Education determines a nation's health, but what determines educational outcomes? A cross-national comparative analysis

Original Article

Education determines a nation's health, but what determines educational outcomes? A cross-national comparative analysis

Arjumand Siddiqi[a,*], Ichiro Kawachi[b], Lisa Berkman[b,c], Clyde Hertzman[d,e], and S.V. Subramanian[b]

[a]Dalla Lana School of Public Health, University of Toronto, 155 College street, Room 566, Toronto, Ontario M5T 3M7, Canada.

[b]Department of Society, Human Development, and Health, Harvard School of Public Health, Boston, Massachusetts, USA.

[c]Harvard Center for Population and Development Studies, Cambridge, Massachusetts, USA.

[d]Human Early Learning Partnership, Vancouver, British Columbia, Canada.

[e]Department of Healthcare and Epidemiology, University of British Columbia, Vancouver, British Columbia, Canada.

*Corresponding author.

Abstract This study is premised on the notion that public health policy should address not only health itself, but also primary determinants of health. We examined the effect of national policies on educational outcomes, in particular, on *adolescent reading literacy* (ARL). We compared the effect of traditional policy indicators – national income and educational spending – with income inequality, a measure of redistributive policies. We used Organization for Economic Cooperation and Development (OECD) data that provide a rare opportunity to test policy effects after accounting for competing individual-, school-, and country-level explanations. Our sample consisted of 119 814 students, 5126 schools, and 24 countries. Multilevel/Hierarchical regression findings were striking: GDP had a significant, but negligible effect on ARL scores ($\beta = 0.002$, SE = 0.0008), while educational spending had no significant effect. By contrast, income inequality exhibited a larger inverse association ($\beta = -1.15$, SE = 0.57). Among the wealthy nations in OECD, additional economic prosperity and educational spending is trumped by distribution of income for its effect on ARL. Our study yielded a striking result about education, a major determinant of health. Not only is income inequality a significant determinant of ARL scores, but direct spending on education and overall national economic prosperity are not.
Journal of Public Health Policy (2012) **33**, 1–15. doi:10.1057/jphp.2011.52; published online 3 November 2011

Keywords: social policy; income inequality; welfare state; OECD; education

Introduction

Our study – that draws on the robust empirical evidence for education as a major determinant of health[1] and, on the spirit of the international 'Health in All Policies' movement[2] – is premised on the notion that the public health community should be concerned not only with policies that shape health itself, but also with those that shape the primary determinants of health, such as education. Accordingly, we examine the effect of national policies on educational outcomes, in particular, on reading literacy.

Our investigation of policies is guided by:

- the longstanding conceptual notion that direct investments in the education system and greater economic prosperity are linked to improved educational outcomes, plus the more recent observation that those countries with higher average levels of educational achievement are characterized by having policies that lead to greater redistribution of socio-economic resources; and
- lessons learned from the evolution of the literature on determinants of health, with many parallels to the evolution of the literature on determinants of education.

Research now demonstrates that, at the individual level, measures of educational attainment and literacy skills are associated with health behaviors, health outcomes, and appropriate use of health services throughout the life.[1] At the population level, this translates – in every society in which it has been measured – into a stepwise association between incremental increases in education and incremental increases in health status – often referred to as the *socio-economic health gradient*.[3] The consistency of the association between education and health is thought to arise from the fundamental role of education in providing individuals with the socio-economic resources that generate the environments and experiences associated with health.[4] These resources include income, living and neighborhood conditions, social networks, and social capital, to name only a few.

The tight relationship between education and health suggests that, in terms of population health, much can be gained by attending to the policies that support educational opportunities for all. Indeed, the increasingly widespread concept of 'Health in All Policies' is based on appreciation of the intimate association between policies affecting the determinants of health (such as education) in society, and the society's

health itself.[2] Put differently, policies that promote education are, very much, policies that promote health, and thus an important part of the domain of public health policy.

