

Second Annual Workshop of Fundacao
Maria Cecilia Souto Vidigal

(1st presentation)

Sao Paulo, Brazil

Evaluation of Early Human Development

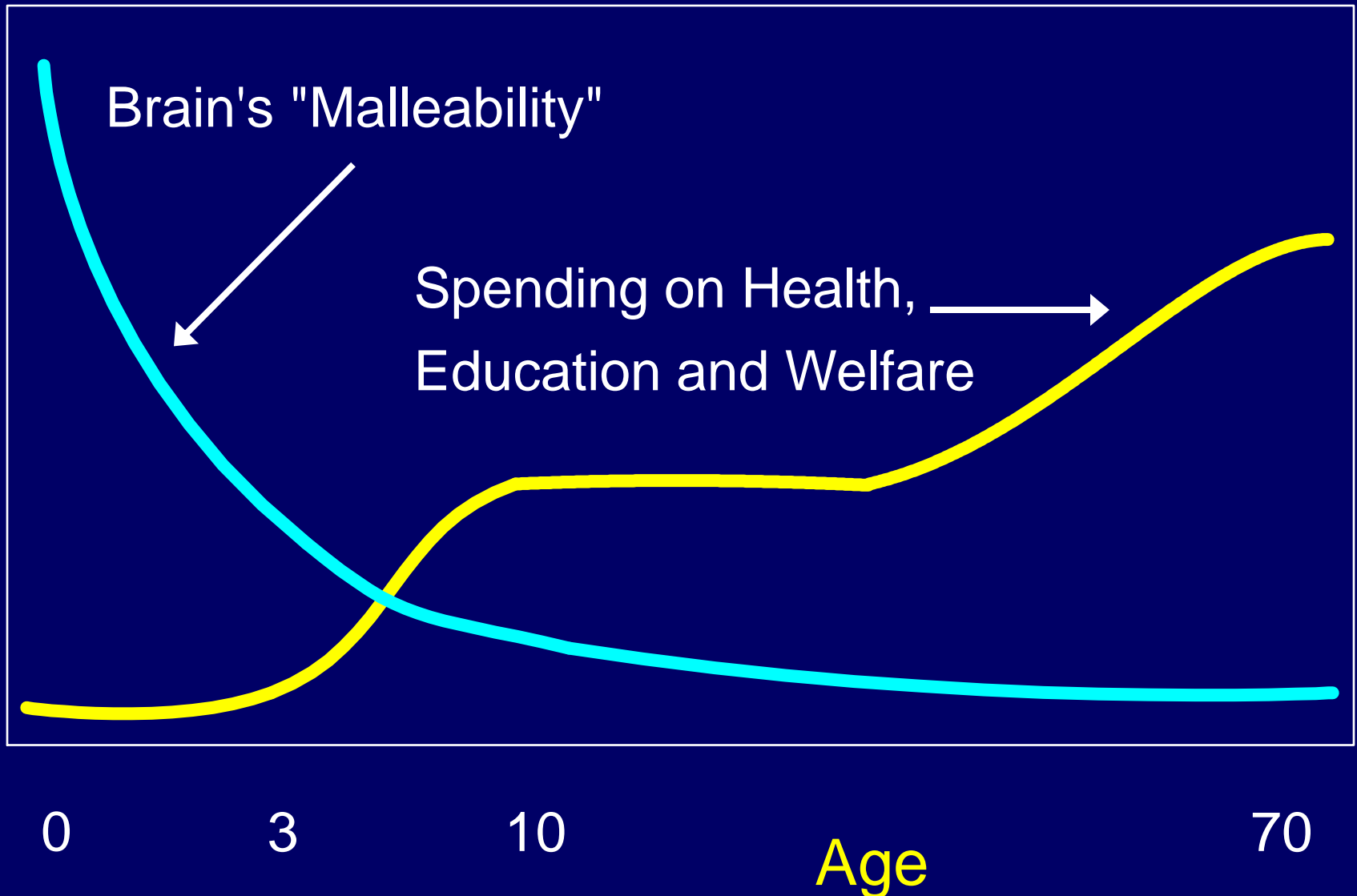
By J. Fraser Mustard
The Founders' Network
Founding Chairman
Council for Early Child Development

