Pediatric Adolesc Med.	4.72	Longitudinal, NLSY	11000 +	6 yrs. approx.	USA	
Gap analysis									
The Early Development Instrument as an evaluation and improvement tool for school-based, integrated services for young children and parents: the Toronto First Duty Project	Cortner et al.	2010	Early Ed. & Dev.	n/a	Pre-post intervention, quasi-experimental, case studies	2003-361; 2005-319	6 yrs. approx	Toronto, Canada	
Early Childhood Computer Experience and Cognitive and Motor Development.	Li & Atkins	2004	Pediatrics	4.27	Intervention	122	\bar{X} = 52 mos. Rural, Head Start	USA	Non-representative sample, study used for hypothesis generation.

REFERENCES

- ⁱ de Villers JG, de Villers PA. Language development. In: Bornstein M. Lamb M, eds. *Developmental psychology: an advanced textbook, 4th edition*. 1999. Mahwah, NJ: Erlbaum, 313-373.
- ⁱⁱ Doherty G. *Zero to Six: The basis for school readiness*. Human Resources Development Canada. R-97-8E. 1997.

Systematic Reviews and Studies

- ³ La Paro KM, Pianta RC. Predicting children's competence in the early school years: A meta-analytic review. *Review of Educational Research*. Winter 2000; 70(4): 443-484.
- ⁴ McCormack J, McLeod S, McAllister L et al. A systematic review of the association between childhood speech impairments and participation across the lifespan. *International Journal of Speech-Language Pathology*. 2009; 11(2): 155-170.
- ⁵ Burger K. How does early childhood care and education affect cognitive development? An international review of the effects of early interventions for children from different social backgrounds. *Early Childhood Research Quarterly*. 2010; 25: 140-165.
- ⁶ Eshel N, Daelmans B, Mello M de et al. Responsive parenting: interventions and outcomes. *Bull World Health Organ*. 2006; 84(12): 991-998.
- ⁷ Sarkadi A, Kristiansson R, Oberklaid F et al. Father's involvement and children's developmental outcomes: a systematic review of longitudinal studies. *Acta Paediatrica*. 2008; 97:153-158.
- ⁸ Genesee F, Lindholm-Leary K, Saunders W et al. English language learners in U.S. schools: an overview of research findings. *Journal of Education for Students Placed at Risk (JESPAR)*. 2005; 10(4): 363 – 385.
- ⁹ Thakkar RR, Garrison, MM, Christakis DA. A systematic review for the effects of television viewing by infants and preschoolers. *Pediatrics*. 2006; 118: 2025-2031.
- ¹⁰ Justice LM, Bowles RB, Pence Turnbull KL, Skibbe LE. School readiness among children with varying histories of language difficulties. *Developmental Psychology*. 2009; 45(2): 460-476.
- ¹¹ Bierman K, Torres M, Domitrovich C et al. Behavioral and cognitive readiness for school: cross-domain associations for children attending Head Start. *Social Development*. 2009, May 1; 18(2): 305-323.

- ¹² Welsh J, Nix R, Blair C et al. The development of cognitive skills and gains in academic school readiness for children from low-income families. *Journal of Educational Psychology*. 2010, Feb 1; 102(1): 43-53.
- ¹³ Bracken S, Fischel J. Relationships between social skills, behavioral problems, and school readiness for Head Start Children. *NHSA Dialog: a Research-to-Practice Journal for the Early Intervention Field* [serial on the Internet]. 2007, Aug 1; 10(2): 109-126.
- ¹⁴ Grissmer D, Grimm KJ, Aiyer SM et al. Fine motor skills and early comprehension of the world: two new school readiness indicators. *Developmental Psychology*. 2010; 46(5): 1008-1017.
- ¹⁵ Nelson R. The impact of ready environments on achievement in kindergarten. *Journal of Research in Childhood Education* [serial on the Internet]. 2005, Mar 1; 19(3): 215.
- ¹⁶ Votruba-Drzal E. Income changes and cognitive stimulation in young children's home learning environments. *Journal of Marriage & Family*. 2003, May; 65(2): 341-355.
- ¹⁷ Belsky J. Early child care and early child development: major findings of the NICHD study of early child care. *European Journal of Developmental Psychology*. 2006; 3(1): 93-110.
- ¹⁸ Dearing E, McCartney K, Taylor B. Does higher quality early child care promote low-income children's math and reading achievement in middle childhood?. *Child Development* [serial on the Internet]. 2009, Sep; 80(5): 1329-1349.
- ¹⁹ McCartney K, Dearing E, Taylor B et al. Quality child care supports the achievement of low-income children: direct and indirect pathways through caregiving and the home environment. *Journal of Applied Developmental Psychology*. 2007, Sep 1; 28(5-6): 411-426.
- ²⁰ Adi-Japha E, Klein P. Relations between parenting quality and cognitive performance of children experiencing varying amounts of childcare. *Child Development*. 2009, May; 80(3): 893-906.
- ²¹ Gormley J, Gayer T, Phillips D, Dawson B. The effects of universal pre-K on cognitive development. *Developmental Psychology*. 2005, Nov; 41(6): 872-884.
- ²² Duncan G, Dowsett C, Claessens A et al. School readiness and later achievement. *Developmental Psychology*. 2007, Nov; 43(6): 1428-1446.
- ²³ Lloyd JEV, Hertzman C. How neighborhoods matter for rural and urban children's language and cognitive development at kindergarten and Grade 4. *Journal of Community Psychology*. 2010; 38(3): 293-313.