Moreover, many determinants of education mirror determinants of health. These parallels offer instructive ways to examine policies that support education. For both health and education, the focus of policy analysis has been on access to and adequacy of sector-specific resources[5] (the health services and education/schooling systems, respectively) and on overall economic growth.[6] For individuals, studies have demonstrated that health and educational outcomes are closely tied to family socio-economic resources,[4,7] suggesting that a broader set of social policies that distribute and redistribute these resources may also have significant consequences. Indeed, for both health and education, population-level patterns suggest that countries with higher average outcomes are those with fewer socio-economic inequalities.[8]

Here is where the similarities in research begin to diminish. Over the last two decades, health research has increasingly attended to the role of redistributive policies (finding strong associations between income inequality and measures of morbidity and mortality in highly income-unequal societies, but not in more income-equal societies).[9,10] Research on education has not yet concentrated on this policy domain.

In the present study, we compare the effects of the two rather traditional policy domains (sector-specific spending and economic growth) with the effects of redistributive policies (as measured by income inequality) – on a measure of educational achievement, adolescent reading literacy (ARL) scores. Though it cannot be equated with policy itself, income inequality measures a major redistributive outcome of policies.

Policy research based on societal comparisons has relied mainly on ecologic-level data (for both health and education outcomes), but our study uses a unique data source compiled by the Organization for Economic Cooperation and Development (OECD) that provides individual-, school-, and country-level indicators. This data structure offers analytic possibilities for understanding the influence of national-level policy factors on educational outcomes, while simultaneously accounting for many individual- and school-level complementary or competing explanations. Our goal is to understand what policy conditions foster strong education outcomes, given education's role as a key determinant of health. We believe this is an important way to understand how to foster better population health as well.

Methods

Main data source

We used data from the 2000 Program for International Student Assessment (PISA), conducted by OECD. PISA is a study of 265 000 15-year-old students in 32 countries (28 OECD members – plus 4 non-member) that '… assesses how far students near the end of compulsory education have acquired the knowledge and skills that are essential for full participation in society …'.[11] Specifically, PISA's emphasis is on understanding what abilities students had obtained, rather than focusing on curricular competencies *per se*.

The sampling frame for the study differed slightly by country, but, in general, included all 15-year-old students attending educational institutions. To obtain a nationally representative sample, OECD used a two-staged sampling strategy in each country, in which schools were first sampled, then children within schools. Schools were sampled using a 'stratified, probability proportional to size' strategy. Stratification incorporated both explicit and implicit strata. Explicit strata were based on factors, such as states/territories/other large geographical units, school type, and urban versus rural location. Implicitly, stratification also sorted schools by smaller geographic units, such as metropolitan areas, public versus private designation, and a few other stratifying variables.

From each school, 35 15-year-old students were randomly selected. Researchers obtained a census of students at schools with fewer than 35 students. PISA provides coding for each student to her/his respective school and country, enabling analysis of the effects of contextual factors on individual reading literacy. To test the effect of policies that affect the distribution of social goods, only countries with established market-based economies were included. Belonging to OECD in 2000 was the basis for inclusion. The net sample consisted of 119 814 children nested in 5126 schools, in 24 countries.

Measures

Dependent variable (obtained from PISA)

ARL scores, assessed using a 141-item paper and pencil test, were measured to assess children's functional capabilities. An international group of experts in education and psychometrics oversaw test development. Items ranged from basic comprehension to more sophisticated

tasks requiring 'deep and multiple levels of understanding'. The resultant ARL score ranged from 0 to 800 and were coded as a continuous variable.

Independent variables

Country-Level Variables (*obtained from OECD*): At the country level, income inequality was described using the Gini coefficient, based on post-tax, post-transfer household income (Table 1). The Gini ranges from 0 to 1, with lower values representing greater equality in the distribution of income. Gini data for most countries were obtained for 1994, the most complete year closest to 2000, for which data were available. When no 1994 data were available, we used data for the closest year to 1994 (between 1992 and 1996). *Educational spending* was described for 2000, using the per cent of gross domestic product (GDP) spent on education (Table 1). Per capita GDP was also measured in 2000 and expressed in current international dollars, adjusted for purchasing power parity (Table 1). All country-level variables were coded continuously.

School-Level Variables (*obtained from PISA*): School-level covariates were included to adjust for the influence of schools on ARL scores. We used two variables considered representative of important school factors: an index of educational resources, and an index of teacher shortage. Both indices were derived from Likert-scaled responses provided by school principals. The index of school's educational resources reflected the extent to which principals felt that the learning of children was hindered by the lack of instructional material, computers, library materials, multimedia resources, science laboratory equipment, and inadequate facilities for the fine arts. Negative values indicate the perception of lower quality of educational material resources. The index of teacher shortage reflected the extent to which principals felt that children's learning was hindered by an inadequacy of teachers in the test-language, mathematics, or science.[12] Negative values indicate a perception that learning is hindered by an inadequacy of teachers. We estimated the internal consistency of these indices for each country. For the index of educational resource shortages, the mean Chronbach's score across the OECD nations was 0.85, while for the index of teacher shortages, it was 0.88. Both indices were modeled as continuous variables.

