

Measuring Early Child Development

Vaudreuil, Quebec

Early Child Development – Outcome Measures

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Founding President, CIAR

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CIAR Programs

- Population Health
- Human Development
- Economic Growth

Experience-Based Brain Development in the early years of life sets neurological and biological pathways that affect:

- Health
- Learning
- Behaviour

Population Outcomes SES Gradients

- Health – physical and mental
- Literacy – language
- Behaviour

Gradients

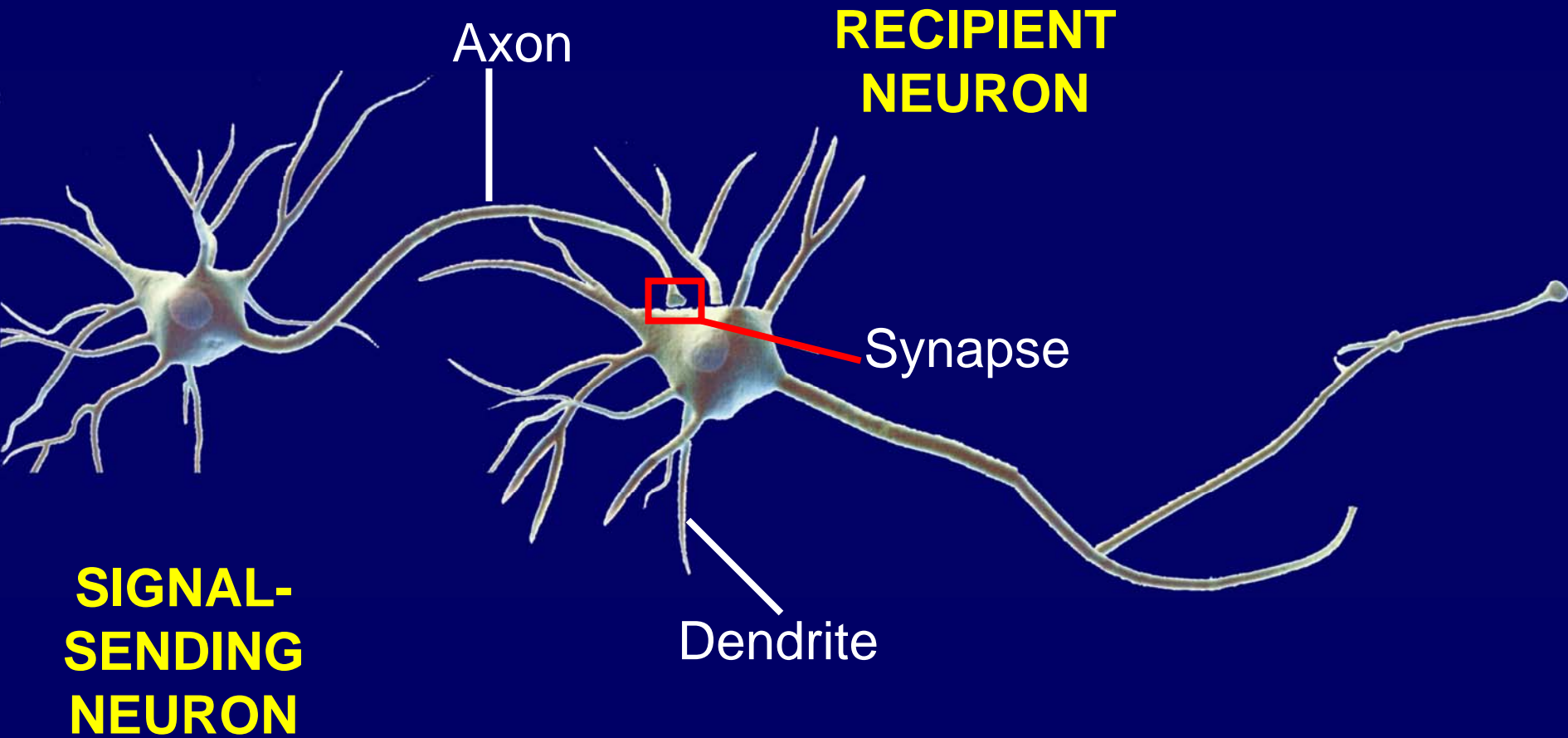
- Can be steep or shallow [No threshold]
- At the lowest SES position, many still do well in respect to health, education and learning
- Not simply a socioeconomic question
- Is a social environment issue
- Is a community support issue

NEUROSCIENCE



The Hostage Brain, Bruce S. McEwen and Harold M. Schmeck, Jr., 1994.

Two Neurons

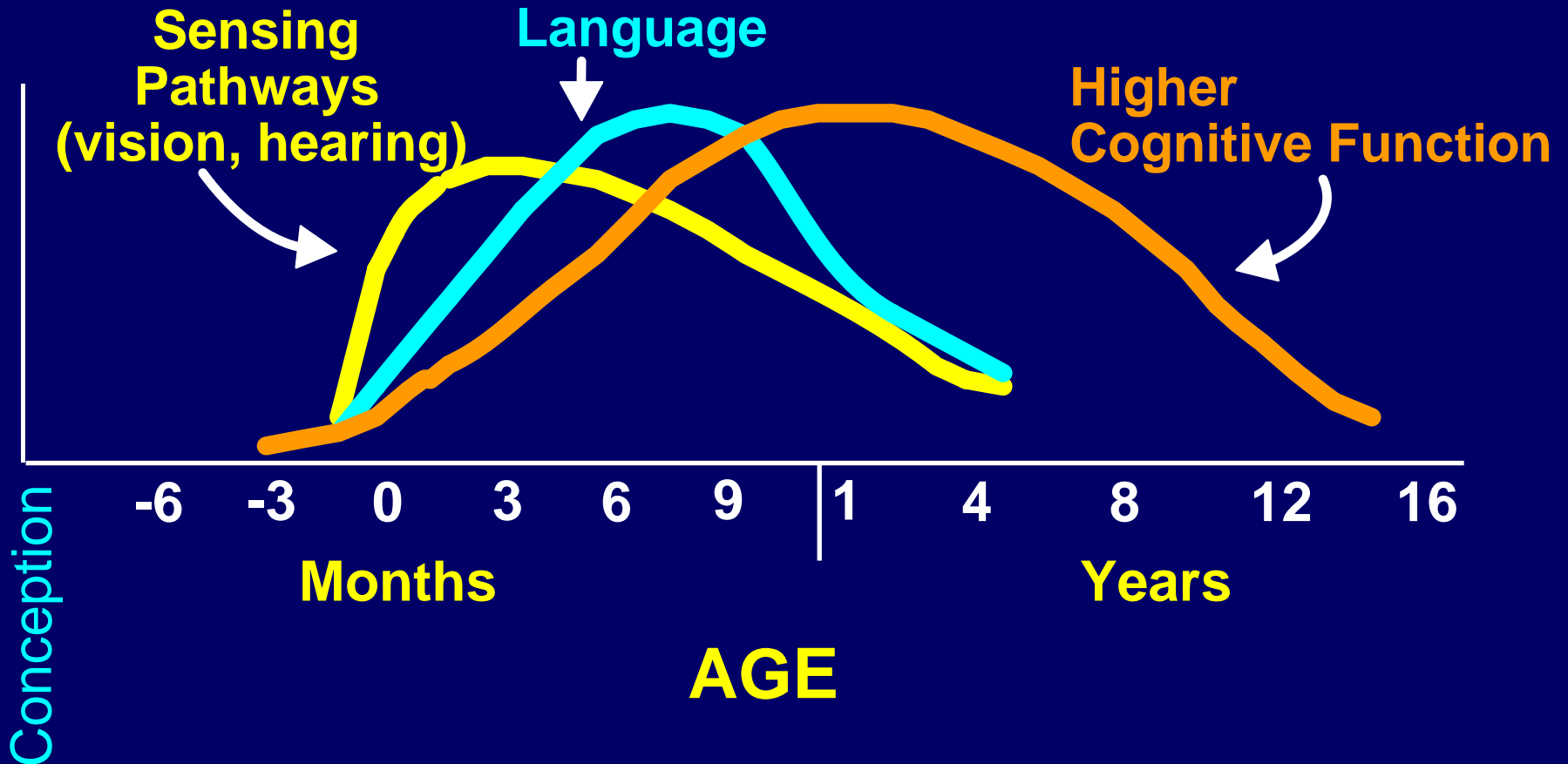


Experience and Brain Development

- Stimuli in early life switch on genetic pathways that differentiate neuron function – **critical and sensitive periods.**
- Stimuli affect the formation of the connections (synapses) among the billions of neurons (sensitive periods).
- The brain pathways that affect literacy, behaviour, and health form early.

