Context Matters: The Interrelatedness of Early Literacy Skills, Developmental Health, and Community Demographics

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Whereas the great majority of literacy research has been focused at the child level, this study examined the relationship between early literacy rates, developmental health of the population, and demographics in 23 school communities. The results showed that school-level literacy scores were related to the physical, social, and emotional maturity of the kindergarten population, as well as community demographics, including the proportion of families in each school catchment area living below the low income cutoff, the proportion of single-parent families, and the community 5-year mobility rate. Furthermore, the proportion of children at risk for literacy difficulties varied systematically by school, ranging from 0% to 44%; this risk was strongly related to developmental health and to demographics of the school commu-
nity. The implications for models of early identification and corresponding intervention programs for at-risk children are discussed.

During the primary school years, developing competencies in reading is an expected outcome for all children; the wide research base on reading development and difficulty has very robustly documented the effects of early reading failure on overall cognitive development and health and well-being (e.g., Cunningham & Stanovich, 1998; Hoddinott, Lethbridge, & Phipps, 2002; Rootman & Ronson, 2003; Snow, Burns, & Griffin, 1998). For example, research on individuals with poor word-reading skills has demonstrated that, without early identification and intervention, these difficulties typically persist throughout adolescence and adulthood (e.g., Bruck, 1992; Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Wilson & Lesaux, 2001) and have significant effects on vocabulary levels and academic experiences (e.g., Biemiller, 2005; Biemiller & Slonim, 2001; Stahl, 1999; Stanovich, 1986). Further, a child with reading difficulties is highly vulnerable to poor life outcomes that extend beyond the classroom, including behavioral problems, depression, and strained peer relationships (Gregg, Hoy, King, Moreland, & Jagota, 1992; Walddie & Spreen, 1993).

Of concern for researchers, practitioners, and policymakers in developed countries, such as Canada and the United States, is the large number of individuals with low literacy levels, in spite of public education for all individuals. For example, in the United States, 40% of all fourth graders read below their grade level, and over 40 million adults have literacy skills that are considered “below basic” (National Center for Education Statistics, 2005). Similarly, in Canada, 30% of adults have literacy levels that are considered sufficient to manage everyday literacy demands but that do not support learning new skills and complex tasks (Statistics Canada and the Organisation for Economic Co-operation and Development, 2005). Individuals from low-income backgrounds and/or minority backgrounds are overrepresented in the population of individuals with low literacy skills (e.g., Donovan & Cross, 2002; National Center for Education Statistics, 2005; Snow et al., 1998). Because literacy is a defining characteristic of health and well-being at the individual and societal levels, a reduction in the inequalities in literacy attainment is crucial for achieving equality of opportunity in a society that increasingly demands literacy skills for full participation.

There are many sources—individual and contextual—of reading difficulties, including underdeveloped phonological awareness skills (e.g., National Institute of Child Health and Human Development, 2000), limited exposure to language-rich experiences, and insufficient opportunities to learn (e.g., Baydar, Brooks-Gunn, & Furstenberg, 1993; Snow et al., 1998). However, the broad and deep research base on reading development is currently limited in its ability to inform the goal of promoting high literacy rates for the population, because the great majority
of studies have focused on child-level factors, including language and cognitive skills, understanding of print, and related reading skills (for relevant reviews, see National Institute of Child Health and Human Development, 2000; Snow et al., 1998). Those studies that have focused on demographic factors and their relationship to reading outcomes have typically focused on the characteristics of children’s home environments, such as home literacy practices, parental education, and family income (e.g., Conger & Donnellan, 2007; Hoddinott et al., 2002; Juel, 1988; Kohen, Brooks-Gunn, Leventhal, & Hertzman, 2002; Snow, Barnes, Chandler, Goodman, & Hemphill, 1991; Snow, Tabors, Nicholson, & Kurland, 1995). The present study was designed to investigate the relationship between school-level literacy rates and contextual demographic factors in a school district in British Columbia, Canada. Like many nations across the world, including the United States, Canada faces similar problems of spatial concentration of poverty and wealth (e.g., Massey, 1996). Furthermore, the influence of poverty on children’s development is similar in Canada and the United States (e.g., Kohen et al., 2002; Offord, Last, & Barrette, 1985).

Studies that examine the effects of contextual influences on child outcomes tend to find that there are very complex ways in which context matters to children’s educational achievement (e.g., Bronfenbrenner, 1989). For example, neighborhood factors, such as the socioeconomic characteristics of the community, the proportion of single-parent families, education levels, mobility rates, labor force participation, neighborhood disorder, and cohesion, explain variance in the achievement of the individual child (Beauvais & Jensen, 2003; Kohen et al., 2002; White, 1982; Willms, 2003). It is important to note that this research focuses on explaining variability of individual children’s outcomes, thus contributing to an understanding of how contextual factors influence child-level outcomes. However, minimal research has been conducted to examine the relationship between the developmental characteristics of the school-aged population and the context in which the children are developing literacy skills. Few, if any, studies of literacy development of school-aged children focus on the characteristics of the school community and/or the relationship between literacy skills and the overall health and well-being of the school population under study. Further, very rarely has the school been the unit of analysis in literacy research. Understanding the variability across school populations and communities is important in order to ensure the development of appropriate models of intervention to fit the local context.