Table 1: Distribution of national-level characteristics

Country	*Gross domestic product per capita*[a]	*Gini coefficient*[b]	*Spending on education (percentage of GDP)*[a]
Australia	26 180	0.31	4.74
Austria	28 010	0.28	5.83
Belgium	26 430	0.22	3.13
Canada	27 750	0.28	5.21
Czech Republic	14 000	0.26	4.38
Denmark	29 310	0.24	8.28
Finland	25 150	0.22	5.94
France	25 320	0.29	5.77
Germany	26 070	0.27	4.54
Greece	16 660	0.33	3.75
Hungary	12 320	0.27	4.92
Ireland	30 100	0.33	4.33
Italy	24 940	0.34	4.65
Japan	25 980	0.25	3.56
Korea	15 220	0.32	3.82
Mexico	8920	0.55	4.41
New Zealand	20 150	0.40	5.96
Norway	35 130	0.24	6.85
Portugal	17 310	0.36	5.76
Spain	19 960	0.35	4.49
Sweden	24 530	0.27	7.74
Switzerland	28 130	0.31	5.48
United Kingdom	24 690	0.34	4.42
United States	34 160	0.36	4.86

[a]Data are from 2000.
[b]Data for Australia, Austria, Canada, France, Germany, Hungary, Ireland, Luxembourg, Mexico, Spain, Sweden, the United Kingdom, and the United States are from 1994; data for Greece, Japan, and Korea are from 1993; data for Finland, Italy, New Zealand, and Norway are from 1995; data for Belgium, Denmark, and Switzerland are from 1992; data for Czech Republic and Portugal are from 1991.

Student-Level Variables (*obtained from PISA*): We included several variables associated with ARL scores. All were derived from written student questionnaires, including age (coded continuously in months), sex (female = 1, male = 0), number of siblings (coded continuously), and family socio-economic status (SES) (coded continuously). SES was measured using an index based on student reporting of the mother's and, separately, the father's occupation. (The higher of the two was used.) We coded these open-ended responses in accordance with the International Classification of Occupations and formulated an index that

captures the attributes of occupations that link education to income. The SES index ranged from 16 to 90 (see Table 4).

Data analysis

We generated descriptive statistics to understand the basic characteristics of the data (Tables 1 and 2) and the basic relationships between the variables (Table 3). We used hierarchical regression to understand the effects of the three policy parameters, after accounting for covariates at the individual-, school-, and national levels (Table 4). We compared the adjusted parameter estimates for GDP, educational spending, and income inequality by visual inspection to determine the relative impact of each on ARL scores.

Modeling proceeded as follows:

- Model 1 (constant term only) – ascertained whether ARL scores differed significantly across countries;
- Model 2 (student variables) – tested the contribution made by student characteristics and whether between-country variance in ARL scores persists after accounting for cross-national compositional differences in student characteristics;
- Model 3 (added school variables) – tested whether between-country variance in ARL scores remains after accounting for cross-national differences in school resources;
- Models 4, 5, and 6 (testing the effects of GDP, educational spending, and income inequality, respectively) – examined the effect of each of the three policy domains, after accounting for differences across countries in the characteristics of students and schools;
- Models 5 and 6 (educational spending and income inequality) – were also adjusted for GDP to account for overall resource level of countries.