From studies in humans, monkeys and rats

Human Brain Development – Synapse Formation



C. Nelson, in From Neurons to Neighborhoods, 2000.

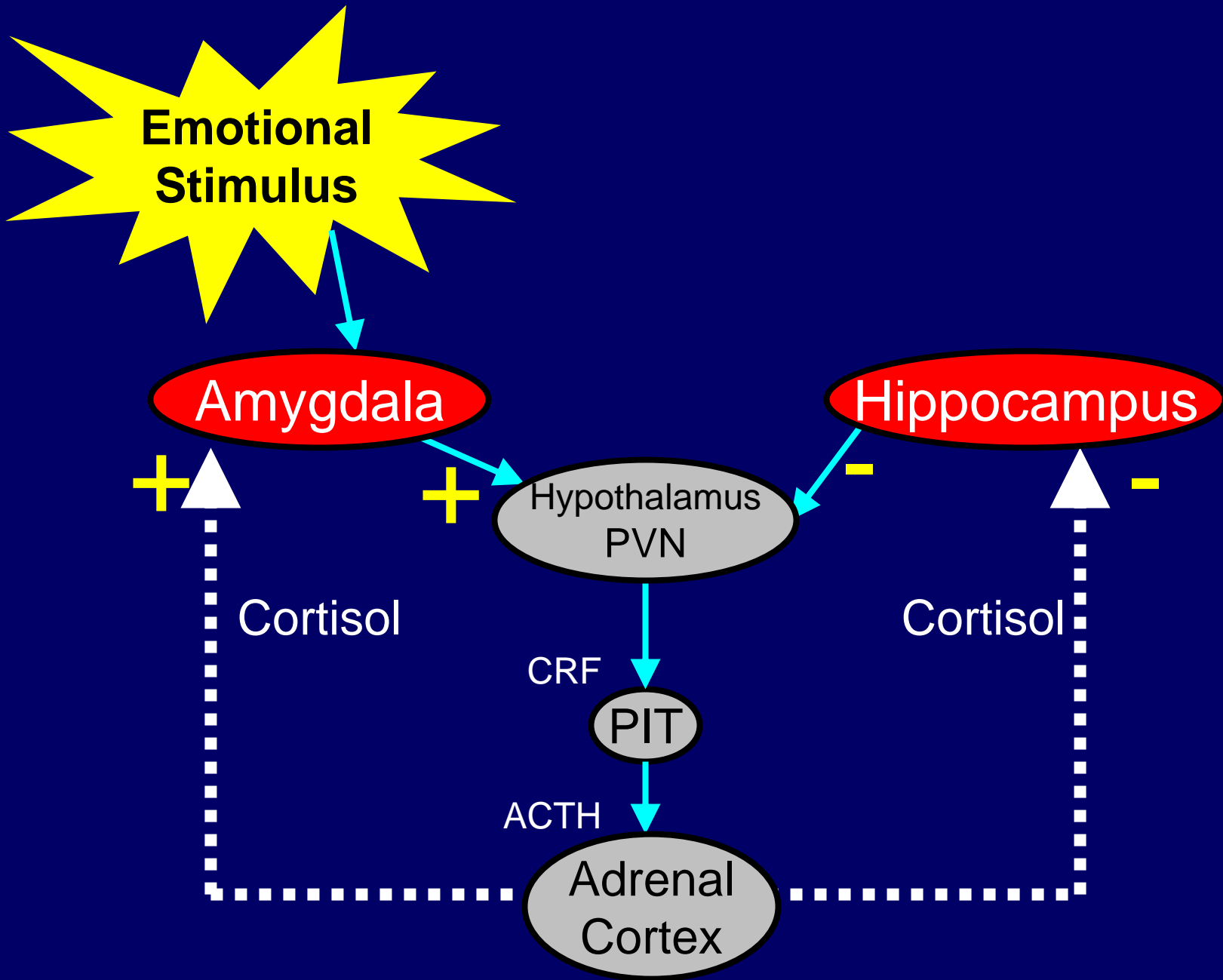
Synaptic Density

At Birth

6 Years Old

14 Years Old





LeDoux, Synaptic Self

Limbic HPA Pathway - Stress

Cortisol – Over Production

Behaviour, depression, diabetes, malnutrition, cardiovascular disease, memory, immune system, drug and alcohol addiction

Cortisol – Under Production

Chronic fatigue syndrome, fibromyalgia, immune system (autoimmune disorders) rheumatoid arthritis, allergies, asthma

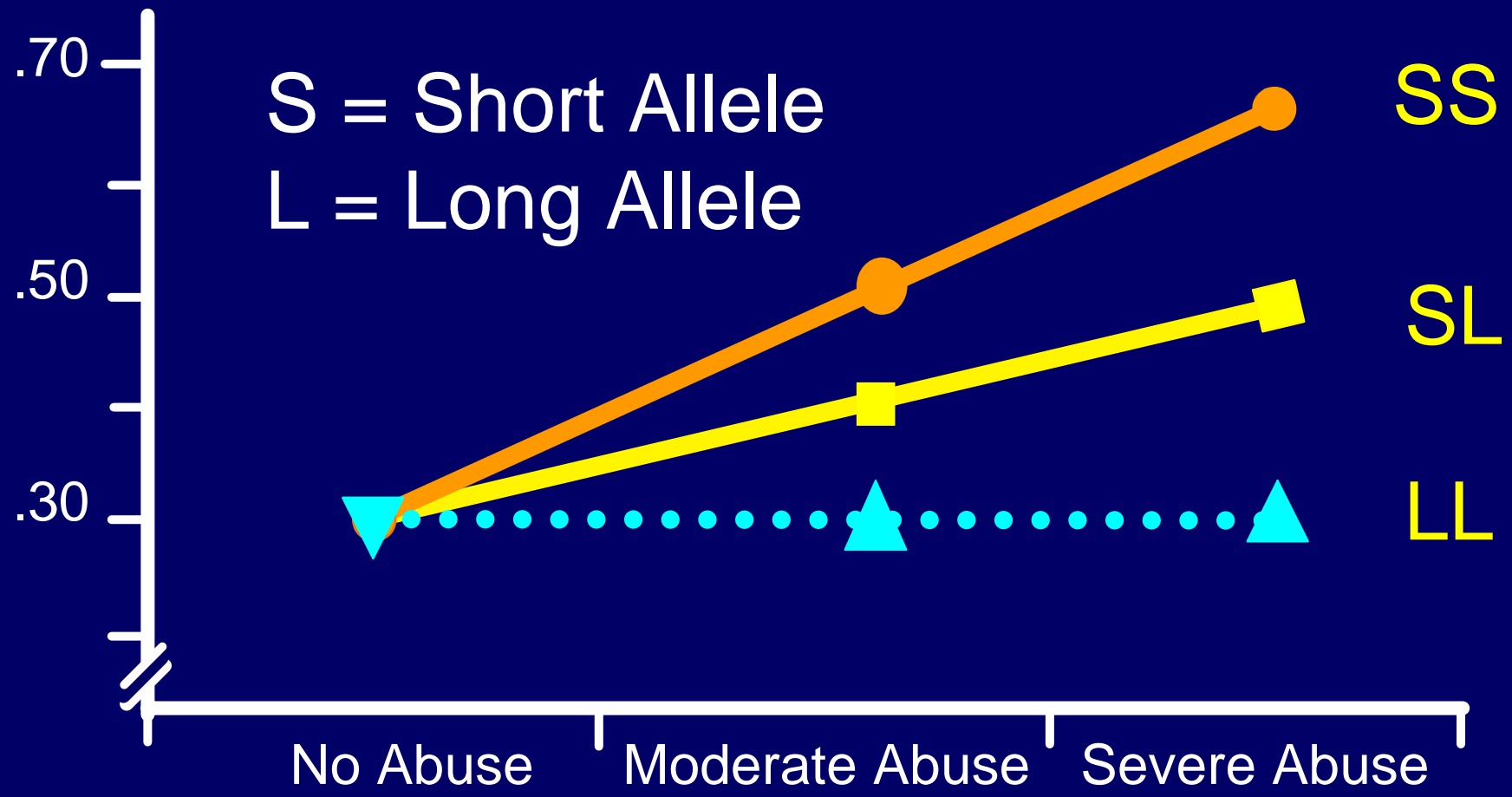
Epigenetics and Brain Plasticity

- Experience and methylation of DNA
- Imprints environmental experiences on the fixed genome
- Maternal behaviour affects DNA methylation
- Can be transmitted to offspring