In this vein, in a recent paper on the state of knowledge about reading instruction, Snow and Juel (2005) called for studies that employ a public health—rather than a purely educational—perspective on the study of literacy development. A public health perspective is one that is focused on the characteristics of the population rather than the individual. For example, researchers might focus on the literacy rates of a kindergarten population and how these characteristics relate to demographic factors of the population and the school community rather than focus
solely on individual trajectories of reading. Such a perspective allows for identification of sources of reading difficulties in order to guide the direction of resources to students who are at risk due to individual-level and contextual factors—those children placed at highest risk for school failure.

Those studies that have focused on population-level literacy have primarily been conducted on adults in order to identify rates of illiteracy in particular communities or at a national level and to describe the characteristics of these populations (e.g., National Center for Education Statistics, 2005; Statistics Canada and the Organisation for Economic Co-operation and Development, 2005). Very few, if any, population-level studies have focused on early literacy rates. To our knowledge, only one study (Gottlieb, Alter, Gottlieb, & Wishner, 1994) has examined school-level literacy rates as a function of population characteristics, and in this case, the focus was on special education. With school-level data from 165 New York City schools, Gottlieb et al. demonstrated that 65% of the variance in school-wide literacy scores was accounted for by a community poverty index, and variables such as teacher characteristics, class size, and ethnicity of the student population accounted for a negligible amount of variance.

In sum, the high rates of reading difficulties within the school-age population in the United States and Canada, especially children from minority and low-income backgrounds (e.g., Gunderson & Clarke, 1998; Kohen et al., 2002), combined with the lack of population-level literacy research conducted with children suggest that developmental research is necessary to uncover patterns of literacy development in school-age populations. Furthermore, it is important to understand the way in which these literacy rates relate to the characteristics of the school and community.

Present Study

As a fundamentally different approach to examining literacy rates at the individual level, the present study is a population-level study that uses a public health framework to explain literacy rates across a school district. A population health framework is based on the premise that healthy childhood development is directly tied to—and dependent upon—the environment in which children live and learn (Janus, Walsh, Viveiros, & Offord, 2001; Keating & Hertzman, 1999). Thus, the hypothesis guiding the study was that the context within which schools operate has an impact on literacy achievement in the school. By context, we refer to several indicators of developmental health and community demographics of the kindergarten population in the district studied. In order to address this hypothesis, the study was guided by two primary research questions: (a) What is the relationship between early literacy skills and contextual factors (i.e., developmental health of the population, demographics of the school community) for the kindergarten population in the school district studied? (b) Are there systematic differences by school in
the proportion of children identified as at risk on measures of early literacy skills? If so, how do these differences vary according to contextual factors?

METHOD

Participants

The focus of the study was on 23 schools in an industrial town (population 75,000) in British Columbia, Canada. As we were interested in understanding the influence of school-level contextual factors (i.e., developmental health and community demographics) on school-level early literacy outcomes, data on early literacy skills, developmental health, and neighborhood demographics were aggregated at the school level. There were 478 kindergartners (259 boys, 219 girls) within the 23 schools; 75% (n = 360) of the sample were children from majority culture backgrounds, 9% (n = 41) of the sample included children who spoke English as a second language, and 16% (n = 77) were children from Aboriginal backgrounds.

Measures and Indicators

Early Literacy Skills

The two measures of early literacy administered to all children in the study were selected as a proxy for overall literacy ability. These measures, one of the child’s language processing skills (i.e., phonological awareness) and the other a proxy for exposure to and awareness of print (i.e., letter identification), are highly correlated with later reading ability and are two measures most common to early literacy screening batteries (e.g., Good & Kaminski, 2002; Invernizzi, Juel, Swank, & Meier, 2003). Although highly correlated with later literacy outcomes, these measures do not represent all aspects of early literacy, such as vocabulary and listening comprehension skills.

Letter identification and word-reading ability. The Reading subtest from the Wide Range Achievement Test–Third Edition–Blue Form (WRAT-3; Wilkinson, 1993) was used to assess children’s letter identification and word-reading skills. This standardized task required children to identify and pronounce uppercase isolated letters (e.g., G, R) and words of increasing difficulty (e.g., cat, palm). Each child was required to identify as many items as possible from the list; the task administration was discontinued when 10 consecutive words were read incorrectly. The raw score was calculated as the number of words read correctly (α = .93).
In other research conducted with a similarly diverse population of children in a British Columbia community, kindergarten scores on the WRAT-3 were found to have a strong relationship with children’s word-reading and reading comprehension skills at second and fourth grades (see Lesaux, Rupp, & Siegel, in press; Lesaux & Siegel, 2003). Given the purpose of the present study, data from individual children within schools were averaged so that the dependent variable for WRAT-3 Reading represents the average reading score by school.