October 3, 2008

Presentation

- Socioeconomic gradients in health and literacy.
- Experience-based brain development in the early years and the effects on health, learning, and behaviour.
- Early human development – outcome measures.
- Success by Ten

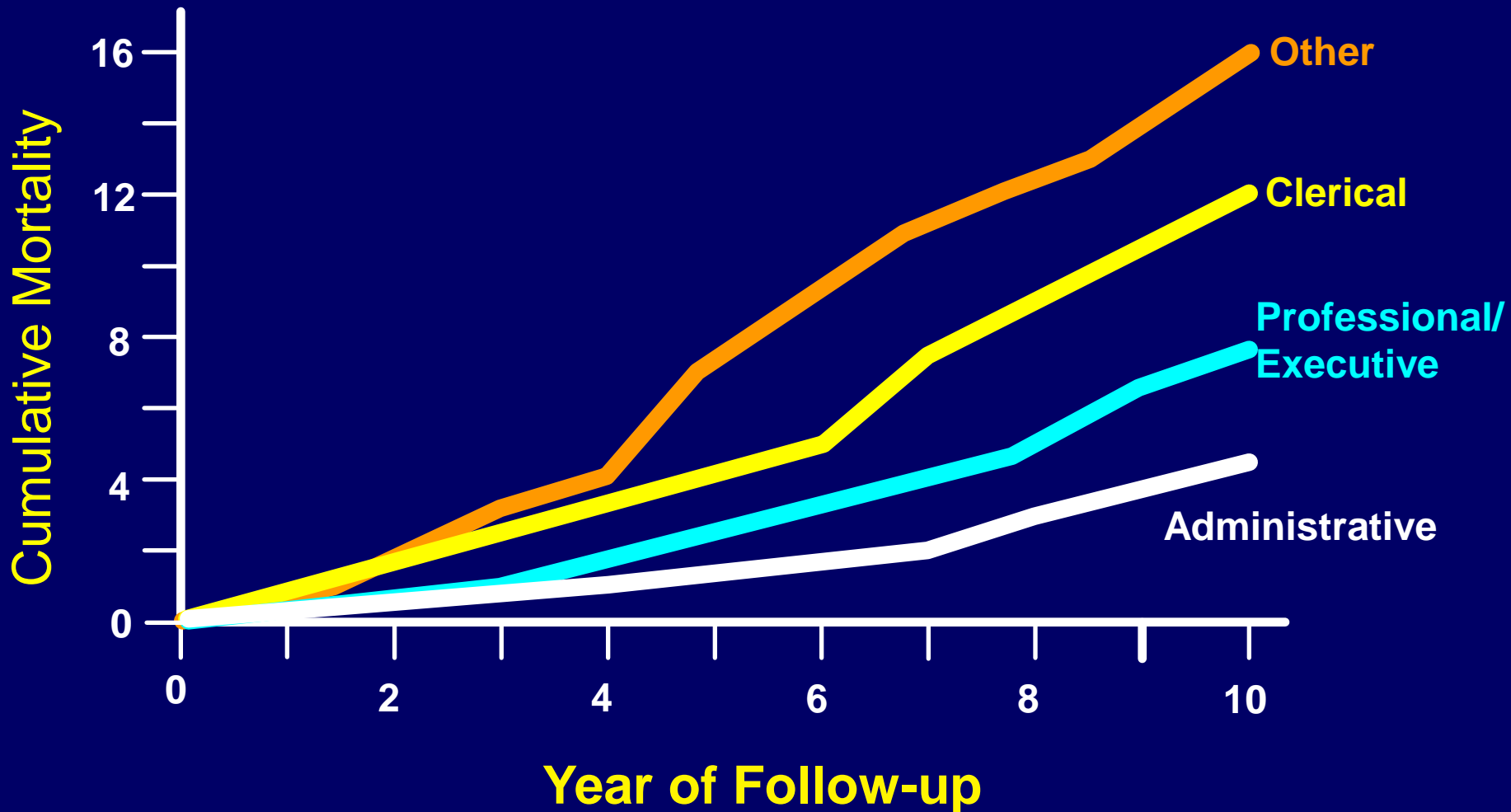
The Mismatch Between Opportunity and Investment