Serotonin Gene, Experience, and Depression

Depression Risk

Age 26



HEALTH

Swedish Longitudinal Study – ECD and Adult Health

Number of Adverse ECD Circumstances*

0 1 2 3 4

Adult Health

Odds - Ratios


General Physical	1	1.39	1.54	2.08	2.66
Circulatory	1	1.56	1.53	2.91	7.76
Mental	1	1.78	2.05	3.76	10.27

* Economic, family size, broken family and family dissention

Lundberg, Soc. Sci. Med, Vol. 36, No. 8, 1993

Health Problems Related to Early Life

- Coronary Heart Disease
- Non-insulin Dependent Diabetes
- Obesity
- Blood Pressure
- Aging and Memory Loss
- Mental Health (depression)



"Follow up through life of successive samples of birth has pointed to the crucial influence of early life on subsequent mental and physical health and development."

Acheson, Donald - Independent Inquiry into Inequalities in Health, 1998

BEHAVIOUR

Stress Pathway and Sensory Stimuli

Touch in the Early Period is Critical

- Rats – Mothers licking pups
- Monkeys – Peer vs mother rearing
- Humans - Attachment

"The aftermath ... can appear as depression, anxiety, suicidal thoughts or post-traumatic stress - or as aggression, impulsiveness, delinquency, hyperactivity or substance abuse."

Martin Teicher
Scientific American, 2002

Substance Abuse and Childhood Abuse

Odds Ratios for Drug and Alcohol Use

<u>Exposure to Child Abuse*</u>	<u>Drugs</u>	<u>Alcohol</u>
0	1.0	1.0
1	2.7	2.0
2	2.9	4.0
3	3.6	4.9
4+	4.7	7.4

* Scale: 0 none
4 intense



Early Brain Development and Criminal Behaviour

Significant correlation with registered criminality (teenage) appeared for language development at 6, 18, and 24 months

Stattin, H. et al -*Journal of Abnormal Psychology*102; 369, 1993

LITERACY

Early Child Development – Language and Health

- Starts early – first 12 months
- Sets capability for mastering multiple languages
- Sets literacy and language trajectory
- Shares neural pathways influencing health

Levels of Literacy: A Reflection of ECD

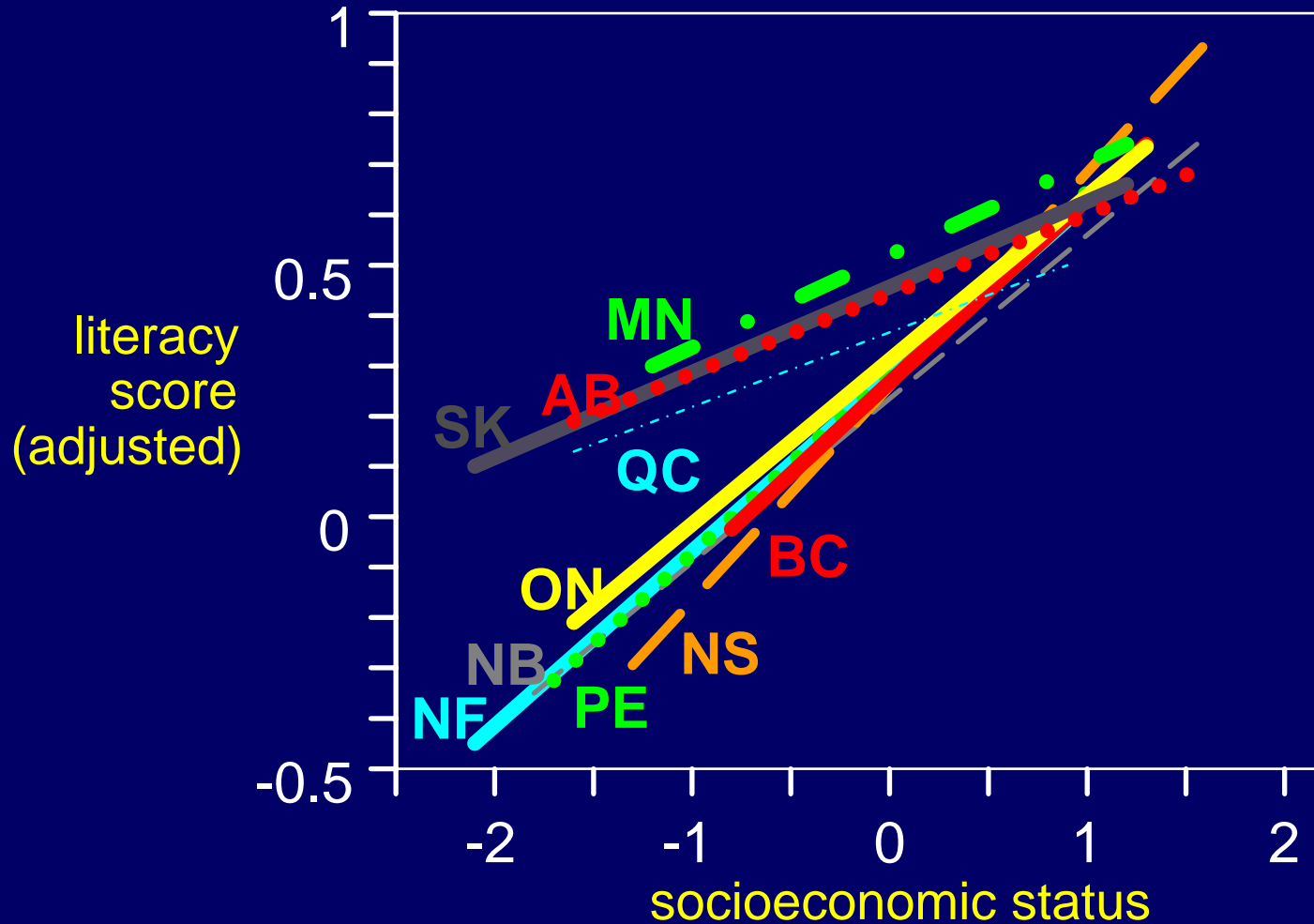
Level 1: indicates persons with very poor skills.

Level 2: people can deal with material that is simple

Level 3: is considered a suitable minimum for coping with the demands of everyday life

Level 4 describe people who demonstrate
and 5: command of higher-order processing skills