**Phonological awareness.** Phonological awareness was assessed with the Phonological Awareness Test (Muter, Hulme, & Snowling, 1997), which consists of five subtests and is individually administered. The subtests measure skill in rhyming ability (10 items), syllable segmentation (8 items), phonemic segmentation (8 items), deletion of initial phoneme (8 items), and deletion of final phoneme (8 items). The Phonological Awareness Test subtest scores were summed to produce a total phonological awareness score (maximum = 42, $\alpha = .91$). As with the WRAT-3 reading measure, in other research conducted with a similarly diverse population of children in a British Columbia community, kindergarten scores on the Phonological Awareness Test were found to have a strong relationship with children’s reading ability at second and fourth grades (see Lesaux et al., in press; Lesaux & Siegel, 2003). For the purpose of the present study, data from individual children within schools were averaged so that the dependent variable for phonological awareness represents the average phonological awareness score by school.

**Developmental Health**

*Early Development Instrument (EDI; Janus & Offord, 2000, 2007).* The EDI is a checklist that kindergarten teachers complete for each child in their class after the teachers have known the children for several months. The EDI was developed to serve as a proxy for the developmental health of children in communities rather than an individual diagnostic tool related to specific curriculum objectives. Thus, although EDI data are collected from individual children, the data are aggregated at community levels in order to provide a community-level indicator of children’s developmental health and well-being. In this light, the completed EDI checklists identify children by a personal identification number, rather than by name, so that EDI data at the individual level cannot be linked to children’s achievement data without obtaining formal consent. For the present study, we had access only to the aggregate-level data.

The EDI requires teachers to rate children’s development in five areas: (a) Physical Health and Well-Being (e.g., child is healthy, independent, ready each day), (b) Social Competence (e.g., child plays, gets along with others, and shares; is self-confident), (c) Emotional Maturity (e.g., child is able to concentrate, help others; is patient, not aggressive or angry), (d) Language and Cognitive Development (e.g., child is interested in reading and writing, can count and recognize numbers and shapes), and (e) Communication Skills and General Knowledge (e.g., child
can tell a story, communicate with adults and children, articulate). The EDI has been shown to have adequate validity as well as satisfactory internal consistency, with Cronbach’s alphas between .84 to .96 for the five domains (Janus & Offord, 2007). Similar reliability values were obtained for the Australian version of the EDI (Brinkman et al., this issue).

Other research focused on the properties of the EDI has demonstrated its sensitivity to child and family characteristics (Janus & Duku, this issue) and the predictive validity of the EDI for fourth-grade standards-based reading and numeracy test scores. For example, only approximately 15% of pre-kindergarten children without any vulnerabilities on the EDI do not pass the fourth-grade standards-based tests, whereas closer to 60% of pre-kindergarten children with vulnerabilities on four or five EDI domains later fail the standards-based measures (D’Angiulli et al., 2006, n.d.).

In order to examine patterns of developmental vulnerability in any given sample, data from the EDI are interpreted at an aggregate level in terms of the percentage of children at risk on each domain. EDI data were collected for all kindergarten children across school districts in British Columbia, and this serves as the comparison group from which to determine vulnerability. The bottom 10% is used as a cutoff for vulnerability status; thus, children who scored in the bottom 10% of all scores are considered vulnerable within the given developmental area. The dependent variable for EDI domains represents the proportion of children, by school, who fall in the bottom 10% of all scores across the province of British Columbia.

Community Demographics

Indicators of community demographics were obtained from the 2001 census data and were aggregated by school catchment area. In Canadian school districts, the administration divides the district into attendance areas—called catchment areas—for the purpose of assigning students to various schools. In making these decisions, the district aims to balance the catchment area student population with the capacity of a given school and prioritizes having students attend a neighborhood school.

Based upon what was learned about the social determinants of early child development from the Canadian National Longitudinal Survey of Children and Youth (Kohen, Hertzman, Brooks-Gunn, Forer, & Linver, 2000; Kohen et al., 2002; Kohen, Hertzman, & Wiens, 1998), six census variables were included in the present study: (a) low income cutoff (LICO), or the income level at which a census family would be paying at least 20% more of their after-tax income on food and housing than the median family;¹ (b) unemployment rate; (c) number of adults

¹The cutoffs for the cost of food and housing are set nationally; thus, LICO underestimates poverty in places with high housing costs. Because British Columbia is a high-cost region of the country for food and housing, LICO generally underestimates poverty across the province. However, within one economic region, such as that in which the present study was conducted, the values are valid compared to one another.
over 20 years old without high school completion; (d) 5-year mobility rate of the community; (e) estimated prevalence of single-parent households; and (f) home ownership rates. The reported values for census variables represent a proportion of census families by school catchment area; thus, for example, a value of 25 on the LICO scale indicates that 25% of the families in the school catchment area were living below LICO.

Procedure

The study was conducted in the 2001/2002 academic year. The early literacy and EDI assessments were administered during February and March of the children’s kindergarten year with the specific criteria that (a) the EDI be administered prior to the early literacy assessment so as not to influence results, and (b) the assessments be conducted by different individuals. Therefore, trained research assistants and school resource staff administered the literacy assessments individually in a quiet room; testing time was approximately 15 to 20 min per child. In contrast, every classroom teacher completed the EDI questionnaires for each individual child; teachers were provided with compensation time of 20 min per child per questionnaire.