Results

Sample characteristics and descriptive statistics are summarized in Tables 1 and 2. Among the 24 countries, the average GDP per capita was US$23 600; lowest in Mexico, $8920; and highest in Norway, $35 130. Average income inequality was 0.32; lowest in Denmark, 0.24;

Table 2: Descriptive statistics of individual-, school-, and national-level variables

	Average	*Minimum*	*Maximum*
National level (N=24)			
Per capita GDP	$23 600	$8920	$35 130
Income inequality (Gini coefficient)	32.17	24.44	54.60
Educational spending (percentage of GDP)	5.12	3.13	8.28
School level (N=5126)			
Educational resource shortage	−0.02	−1.90	3.22
Teacher shortage	0.03	−0.95	3.47
	Average (SE)	*Minimum*	*Maximum*
Individual level (N=119 814)			
Index of reading literacy	505.81 (1.86)	23.17	800.00
Index of socio-economic status	49.06 (0.25)	16.00	90.00
Student age in months	188.50 (0.04)	182.00	195.00
	N (percentage)		
Female	60 377 (50.93)	—	—
Sibling(s)	101 565 (82.84)	—	—

the highest Gini coefficient, 0.55 in Mexico. Average level of educational spending was 5.12 per cent of GDP per capita; lowest in Belgium (3.13 per cent), and the highest in Denmark (8.28 per cent). At the school level, both the index of educational resource shortage and the index of teacher shortage had small mean values (0.03 and −0.02, respectively), indicating that, on average, principals did not believe schools had major resource shortages. The range of scores, however, was quite large, pointing to substantial variability in the sample. Approximately half of the children (60 377) were females, and 82.84 per cent (101 565) had siblings. Results of *t*-tests indicated that, compared to males, females had significantly higher reading literacy, as did children with siblings in comparison to only children ($P < 0.0001$). The average SES index score was 49.06 (SE = 0.25), ranging from 16 to 90. The index of reading literacy averaged 505.81 (SE = 1.86), ranging from 23.17 to a maximum of 800.

Table 3 displays the results of our correlational analyses at the country level. The national mean value for each individual- and school-level

Table 3: Country-level correlational analyses

	GDP per capita	*Income inequality*	*Educational spending*	*Index of SES*	*ARL score*	*Index of teacher shortage*	*Index of educational resource shortage*
GDP per capita	1.00	—	—	—	—	—	—
Income inequality	−0.23***	1.00	—	—	—	—	—
Educational spending	0.28***	−0.01	1.00	—	—	—	—
Index of SES	0.18***	−0.06***	0.05***	1.00	—	—	—
ARL score	0.20***	−0.20***	0.006	0.32***	1.00	—	—
Index of teacher shortage	−0.13***	0.11***	−0.07***	−0.07***	−0.14***	1.00	—
Index of educational resource shortage	−0.29***	0.17***	−0.13***	−0.12***	−0.18***	0.33***	1.00

***$P < 0.001$.

Table 4: Effects of student, school, and policy on adolescent reading literacy scores: results of hierarchical regression

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
	Constant	+ *Student factors*	+ *School factors*	+ *GDP*	+ *Educational spending*	+ *Gini*
Constant	504.37***	216.96***	217.21***	224.41***	192.97***	179.40***
Student						
Age	—	1.16***	1.15***	1.15***	1.15***	1.15***
Female	—	26.45***	26.63***	26.63***	26.63***	26.63***
Siblings	—	4.60**	4.62**	4.61**	4.61**	4.61**
SES	—	1.09***	1.08***	1.08***	1.08***	1.08***
School						
Educational resources	—	—	−4.51***	−4.48***	−4.49***	−4.50***
Teacher resources	—	—	−5.42***	−5.40***	−5.43***	−5.42***
Country						
GDP	—	—	—	0.002*	0.002*	0.001*
Educational spending	—	—	—	—	−3.68	—
Gini	—	—	—	—	—	−1.15*
Variance						
Student	63 659.50*	6018.85*	6019.45*	6019.46*	6019.46*	6019.45*
School	2430.04*	1808.45**	1746.44**	1746.34**	1756.39**	1746.44**
Country	670.62**	576.76**	548.61**	382.39**	419.92**	437.95**

*$P<0.05$, **$P<0.01$, ***$P<0.001$.

variable was used to calculate Pearson's coefficients. Among bivariate relationships, reading literacy was most strongly associated with the index of SES ($r = 0.32$), and least strongly associated with educational spending ($r = 0.006$). Correlations between reading literacy and the two other main predictor variables were in the expected direction. Reading was inversely associated with income inequality ($r = -0.20$), and positively associated with per capita GDP ($r = 0.20$).