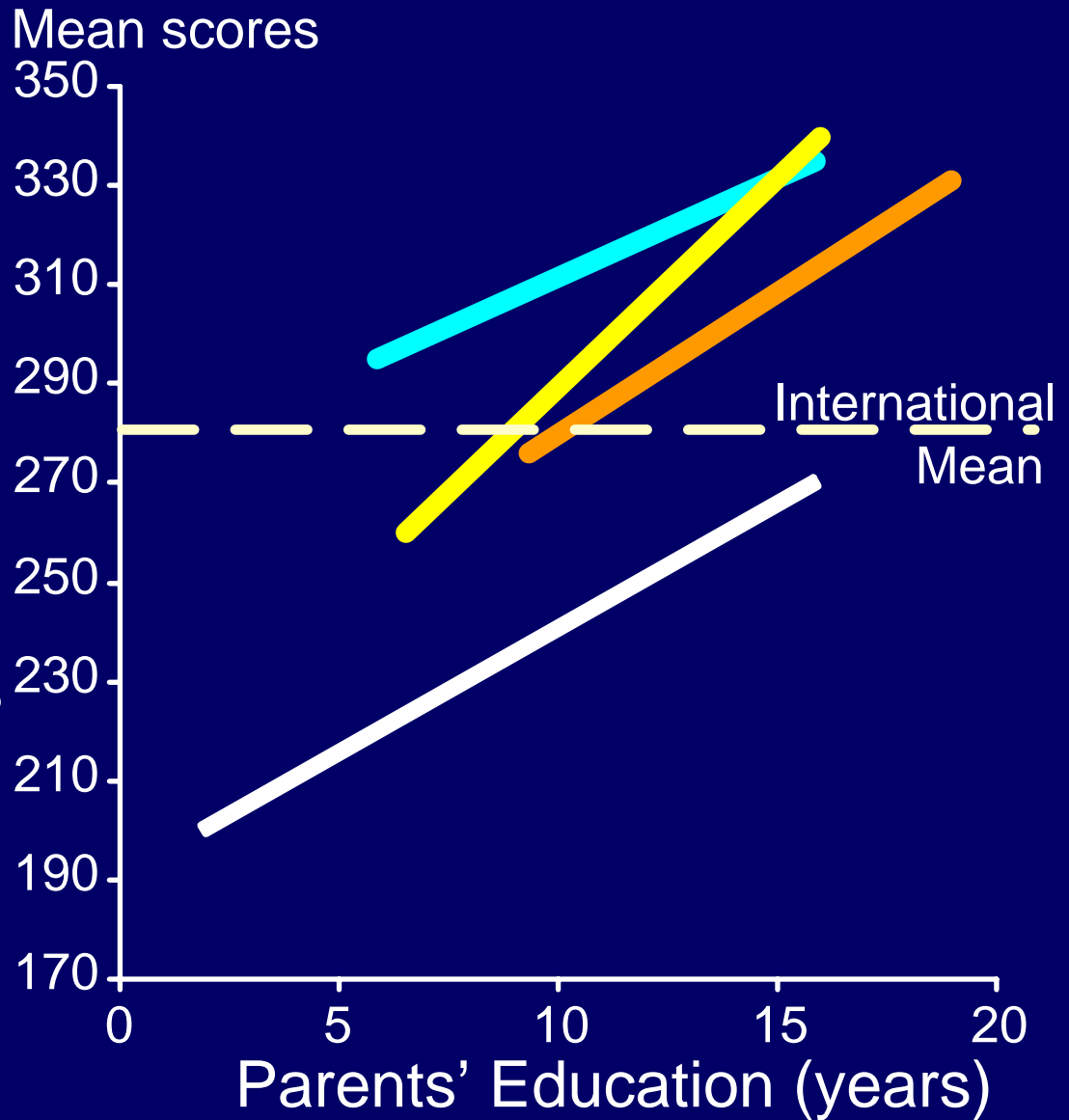
Literacy and SES Gradients for Youth by Province 1994



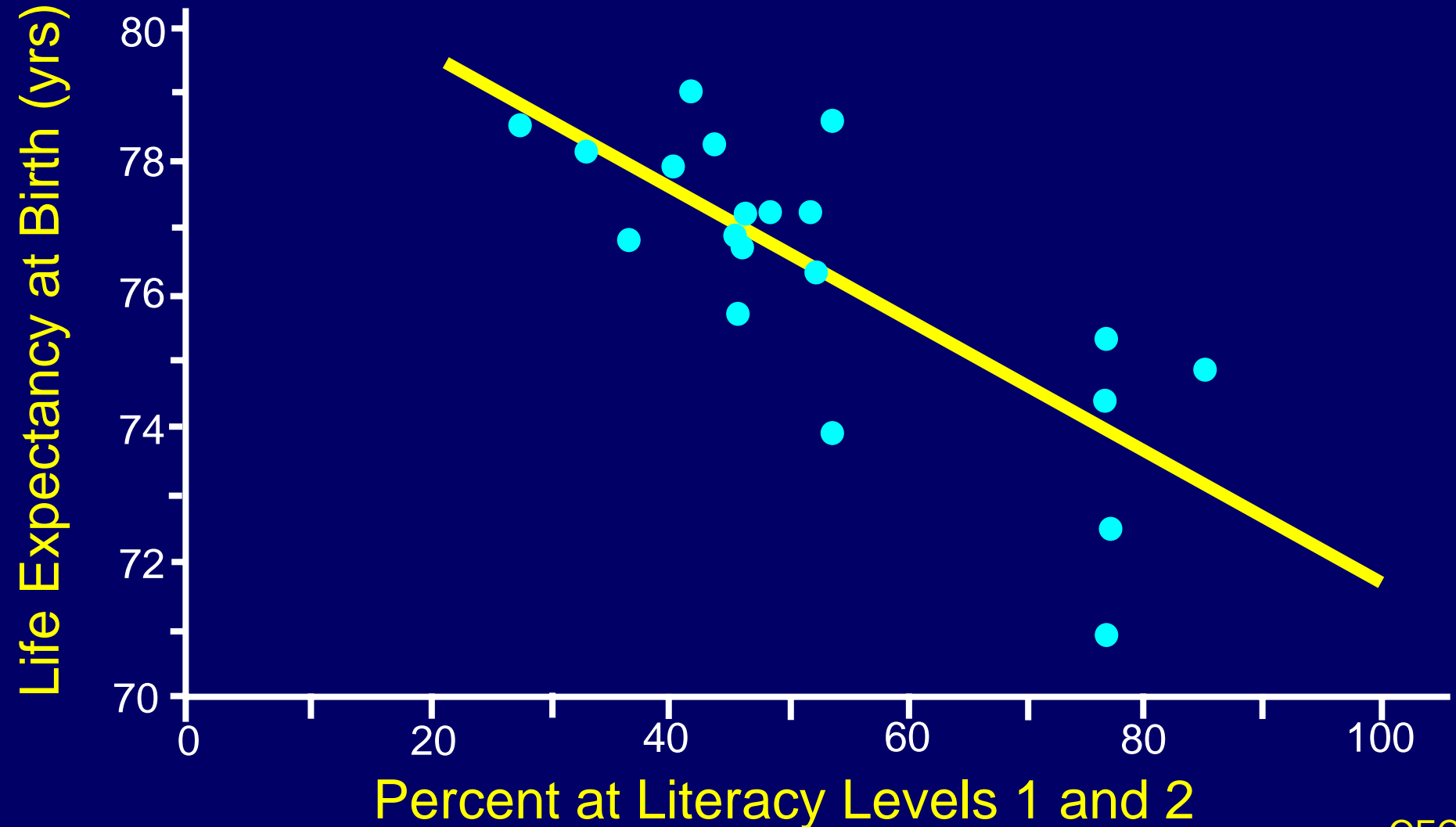
*J. Douglas Willms, "Literacy Skills of Canadian Youth"
Atlantic Centre for Policy Research in Education, University
of New Brunswick, October 21, 1996. Prepared for Statistics Canada.*