RESULTS

The two research questions that guided this study were intended to examine whether relationships existed between school-level indicators of literacy and contextual factors, particularly developmental health of the kindergarten population and the demographics of the school community. The research questions also called for an examination of the distribution of children at risk for literacy difficulties and the relationship between the proportion of children at risk for literacy difficulties and the demographics of the school community. Prior to addressing these two research questions, our preliminary analyses involved calculating descriptive statistics; Table 1 provides descriptive statistics (means, standard deviations, ranges) on the measures and indicators used for the 23 schools in the study.

Early Literacy Skills, Population Health, and Demographics of the School Communities

Our first research question was designed to examine the relationship between early literacy skills and contextual factors for the kindergarten population in the school district studied.

Table 2 displays the bivariate correlations among the school-level early literacy variables and the variables representing contextual factors.
School-level letter–word identification was negatively correlated with EDI vulnerability rates on the domains of Physical Health and Well-Being ($r = −.67$, $p < .001$), Social Competence ($r = −.49$, $p < .05$), and Emotional Maturity ($r = −.56$, $p < .01$). School-level phonological awareness was negatively correlated with EDI vulnerability rates on the domains of Social Competence ($r = −.58$, $p < .01$) and

### TABLE 1
Descriptive Statistics on All Indicators and Measures for the 23 Schools Studied

<table>
<thead>
<tr>
<th>Measure</th>
<th>District ($n = 23$)</th>
<th>Low Needs ($n = 8$)</th>
<th>Moderate Needs ($n = 9$)</th>
<th>High Needs ($n = 6$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Literacy outcomes</strong></td>
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<tr>
<td>WRAT-3 Reading percentile</td>
<td>52.67 (9.86)</td>
<td>61.17 (3.88)</td>
<td>54.56 (4.55)</td>
<td>38.50 (3.27)</td>
</tr>
<tr>
<td>Phonological awareness (maximum = 42)</td>
<td>34.00–66.94</td>
<td>53.5–66.94</td>
<td>43.58–58.87</td>
<td>34.00–42.91</td>
</tr>
<tr>
<td><strong>Developmental health (EDI)</strong></td>
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<tr>
<td>% Risk Physical Health and Well-Being</td>
<td>15.29 (16.26)</td>
<td>6.33 (5.40)</td>
<td>9.63 (10.45)</td>
<td>35.74 (16.08)</td>
</tr>
<tr>
<td>% Risk Social Competence</td>
<td>11.07 (16.61)</td>
<td>8.19 (11.62)</td>
<td>2.30 (3.81)</td>
<td>28.06 (22.43)</td>
</tr>
<tr>
<td>% Risk Emotion Maturity</td>
<td>0.0–55.6</td>
<td>0.0–33.3</td>
<td>0.0–10.0</td>
<td>0.0–55.6</td>
</tr>
<tr>
<td>% Risk Language and Cognitive Development</td>
<td>8.64 (13.14)</td>
<td>5.63 (7.73)</td>
<td>1.92 (3.42)</td>
<td>22.74 (17.96)</td>
</tr>
<tr>
<td>% Risk Communication Skills and General Knowledge</td>
<td>12.82 (16.55)</td>
<td>11.16 (22.64)</td>
<td>6.92 (7.68)</td>
<td>23.89 (13.37)</td>
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<tr>
<td><strong>Demographics of the school community</strong></td>
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<tr>
<td>% Living below low income cutoff</td>
<td>25.95 (16.66)</td>
<td>22.66 (10.75)</td>
<td>15.51 (11.17)</td>
<td>45.47 (12.61)</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>6.5–57.6</td>
<td>6.5–33.4</td>
<td>7.7–42.1</td>
<td>28.1–57.6</td>
</tr>
<tr>
<td>% Without high school completion</td>
<td>14.57 (9.79)</td>
<td>12.09 (12.11)</td>
<td>14.76 (7.89)</td>
<td>17.62 (9.79)</td>
</tr>
<tr>
<td>Residential transience over 5 years</td>
<td>0.0–33.3</td>
<td>0.0–33.3</td>
<td>2.7–28.6</td>
<td>7.7–33.3</td>
</tr>
<tr>
<td>% Single parents</td>
<td>30.77 (7.88)</td>
<td>32.48 (8.53)</td>
<td>29.04 (8.89)</td>
<td>31.1 (5.90)</td>
</tr>
<tr>
<td>% Home ownership rate</td>
<td>15.7–47.7</td>
<td>18.1–47.7</td>
<td>15.7–47.6</td>
<td>22.9–36.5</td>
</tr>
<tr>
<td>Residential transience over 5 years</td>
<td>44.69 (10.04)</td>
<td>40.44 (6.98)</td>
<td>41.42 (6.98)</td>
<td>55.25 (10.74)</td>
</tr>
<tr>
<td>% Single parents</td>
<td>32.4–62.2</td>
<td>32.4–48.5</td>
<td>34.3–53.2</td>
<td>34.2–62.2</td>
</tr>
<tr>
<td>% Single parents</td>
<td>21.38 (9.62)</td>
<td>19.15 (7.37)</td>
<td>16.84 (6.43)</td>
<td>31.15 (10.27)</td>
</tr>
<tr>
<td>Home ownership rate</td>
<td>10.5–41.0</td>
<td>11.1–28.6</td>
<td>10.5–31.4</td>
<td>13.6–41.0</td>
</tr>
<tr>
<td>% Single parents</td>
<td>69.88 (20.22)</td>
<td>73.56 (22.80)</td>
<td>78.90 (11.08)</td>
<td>51.45 (17.32)</td>
</tr>
<tr>
<td>Home ownership rate</td>
<td>32.9–100.0</td>
<td>42.5–100.0</td>
<td>51.5–87.5</td>
<td>32.9–83.4</td>
</tr>
</tbody>
</table>