Results of multilevel regression can be found in Table 4. Model 1 suggests that cross-national variation in ARL scores is significant and attributable to differences between students, schools, and countries. Models 2 and 3 suggest significant effects of all student characteristics and all school characteristics. Being older, female, having siblings, and higher SES were associated with higher ARL scores, while fewer educational resources and teacher resources were associated with lower ARL scores. These models also suggest that, after accounting for differences in students and schools, significant variance remains at the country level. Stated differently, cross-national differences in reading literacy could not fully be accounted for by either student- or school-level differences.

Models 4, 5, and 6 tested the main effects of each policy. Model 4 suggests a positive and significant, but negligible, effect of GDP on ARL scores ($\beta = 0.002$, SE $= 0.0008$). Model 5 suggests no significant association between educational spending and ARL scores. Model 6 suggests that income inequality is negatively associated with ARL scores ($\beta = -1.15$, SE $= 0.57$). Increases in income inequality are associated with decreases in ARL scores. Of the three policy domains we explored, income inequality had the strongest effect on ARL scores.

Discussion

Our study yielded a striking and somewhat counterintuitive result about a major determinant of health. Not only is income inequality a significant determinant of ARL scores, but direct spending on education and overall national economic prosperity are not. Specifically, a one-point increase in the Gini coefficient is associated with about a one and one-half point decrease in ARL scores. While this may seem like a small effect, two points suggest its size is noteworthy. First, income inequality (and, by extension, the set of underlying social policies) represents a contextual effect, and thus

exerts influence on every child in a nation. Second, a one-point difference on the reading literacy scale is associated with approximately five school days' worth of learning.[13] Thus, the 30-point range of the Gini coefficient across the OECD countries is accounted for ARL levels equivalent to 150 days' difference in schooling, about one half school year.

That additional gains to GDP did not improve ARL scores in advanced capitalist economies is also a rather novel finding. This result implies that, among the world's wealthiest nations, growth strategies are no longer an effective means of improving human development. These findings parallel findings in the health literature, which has established that, among wealthy nations, increments in per capita GDP do not produce increments in life expectancy.[6]

The finding that additional educational spending also failed to improve ARL scores is particularly surprising. On the one hand, these findings are also paralleled in the health literature, where total sector-specific spending at the national level is not correlated with measures of population health.[5] Yet, it may be that the total amount spent by the government on education is not indicative of the extent to which all citizens benefit from the spending or the distribution of educational resources among citizens.

The importance of distributional aspects of policy is highlighted by a comparison of the United States and Canada, countries that spend a similar portion of their GDP (4.86 per cent and 5.21 per cent, respectively) on education. In the United States, however, educational funds are not redistributed across local (neighborhood) boundaries, and thus across school districts. In Canada, funds are collected by provinces and distributed on a per-pupil basis across school districts. These crucial differences in the distribution of educational monies are obfuscated by measures of spending at the national level.

What about the significant influence of income inequality? At the outset, we described the importance of income inequality as an indicator of the distribution of socio-economic resources. On the basis of earlier literature, we believe the significance of resource distribution for ARL scores implicates three primary pathways:

1. perhaps most intuitively, material resources themselves – in the form of goods, services, and quality of living and learning conditions – become more abundantly available at all points along the spectrum of society[9];

2. income inequality is inversely related to social cohesion.[14] In the realm of health, measures of social cohesion are associated with all-cause mortality, cardiovascular mortality, malignant neoplasms, and infant mortality.[15] In the realm of education, verbal ability and behavioral difficulties in pre-school children[16] and anti-social behavior in pre-teens[17] have been linked to social cohesion;
3. the psychological (stress) impact of societal inequality.[9] Though stress induced from income inequality has not been formally tested in relation to health or education outcomes, insights can be gleaned from research on the influence of family SES on parental stress. Low-income parents have been found to be at increased risk of psychological distress arising from a combination of greater exposure to '… negative life events and … fewer resources with which to cope with adverse life experiences'.[18] We suggest that, perhaps the perception of lack of resources intensifies in an environment in which there are greater economic and social distances between poorer and richer families.

These pathways are not likely to be mutually exclusive; rather, they may operate jointly. The psychological impact of limited resources may derive from deprivation, not only of family resources, but also inadequate resources at the societal level.