Socioeconomic Gradients for Document Literacy Scores

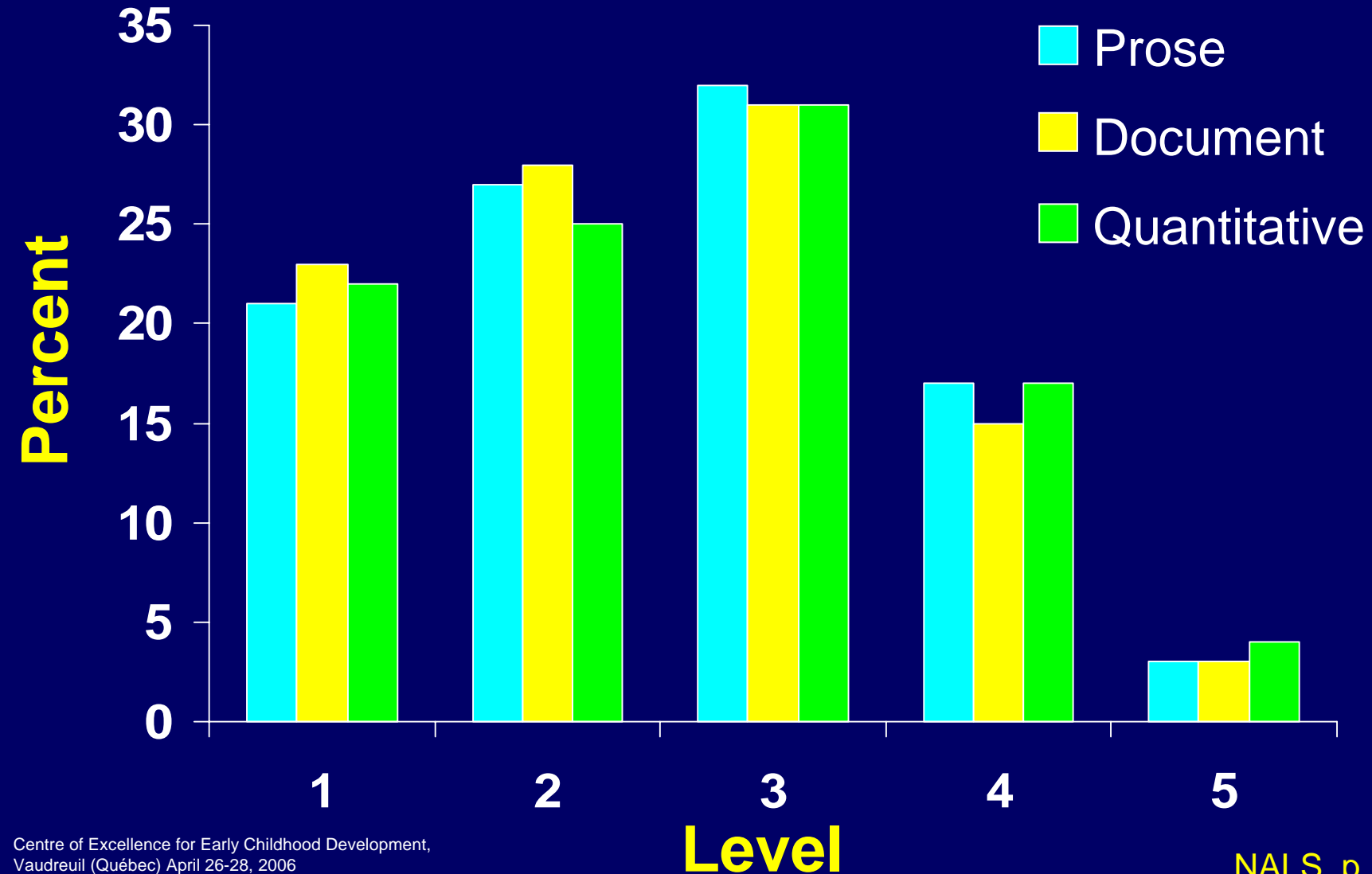
- Sweden
- Netherlands
- Canada
- Chile



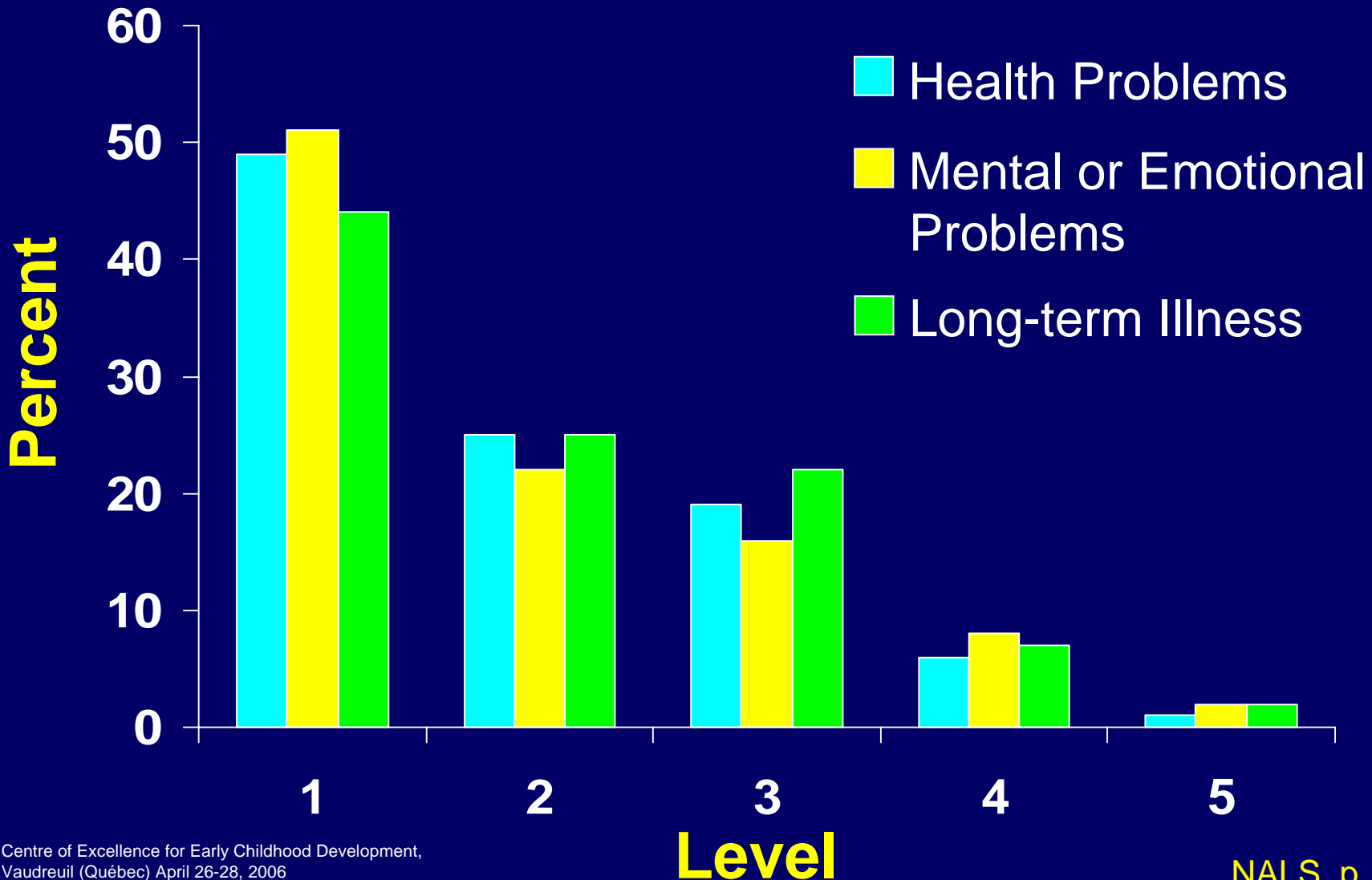
Life Expectancy & Literacy



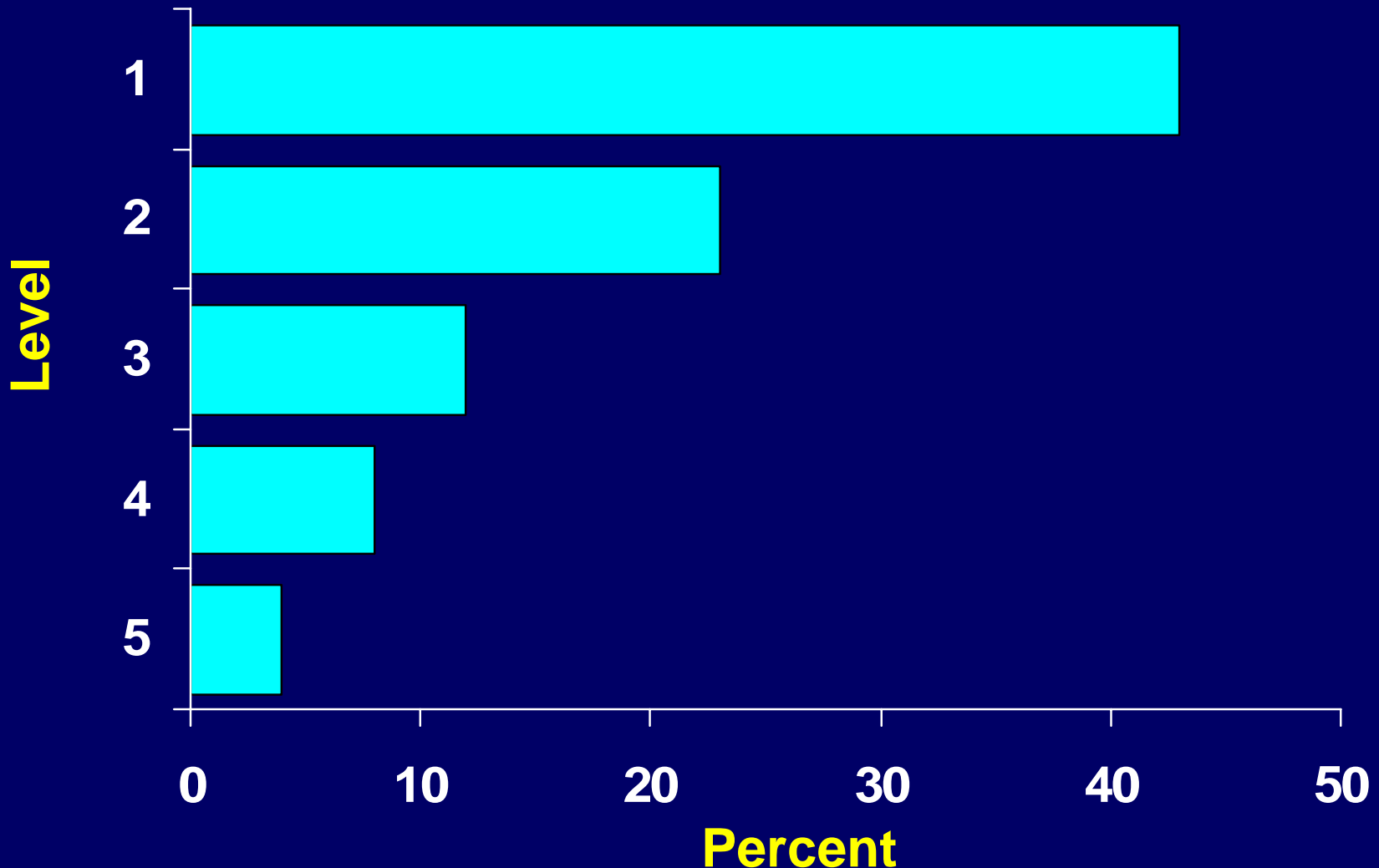
Literacy Levels for the Total Population – USA



Literacy Levels by Physical, Mental or Other Health Conditions – USA (Quantitative)



Percentages of Adults in Poverty, by Literacy Level – USA (Prose)



Human Studies

- Observational studies
- Cross-sectional studies
- Longitudinal studies
- Interventions