**Note.** Data are means ($SD$) and ranges. Means in the same row that do not share subscripts differ at least at $p < .01$ based on least significant difference post hoc analyses. WRAT-3 = Wide Range Achievement Test–Third Edition; EDI = Early Development Instrument.
### TABLE 2
Bivariate Correlations Among Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
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<th>12</th>
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<tbody>
<tr>
<td>1. WRAT-3 Reading</td>
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<td>2. Phonological awareness</td>
<td>.45*</td>
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<td>3. EDI physical</td>
<td>−.67***</td>
<td>−.40</td>
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<td>4. EDI social</td>
<td>−.49*</td>
<td>−.58**</td>
<td>.64**</td>
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<td>5. EDI emotional</td>
<td>−.56**</td>
<td>−.32</td>
<td>.49*</td>
<td>.77***</td>
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<tr>
<td>6. EDI language</td>
<td>−.34</td>
<td>−.51*</td>
<td>.36</td>
<td>.73***</td>
<td>.40</td>
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<tr>
<td>7. EDI communication</td>
<td>−.31</td>
<td>−.34</td>
<td>.63**</td>
<td>.65**</td>
<td>.33</td>
<td>.83**</td>
<td>----</td>
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<tr>
<td>8. Below low income cutoff</td>
<td>−.55**</td>
<td>−.64**</td>
<td>.68**</td>
<td>.76***</td>
<td>.67**</td>
<td>.67**</td>
<td>.61**</td>
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<tr>
<td>9. Unemployment rate</td>
<td>−.13</td>
<td>.12</td>
<td>.38</td>
<td>.11</td>
<td>.20</td>
<td>−.13</td>
<td>.24</td>
<td>.41</td>
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<tr>
<td>10. No high school</td>
<td>.03</td>
<td>−.24</td>
<td>.08</td>
<td>.37</td>
<td>.09</td>
<td>.52*</td>
<td>.51*</td>
<td>.45*</td>
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<tr>
<td>11. Mobility rate</td>
<td>−.55**</td>
<td>−.44*</td>
<td>.69***</td>
<td>.60**</td>
<td>.59**</td>
<td>.14</td>
<td>.26</td>
<td>.75***</td>
<td>.35</td>
<td>−02</td>
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</tr>
<tr>
<td>12. Single parents</td>
<td>−.50*</td>
<td>−.43*</td>
<td>.65**</td>
<td>.54**</td>
<td>.53**</td>
<td>.16</td>
<td>.32</td>
<td>.87***</td>
<td>.53**</td>
<td>.26</td>
<td>.85***</td>
<td>----</td>
</tr>
<tr>
<td>13. Home ownership</td>
<td>−.34</td>
<td>.28</td>
<td>−.65</td>
<td>−.47*</td>
<td>−.51*</td>
<td>−.02</td>
<td>−.27</td>
<td>−.80***</td>
<td>−.52*</td>
<td>.08</td>
<td>.82***</td>
<td>92***</td>
</tr>
</tbody>
</table>

*Note.* All variables represent school-level aggregates. The values for EDI and community demographic variables represent proportions by school catchment area. WRAT-3 = Wide Range Achievement Test–Third Edition; EDI physical = Early Development Instrument, Physical Health and Well-Being; EDI social = EDI Social Competence; EDI emotional = EDI Emotional Maturity; EDI language = EDI Language and Cognitive Development; EDI communication = EDI Communication Skills and General Knowledge.

*p < .05. **p < .01. ***p < .001.
Language and Cognitive Development ($r = -.51, p < .05$). Together, these results indicated that school-level early literacy was negatively related to the proportion of children per school identified as vulnerable on the EDI. In other words, the greater the proportion of vulnerable children, the lower the school-level early literacy scores.