²⁴ Lloyd JEV, Li L, Hertzman C. Early experiences matter: Lasting effect of concentrated disadvantage on children's language and cognitive outcomes. *Health & Place*. 2010, Mar; 16(2): 371-380.

²⁵ Baydar N, Kagitcibasi C, Kuntay A et al. Effects of an educational television program on preschoolers: variability in benefits. *Journal of Applied Developmental Psychology*. 2008, Sep 1; 29(5): 349-360.

²⁶ Zimmerman FJ, Christakis DA. Children's television viewing and cognitive outcomes: a longitudinal analyses of national data. *Archives of Pediatric and Adolescent Medicine*. 2005, July; 159: 619-623.

Additional References

²⁷ Pianta RC, McCoy SJ. The first day of school: the predictive validity of early school screening. *Journal of Applied Developmental Psychology*. 1997; 16: 1-22.

²⁸ Canadian Council on Learning, *State of Learning in Canada: A Year in Review*. Ottawa: 2010.

²⁹ Pivik, J. *Promoting literacy, social emotional learning and parent/community involvement in inner city schools: combining evidence-based research and experiential knowledge*. Vancouver District School Board: Vancouver, BC. 2009.

³⁰ Janus M, Offord D. Development and psychometric properties of the Early Development Instrument (EDI): a measure of children's school readiness. *Canadian Journal of Behavioral Science*. 2007; 39(1): 1-22.

³¹ Hertzman C, Kershaw P, Irwin et al. (2008). Four uses of the EDI: The case of British Columbia. *Bringing it together: Merging community-based, life-course, linked data, and social indicator approaches to monitoring child development* (p. 23-31). Proceedings from the Early Childhood Learning Knowledge Centre's Monitoring Committee Workshop: Canadian Council on Learning. Available at <http://search.ccl-cca.ca/NR/rdonlyres/A926804D-EA69-4C70-A2E4-224A734C0410/0/BringingItTogetherEN.pdf>. Accessed March 7, 2009.

³² Pivik, J. *Environmental scan for school readiness and health: definitions, indicators, determinants and interventions*. Nova Scotia : National Collaborating Centre for Health Determinants; 2009.

³³ Brooks-Gunn J, Liaw F, & Klebanov P.K. Effects of early intervention on cognitive function of low birth weight preterm infants. *Journal of Pediatrics*. 1992; 120(3): 350-359. Available at <http://www.promisingpractices.net/>

³⁴ Brooks-Gunn J, Liaw F, & Klebanov et al. Enhancing the development of low-birthweight, premature infants: Changes in cognition and behavior over the first three years. *Child Development*. 1993; 64: 736-753. Available at <http://www.promisingpractices.net/>

³⁵ Olds D, Henderson C.R. Jr, Tatelbaum R et al. Improving the delivery of prenatal care and outcomes of pregnancy: A randomized trial of nurse home visitation. *Pediatrics*. 1986; 77: 16-28.

³⁶ Olds D, Henderson C.R. Jr, Kitzman H. Does prenatal and infancy nurse home visitation have enduring effects on qualities of parental caregiving and child health at 25-50 months of life? *Pediatrics*. 1994; 93: 89-98.

³⁷ Kitzman H, Olds D, Henderson C.R, et al. Effect of prenatal and infancy home visitation by nurses on pregnancy outcomes, childhood injuries, and repeated childbearing: a randomized controlled trial. *Journal of the American Medical Association*. 1997; 278(8): 644-652.