Romanian Adoption Project – B.C.

Scores at 10.5 Years

	CB	EA	LA
IQ	108	99	85
Language Score	106	99	88
Behaviour	13%	9%	43%

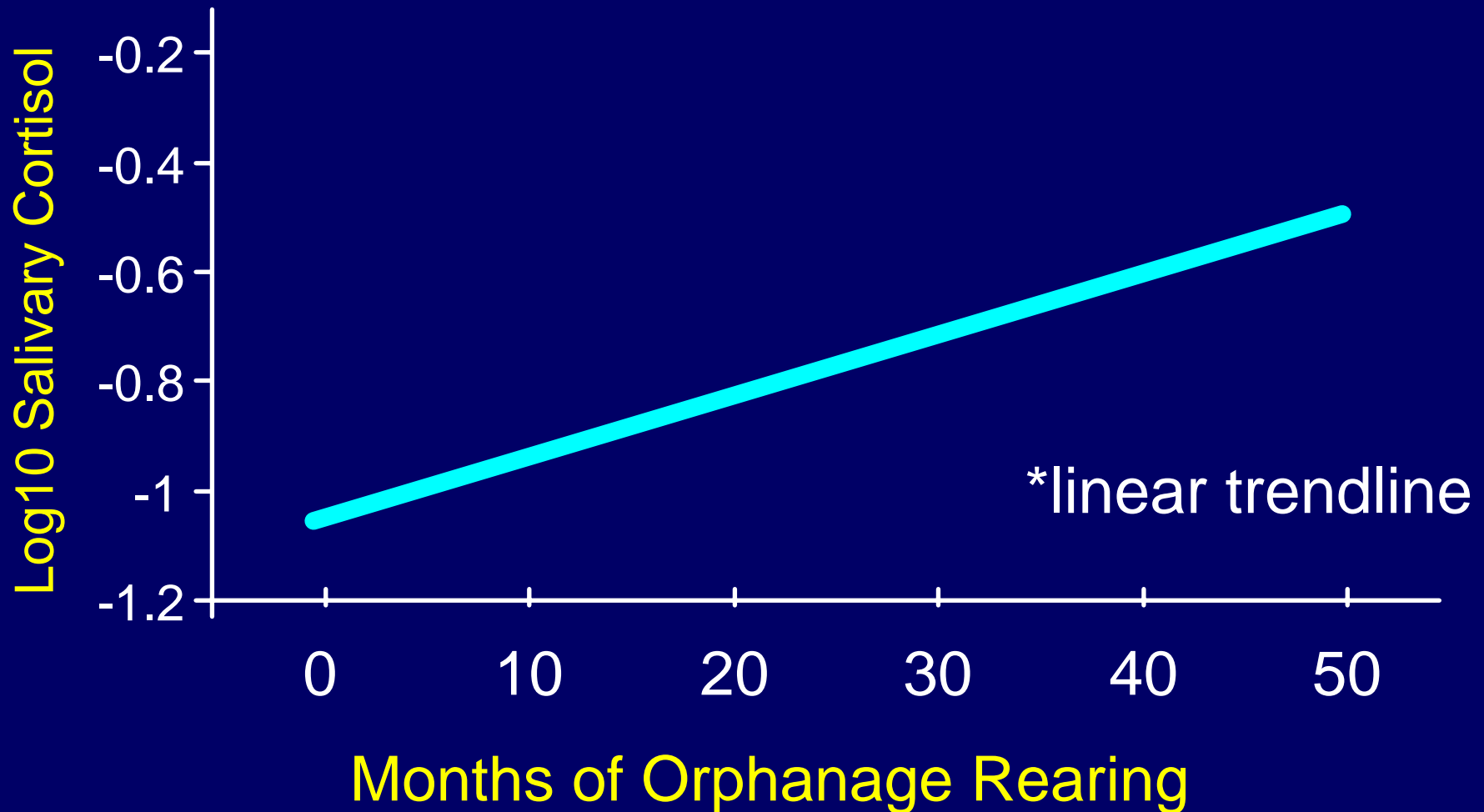
CB - Canadian Born

EA - Early Adopted (within 4 months)

LA - Late Adopted (8 months or later)

L. Le Mare

Evening Cortisol Levels Increase with Months of Orphanage Rearing *



1958 British Birth Cohort

Age 45

- Cortisol pathway response in adults correlates with quality of ECD.
- Children with poor math skills at 7-16 years have dysfunctional cortisol secretion patterns at age 45.