In terms of community demographics, school-level letter–word identification was negatively correlated with percentage of school neighborhood living below LICO ($r = -.55, p < .01$), the neighbourhood mobility rate ($r = -.55, p < .01$), and the neighborhood estimated prevalence of single parents ($r = -.50, p < .05$). School-level phonological awareness was also moderately negatively correlated with percentage of school neighborhood living below LICO ($r = -.64, p < .01$), the neighborhood mobility rate ($r = -.44, p < .05$), and the neighborhood estimated prevalence of single parents ($r = -.43, p < .05$). In general, then, the greater the school community was characterized by community and family instability, the lower the school-level literacy scores.

Distribution of Literacy Risk Across the School Communities Studied

The results thus far demonstrated a consistent trend in the relationships between school-level literacy outcomes, demographics of the school community, and school-level developmental health. Thus, our second research question was designed to uncover patterns of literacy achievement in the 23 schools studied in order to examine how the proportion of children identified as at risk on the early literacy tasks varied according to the developmental health of the kindergarten population studied and to the demographics of the school community. This question was conceptualized in order to bring the schools into direct focus and thus provided the most concrete information, as it relates to implications for intervention program design and related policy.

Child-Level Classification

In order to address this question, we first classified individual children as at risk or not at risk. Children were classified as at risk if they demonstrated below average performance on WRAT-3 Reading (25th percentile or below) and below average performance on at least one indicator of phonological awareness (i.e., below 1 SD on rhyme detection, syllable identification, phoneme identification, or initial phoneme deletion). Children were classified as not at risk if their performance fell in the average range on both WRAT-3 Reading (i.e., at or above 40th percentile) and phonological awareness skills (i.e., 1 SD or above on at least two measures of phonological awareness). In all, 91 children were identified as at risk and 368 were identified as not at risk for literacy difficulties.
In order to ensure that the classification method resulted in two distinct groups of kids, we used $t$ tests to make comparisons between at-risk and not-at-risk children. Cohen’s $d$ (Cohen, 1992) was used as a measure of effect size (.2 = small, .5 = medium, .8 = large). The at-risk children scored significantly lower than the typical children on both WRAT-3 Reading, $t(455) = 24.01, p < .001, d = 2.25$; and phonological awareness, $t(456) = 11.24, p < .001, d = 1.05$.

**School-Level Distribution of Risk for Literacy Difficulties**

Given the distinct nature of the two groups on the early literacy measures, we then proceeded with the analyses to examine whether there were differential patterns of risk across the 23 schools. Based on current research in school-wide prevention of academic and behavioral problems that focuses on school-level characteristics (e.g., Kameenui & Simmons, 1999; Mathes & Torgesen, 1998; Sugai & Horner, 1999, 2001; Taylor-Green et al., 1997) rather than solely on individual children’s characteristics, schools were classified into low, moderate, or high literacy needs based on the proportion of students at risk at each school. A low-literacy-needs school was defined as having 1% to 9% of the kindergarten student population classified as at risk; a moderate-needs school was defined as 10% to 25% of the kindergarten population classified as at risk; and a high-needs school had greater than 25% of kindergarten children at risk for reading failure. Of the 23 schools in the sample, 8 were classified as having low literacy needs, 9 as moderate needs, and 6 as high needs.

A series of one-way analyses of variance (ANOVAs) were conducted to make comparisons between low-, moderate-, and high-literacy-needs schools. Partial eta squared was used as a measure of effect size (.01 = small, .06 = moderate, .14 = large), and the Bonferroni correction factor was used to reduce the increase in Type I errors associated with conducting multiple ANOVAs. Least significant difference (LSD) post hoc tests were used to examine the significant differences identified in the ANOVAs. The third, fourth, and fifth columns in Table 1 summarize the characteristics of the low-, moderate-, and high-literacy-needs schools, respectively.

**Early literacy skills.** The results of the ANOVAs (Bonferroni corrected $\alpha = .025$) indicated that across schools there were significant group differences on both WRAT-3 Reading, $F(2, 20) = 55.93, p < .001, \eta^2_p = .74$; and phonological awareness, $F(2, 20) = 5.01, p = .017, \eta^2_p = .20$. The LSD post hoc tests indicated that the high-needs schools performed significantly worse than the moderate- and low-needs schools on both WRAT-3 Reading and phonological awareness; the moderate-needs schools performed significantly lower than the low-needs schools on WRAT-3 Reading but performed similarly to the low-needs schools on phonological awareness.
**Contextual factors.** Differences on contextual factors (i.e., developmental health and community demographics) were important to examine in order to determine whether the difficulties in high-needs schools were restricted to literacy or reflective of more general vulnerabilities in the classroom and the community. Results from the ANOVAs (Bonferroni corrected $\alpha = .01$) conducted on the developmental health domains indicated significant differences by school on the percentage of children at risk on the EDI domains of Physical Health and Well-Being, $F(2, 20) = 14.45, p < .001, \eta^2_p = .42$; Social Competence, $F(2, 20) = 6.96, p = .005, \eta^2_p = .26$; and Emotional Maturity, $F(2, 20) = 7.87, p = .003, \eta^2_p = .28$. LSD post hoc analyses revealed that, as compared to low- and moderate-needs schools, high-needs schools had significantly more children identified as vulnerable on the EDI Physical Health and Well-Being, Social Competence, and Emotional Maturity domains. Figure 1 graphically represents the relationship between developmental health (in this case, the EDI Physical Health and Well-Being scale) and school literacy outcomes. There were no differences by school groups on EDI Language and Cognitive Development, $F(2, 20) = 2.16, p = .14$; or Communication Skills.
and General Knowledge, $F(2, 20) = 2.34, p = .12$. That school differences did not emerge on the EDI Language and Cognitive Development or Communication Skills and General Knowledge domains reinforces for school populations the need to be assessed in all domains of development in order to guide effective instruction.