In sum, our analysis lends support to the notion that post-tax, post-transfer income inequality – and thus underlying social policies – is a key determinant of health, and plays a significant role in education as measured by ARL in advanced capitalist economies. We found no evidence for a role of educational spending or of GDP. It is unclear why educational spending was not associated with ARL scores, but lessons from the curvilinear association between national income and health suggests these countries have reached a level of economic prosperity at which marginal gains to national income do not appreciably affect well-being.

The cross-sectional nature of the data prevented us from examining ARL scores in relation to exposures to policy over the life course. In addition, residual confounding may exist. Factors associated with income inequality and ARL scores, such as educational policies beyond spending, were not accounted for. Availability of longitudinal data across countries and more refined measures of educational and social policies will surely advance knowledge in this area and should be incorporated in future studies.

About the Authors

Arjumand Siddiqi is an Assistant Professor at the Dalla Lana School of Public Health, University of Toronto, Canada.

Ichiro Kawachi is Professor and Chair of the Department of Society, Human Development, and Health, Harvard School of Public Health.

Lisa Berkman is the Director of the Harvard Center for Population and Development Studies, and Professor in the Department of Society, Human Development, and Health, Harvard University.

Clyde Hertzman is the Director of the Human Early Learning Partnership, and Professor in the Department of Healthcare and Epidemiology, University of British Columbia.

S.V. Subramanian is Professor of Population Health and Geography in the Department of Society, Human Development, and Health, Harvard School of Public Health.

References

1. Berkman, N. *et al* (2004) Literacy and Health Outcomes. Rockville, MD: Agency for Healthcare Research and Quality. Contract No.: 04-E007-2.
2. Puska, P. (2007) Health in all policies. *European Journal of Public Health* 17(4): 328.
3. Adler, N.E. and Ostrove, J.M. (1999) Socioeconomic status and health: What we know and what we don't. *Annals of the New York Academy of Sciences* 896(1): 3–15.
4. Link, B. and Phelan, J. (1995) Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior* 35(Extra Issue): 80–94.
5. Babazono, A. and Hillman, A.L. (1994) A comparison of international health outcomes and health care spending. *International Journal of Technology Assessment in Health Care* 10(3): 376–381.
6. Rodgers, G. (1979) Income and inequality as determinants of mortality: An international cross-section analysis. *Population Studies* 33(2): 343–351.
7. Duncan, G. and Brooks-Gunn, J. (1997) *Consequences of Growing Up Poor.* New York: Russell Sage Foundation.
8. Siddiqi, A., Kawachi, I., Berkman, L., Subramanian, S. and Hertzman, C. (2007) Variation of socioeconomic gradients in children's developmental health across advanced capitalist societies: Analysis of 22 OECD nations. *International Journal of Health Services* 7(1): 63–87.
9. Kawachi, I. (1999) Income inequality and health: Pathways and mechanisms. *Health Services Research* 34(1 Pt 2): 215.
10. Chung, H. and Muntaner, C. (2007) Welfare state matters: A typological multilevel analysis of wealthy countries. *Health policy*, (Amsterdam, Netherlands) 80(2): 328–339.
11. Adams, R.J. and Wu, M. (2000) PISA 2000 Technical Report: OECD.

12. Schulz, W. (2002) Constructing and validating the questionnaire indices. In: R. Adams and M. Wu (eds.) *PISA 2000 Technical Report*. Paris: OECD.
13. Willms, J. (2004) Provincial Variation in Reading Scores of 15-Year-Olds: Statistics Canada. Contract No.: 11-008.
14. Kawachi, I. and Kennedy, B. (1997) Health and social cohesion: Why care about income inequality? *British Medical Journal* 314(7086): 1037–1040.
15. Kawachi, I. (2000) Social cohesion, social capital, and health. In: L. Berkman and I. Kawachi (eds.) *Social Epidemiology*. New York: Oxford University Press.
16. Kohen, D., Brooks-Gunn, J., Leventhal, T. and Hertzman, C. (2002) Neighborhood income and physical and social disorder in Canada: Associations with young children's competencies. *Child Development* 73(6): 1844–1860.
17. Drukker, M., Kaplan, C., Feron, F. and van Os, J. (2003) Children's health-related quality of life, neighbourhood socio-economic deprivation and social capital. A contextual analysis. *Social Science & Medicine* 57(5): 825–841.
18. Development CoItSoEC. (ed.) (2003) *From Neurons to Neighborhoods: The Science of Early Childhood Development*. Washington DC: National Academy Press.