Power and Hertzman

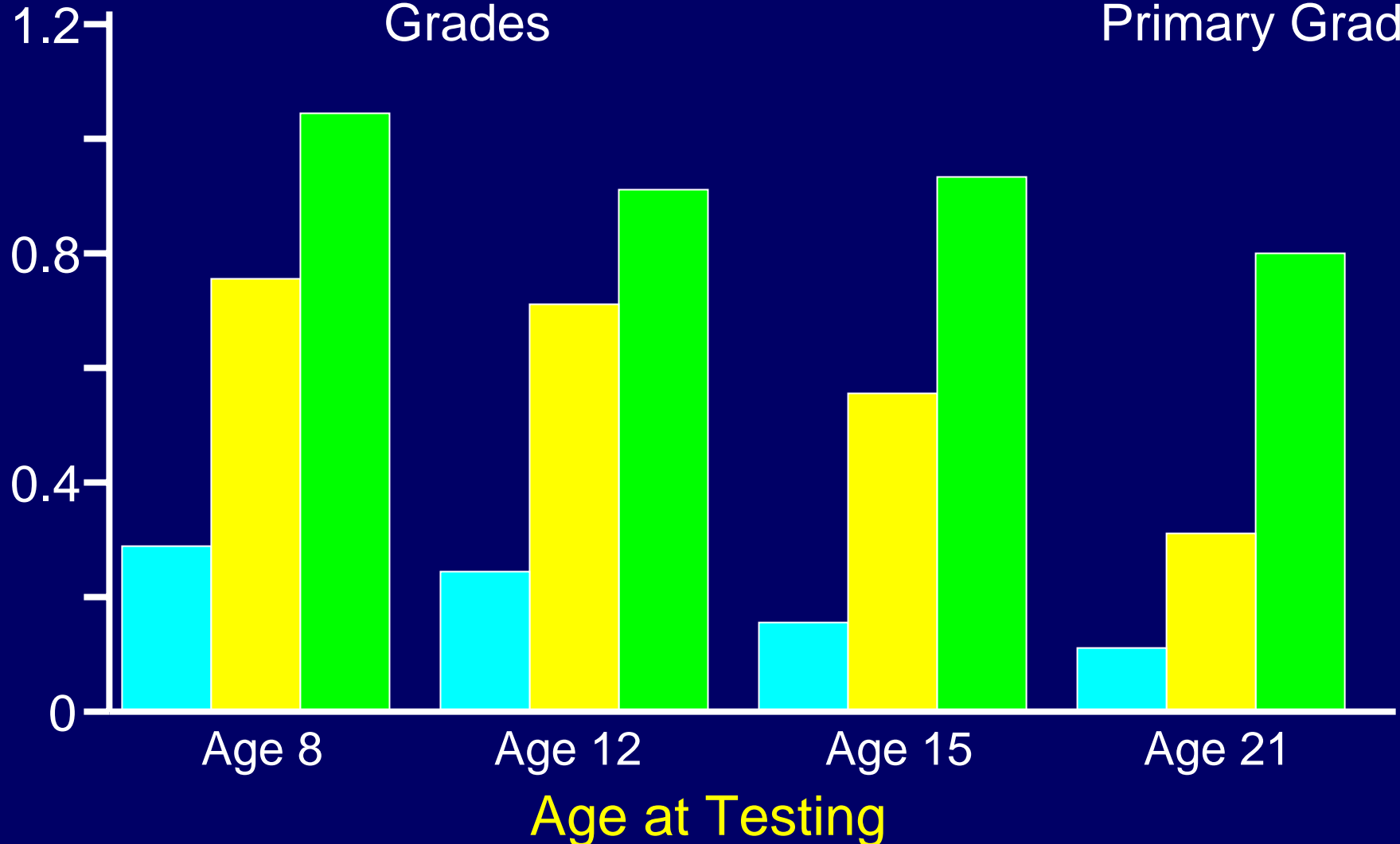
Abecedarian Study – Reading

Effect Size

Primary
Grades

Preschool

Preschool &
Primary Grades



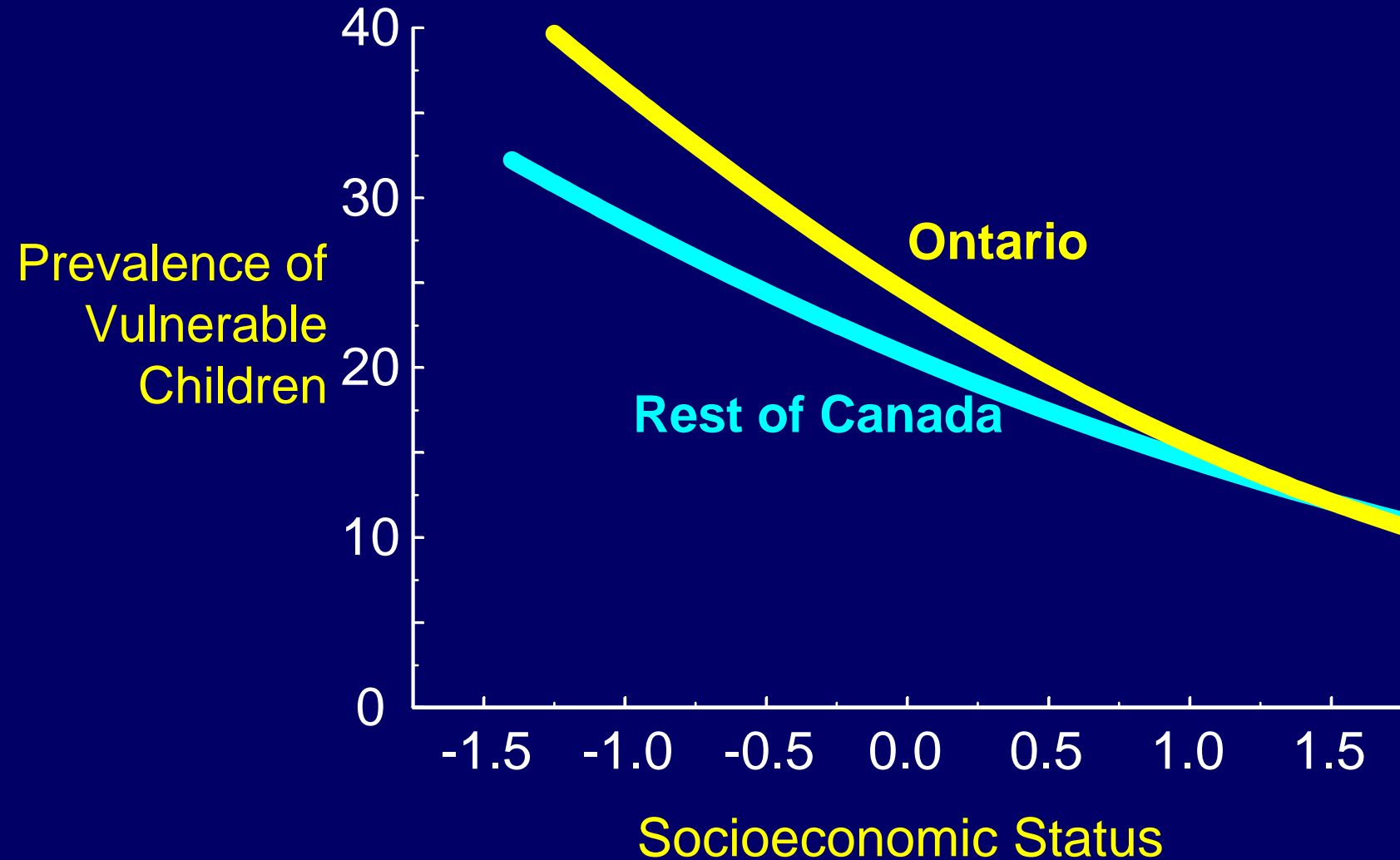
EARLY CHILD DEVELOPMENT PROGRAMS

Early Child Development and Parenting Centres

- Offer from conception to school entry
- Role of health professionals
- Learn parenting by doing
- Provide non-parental care
- Link to Children's Services as needed
- Integrate with primary schools