The results from the ANOVAs conducted on the indicators of community demographics (Bonferroni corrected $\alpha = .008$) showed significant school group differences on percentage of population living below LICO, $F(2, 19) = 12.76, p < .001, \eta^2_p = .40$; residential mobility rates, $F(2, 20) = 6.96, p = .005, \eta^2_p = .26$; and prevalence of single parents, $F(2, 20) = 6.44, p = .007, \eta^2_p = .24$. The post hoc analyses indicated that high-needs schools tended to be located in communities with higher proportions of families living below LICO, single-parent families, and neighborhood mobility. There were no group differences in unemployment, $F(2, 20) = 0.53, p = .60$; high school completion rate, $F(2, 20) = 0.39, p = .69$; or home ownership rate, $F(2, 20) = 4.70, p = .02$.

**DISCUSSION**

The results of this study shed light on important issues related to literacy difficulties in the context of the developmental health and the community demographics of school populations. The findings support the use and importance of a public health framework for the study of population health in the context of early literacy achievement. Indeed, early literacy competencies in kindergarten children were not uniform across schools, a finding that would have been masked had we not examined literacy achievement by calculating the percentage of children at risk for literacy difficulties at the school level. Further, the findings demonstrate the interrelatedness of school-level early literacy skills, developmental health, and the economic resources of the school community.

The prevalence of reading difficulties among school-age children and the proportion of learners who do not respond to current models of intervention suggest the need for more attention to the contextual factors that have an influence on school-wide literacy rates. Yet, significant research has established early predictors of reading disability based on measures of broad constructs, such as children’s language abilities and experiences with print (e.g., Hall, Bramlett, Barnett, & Cox, 1994; Share, 2004; Snow et al., 1998). As a result, corresponding early identification and intervention programs focus on child-level literacy skills. In turn, the tendency in the field has been to develop and evaluate instructional practices at the individual level—for all children and all classrooms and schools. However, because literacy development is rarely studied in a way that explicitly addresses risk across several domains, little attention has been paid to the school contexts within which such programs occur and, more important, whether such programs can be effectively implemented in all classrooms for all children.
The systematic differences in distribution of risk and the corresponding relationship with community demographics and children’s developmental health suggest that literacy ability may be only one aspect of a host of risk factors for these children. These results reinforce the fact that there are very complex ways in which context matters to educational achievement for children (e.g., Beauvais & Jenson, 2003; Bronfenbrenner, 1989; Willms, 2003); in turn, these findings have implications for research, policy, and practice, particularly in the domain of literacy. Primarily, the findings suggest that there are substantial differences in proportion of children at risk, as a function of school community, and that schools with differing proportions of children at risk are likely to vary in ability to meet children’s needs (Bradley & Corwyn, 2002; Offord, Kraemer, Kazdin, Jensen, & Harrington, 1998; Rose, 1994).

For example, as is the case in this study, consider a school with a relatively small proportion of children (e.g., 10% of the population) identified as at risk for literacy difficulties versus a school that has a relatively larger proportion of children at risk for literacy difficulties (e.g., 45% of the population). Similarly, consider the school’s ability to meet children’s developmental needs in a school that has a community context of affluence and stability versus a school that has a community context of poverty, instability, and high rates of transience. In the case of a school with 45% of children at risk for literacy difficulties, adequately addressing literacy, even with evidence-based programs, is likely to take a different form and be more difficult than in a school with a much smaller proportion of risk cases. The day-to-day functioning of high-needs schools and the ability of the teacher to effectively transmit kindergarten curriculum in these schools are likely to differ greatly from those in low-needs schools. More specifically, given that the population of kindergarten children in high-needs schools differed from that of those in low- and moderate-needs schools in domains of child development not in the realm of literacy development (i.e., EDI Physical Health and Well-Being, Social Competence, Emotional Maturity), intervention programs targeted only at early literacy skills may not be as effective in high-needs schools as compared to those characterized as low needs (e.g., Al Otaiba & Fuchs, 2002; Nelson, Benner, & Gonzalez, 2003).

To further illustrate the implications of the findings, the school with 45% of learners identified as at risk for literacy difficulties had significant proportions of learners identified as vulnerable on measures of developmental health, and the indicators of the demographics of the school community suggest higher risk for overall developmental outcomes. In this context, in addition to those cognitive and language skills related to literacy development, problems of time on task due to behavior, attention span, and listening behaviors, as well as the routines related to learning activities, are likely to be inherent difficulties of delivering the program and instruction and are related to early literacy development (Al Otaiba & Fuchs, 2002; Nelson et al., 2003). Finally, given the relationship between special education placement and demographic characteristics of the individual students (Artiles,
and the differential levels of inclusive practices for children with special needs in the United States and in Canada, and especially by region in British Columbia (for a discussion, see Siegel & Ladyman, 2001), there are also likely to be more children designated for special education services in the high-needs school than in the low-needs school.