³⁸ Olds D, Eckenrode J, Henderson C.R. Jr et al. Long-term effects of nurse home visitation on maternal life course and child abuse and neglect: fifteen-year follow-up of a randomized trial. *Journal of the American Medical Association*. 1997; 278(8): 637-643.

³⁹ Olds D., Henderson C. R Jr et al. Long-term effects of nurse home visitation on children's criminal and antisocial behavior: 15-Year follow-up of a randomized controlled Trial. *Journal of the American Medical Association*, 1998; 280(14): 1238-1244.

⁴⁰ Kagan S. L., Neuman M. J. Defining and implementing school readiness: challenges for families, early care and education, and schools. In: Weissberg RP, Gullotta TP, Hampton RL, Ryan, BA, Adams GR, eds. *Healthy Children 2010: Establishing Preventive Services*. 1997; 61-96.

⁴¹ Connor CM, Morrison F. *Services or programs that influence young children's academic success and school completion*. Encyclopedia on Early Childhood Development. 2006. Available at http://www.child-encyclopedia.com/pages/PDF/Connor-MorrisonANGxp_rev.pdf. Accessed May 2, 2009.

⁴² Barnett W. S. Long-term effects of early childhood programs on cognitive and school outcomes. *Future of Children*. 1995; 5(3): 25-50.

- ⁴³ Ramey CT, Campbell FA. Preventive education for high-risk children: cognitive consequences of the Carolina Abecedarian Project. *American Journal of Mental Deficiency*. 1984; 88(5): 515–523.
- ⁴⁴ Burchinal M, Lee M, Ramey C.T. Type of daycare and preschool intellectual development in disadvantaged children. *Child Development*. 1989; 60: 128–137.
- ⁴⁵ Burchinal M, Lee M, Ramey C.T. Ibid. 1989.
- ⁴⁶ Campbell F A, Ramey CT. Cognitive and school outcomes for high-risk African-American students at middle adolescence: positive effects of early intervention. *American Educational Research Journal*. 1995; 32(4): 743–772.
- ⁴⁷ Campbell F A, Ramey CT, Pungello E et al. Early childhood education: young adult outcomes from the Abecedarian Project. *Applied Developmental Science*. 2002; 6(1): 42–57.
- ⁴⁸ Freudenberg N, Ruglis J. Reframing school dropout as a public health issue. *Prev Chronic Dis* .2007; 4(4). Available at http://www.cdc.gov/pcd/issues/2007/oct/07_0063.htm. Accessed November 4, 2010.
- ⁴⁹ Emel BL, Alkon A. *Health and school readiness literature review: selected programs, components, and findings in the United States, excluding California*. 2006; California Childcare Health Program. Oakland, CA. See http://www.ucsfchildcarehealth.org/pdfs/training_etc/HS_Readiness_Full_v3.pdf, Accessed March 13, 2008.
- ⁵⁰ Leventhal T, Brooks-Gunn J. The neighborhoods they live in: the effects of neighbourhood residence on child and adolescent outcomes. *Psychological Bulletin*. 2000; 126(2): 309-337.
- ⁵¹ Jencks C, Mayer S. The social consequences of growing up in a poor neighbourhood. In: Lynn LE, McGeary MG, eds. *Inner City Poverty in the United States*. Washington, DC: National Academy Press; 1990.
- ⁵² Tremblay R., Boulerice B, Foster H et al. *Multi-level effects on behavior outcomes in Canadian children*. Working paper No. W-01-2E. Ottawa: Applied Research Branch, Human Resources Development Canada. 2001;
- ⁵³ Oliver L, Dunn J, Kohen D, Hertzman C. Do neighbourhoods influence the readiness to learn of kindergarten children in Vancouver? A multilevel analysis of neighbourhood effects. *Environment & Planning*. 2007; 39(4): 848-868.

⁵⁴ Evans G. The environment of childhood poverty. *American Psychologist*. 2004; 59(2); 77-92.

⁵⁵ National Institute of Child Health and Human Development Early Child Care Research Network. Poverty and patterns of child care. In: Duncan G J, Brooks-Gunn J, eds. *Consequences of growing up poor*. New York: Russell Sage Foundation. 1997; pp. 100–131.

⁵⁶ Emery RE, Laumann-Billings L. An overview of the nature, causes, and consequences of abusive family relationships. *American Psychologist*. 1998; 53: 121–135.

⁵⁷ Duncan G J, Yeung W, Brooks-Gunn J et al. How much does poverty affect the life chances of children? *American Sociological Review*. 1998; 63: 406–423.

⁵⁸ Coley R J. *An uneven start: indicators of inequality in school readiness*. Princeton, NJ: Educational Testing Service. 2002.