OUTCOME MEASURES

Vulnerable Children Aged 4 to 6 – NLSCY 1998



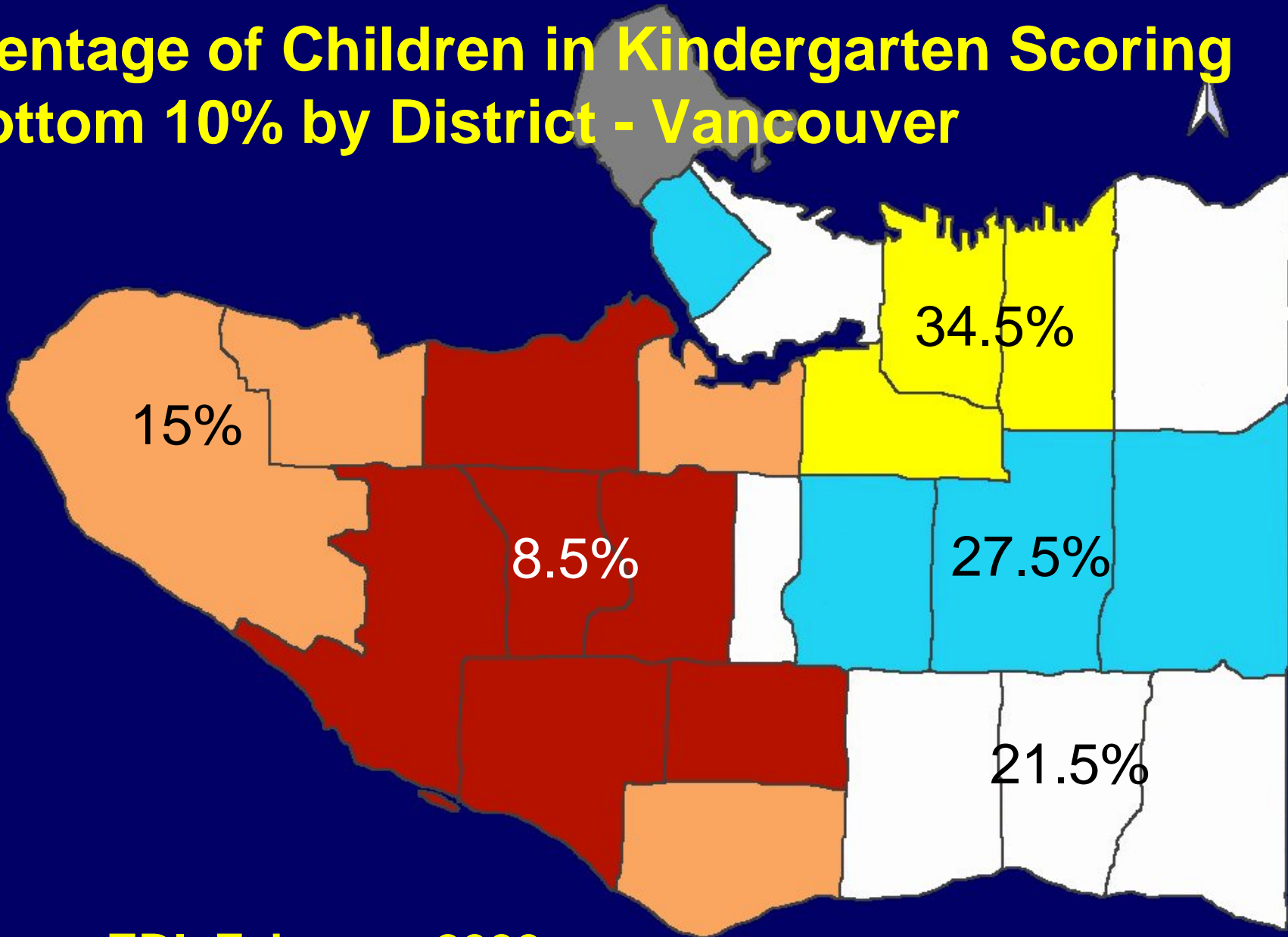
Early Development Instrument (EDI)

- Physical health and well-being
- Social knowledge and competence
- Emotional health/maturity
- Language and cognitive development
- Communication skills and general knowledge

Measures of Early Child Development (EDI)

- Predict learning (populations)
- Predict behaviour (populations)
- Physical and mental health

Percentage of Children in Kindergarten Scoring in Bottom 10% by District - Vancouver



EDI, February 2000

EDI Results – Vancouver Districts

District	Income \$	EDI Results % scoring in bottom 10%
1	12,000-24,000	34.5
2	24,000-37,000	27.5
3	37,000-49,000	21.5
4	49,000-62,000	15.0
5	62,000-74,000	8.5



Vancouver

Grade 4 and Grade 7 Tests

Proportion of children failing to meet Grade 4 and Grade 7 test standards correlates strongly with proportion of children vulnerable on the EDI index at time of school entry.

Earlier Development Measures

- 18 Months (family physicians and Public Health)
- Salivary sterols

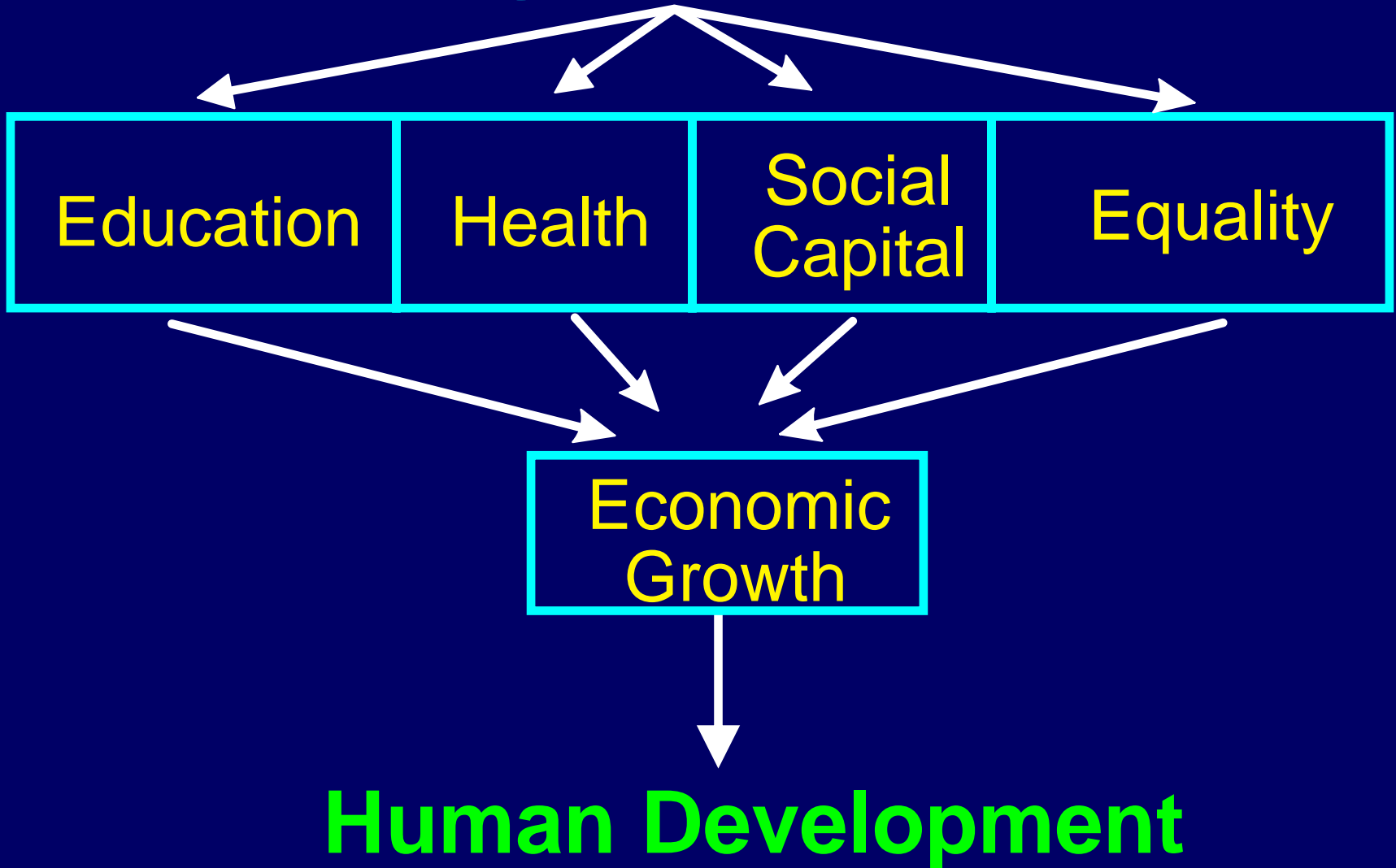
Integrated Population Data Record British Columbia and Manitoba

- Pregnancy
- Birth and infancy
- Development (ECD)
- Education
- Adult health and well-being

Heckman

- Adverse family environments promote adult failure.
- Major economic and social problems can be traced to low levels of skill and ability in the population.

Integrated - ECD



Van der Gaag, World Bank

Human Evolution and the Continuing Evolution of Civilizations

- Improve health and well-being of populations.
- Improve ability and competence of populations.
- Establishing sustainable, tolerant, pluralistic, societies.
- Equity in literacy and income.

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