In order to promote the health and well-being of the population via development of effective literacy skills, it is crucial that effective models of instruction and intervention reflect a comprehensive understanding of those factors that have an influence on reading development and that assessment is focused at the population and community levels (for related discussions, see Love, Aber, & Brooks-Gunn, 1994; Shepard, 1997). Such models would be much more sensitive to the growing population of school-age children who are characterized by variability and vulnerability on a number of demographic characteristics.

In this case, we argue for identifying communities that are most at risk and, consistent with early childhood research on the prevention of developmental difficulties and promotion of academic and social–emotional development (Battistich, Watson, Solomon, Lewis, & Schaps, 1999; Belfield, Nores, Barnett, & Schweinhart, 2006; Bogard & Takanishi, 2005; Dearing, McCartney, Weiss, Kreider, & Simpkins, 2004; Yoshikawa & Zigler, 2000), targeting these communities with multipronged services to promote the overall development of the child and to increase the capacity in the community to serve all children. In population health research, one of the salient indicators of a nation’s health is the magnitude of the gap, or gradient, in socioeconomic status between the rich and the poor; those nations deemed healthiest are those with the smallest gradient (for a discussion, see Keating & Simonton, 2006; Willms, 2003). In the context of promoting literacy achievement of all children, and in conceptualizing school health related to literacy, we might conceptualize the healthiest district as the one with the least variability in literacy rates from school to school.

Significant variation in developmental health and early literacy skills of populations of children across the school communities studied were easily identifiable as early as kindergarten. As such, public funds and district resources must be differentially allocated on the basis of school community characteristics; this is the case in the preschool years as well as upon school entry at kindergarten. In the elementary school setting, intervention services for children have historically focused on academic skills. In fact, these data would argue for a multipronged intervention approach that focuses on social–emotional dimensions and physical health and well-being to promote learning and self-regulation, with age-appropriate literacy skills as one desired outcome; this is a model that has historically been applied to preschool settings (e.g., Belfield et al., 2006). In addition, these findings reinforce the need for public policies that target at-risk communities and parents in order to promote children’s health and well-being (Lee & Burkam, 2002).
The need for population-based studies of literacy runs parallel to recent advances in research on the identification of learning disabilities and instruction for those at risk for reading difficulties. Although Canada and the United States differ, on average, in the extent to which inclusive practices are commonplace, there is considerable similarity in the way in which early difficulties are identified and addressed; in both countries, there is a strong push toward effective early identification and intervention for children at risk for school difficulties. Specifically, response-to-intervention is an instructional model that is emerging in order to address the problem of high rates of special education placements, reading difficulties that are most remediable in their earliest stages, (mis)placement in special education due to lack of exposure to appropriate instruction, and the overrepresentation of children from minority backgrounds in special education (see Bradley, Danielson, & Doolittle, 2005; Siegel & Ladyman, 2001; Wagner, Francis, & Morris, 2005, for relevant discussions of these issues). The premise behind the response-to-intervention model is that at-risk students should receive effective instruction with progress monitoring before being considered for special education (Fuchs, Fuchs, & Speece, 2002). There are two important related consequences of this model. First, the model places an emphasis on early identification of children in need of different or more intensive instructional approaches. In turn, a second consequence of this model is that an emphasis is placed on school contexts with higher rates of children in need of targeted instructional attention to promote their literacy skills and academic development. This creates the opportunity and the need for conversations about school-level models of prevention of academic difficulties in diverse populations of learners.

Moreover, there is a growing awareness of the difficulty of effectively implementing research-based interventions in practice, and researchers are increasingly attending to broader factors, such as school and classroom climate, culture in the community, and teacher characteristics, in order to understand how best to translate research to practice to promote the healthy development of all learners (e.g., Donovan, Wigdor, & Snow, 2003; Shonkoff & Phillips, 2000). Akin to the notion of differentiated instruction, whereby we refer to the ability to provide instruction—via particular instructional approaches and curriculum—that meets the needs of children of varied abilities who are in the same classrooms, we might also think about differentiated intervention design, one that is tailored to the level of risk of the school population rather than of individual children. We propose that in the case of differentiated intervention designs, the salient variables and components of the intervention reflect the developmental features of the school population of interest and corresponding demographics of the school community. Thus, from school to school, multipronged (e.g., literacy skills, social–emotional maturity, physical health) intervention models would vary according to attributes of the school population and community. More research in elementary schools that uses an interdisciplinary framework to examine different models of intervention whose
components, target skills, and structure for delivery vary as a function of school characteristics is needed in order to refine our understanding of how to promote the literacy skills of all school-age children as early as kindergarten, if not before.

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