CIAR - History

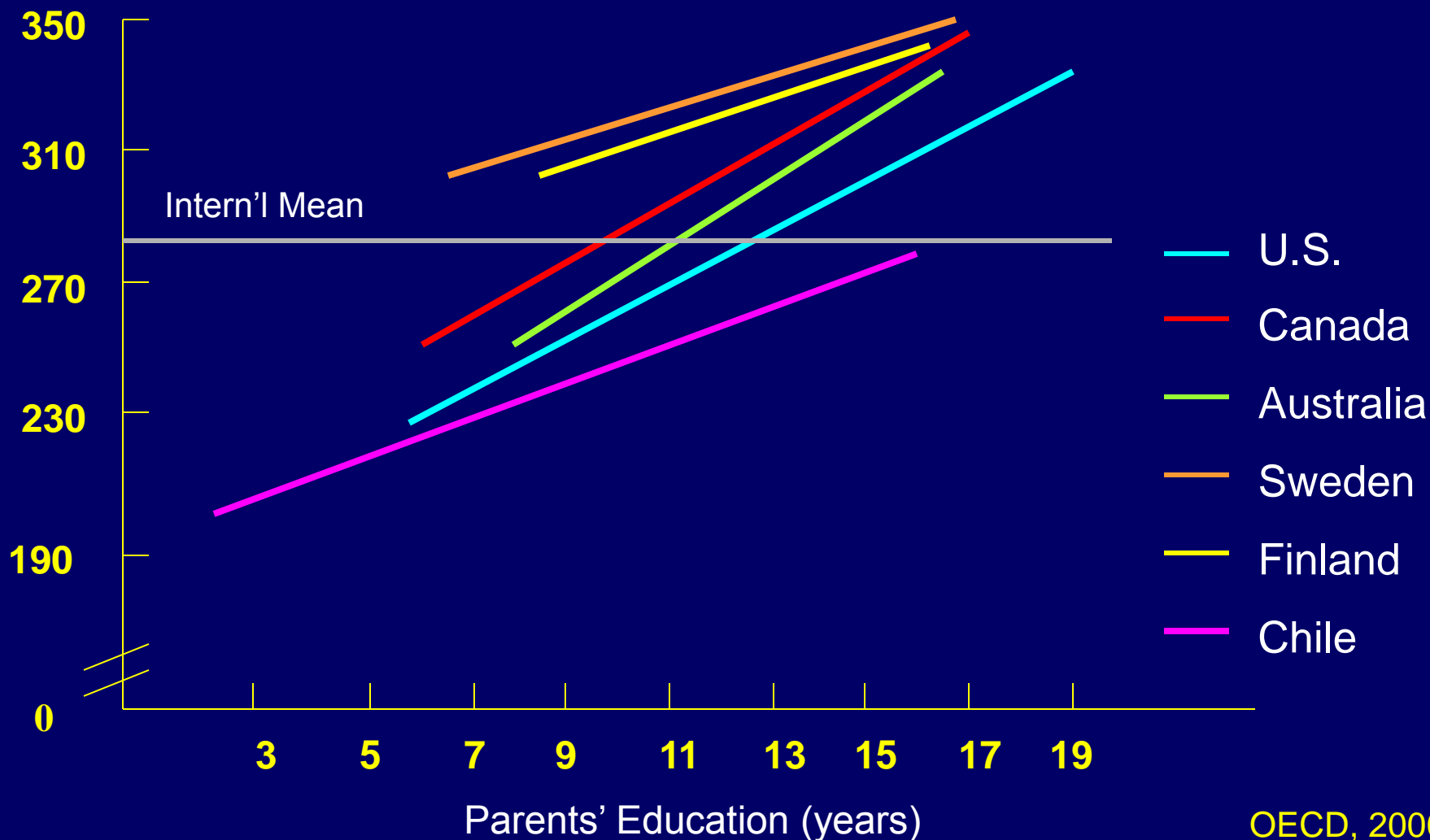
- Population Health
- ↓
- Human Development
- ↓
- Experience-based Brain and Biological Development

U.K. CIVIL SERVICE Mortality - All Causes

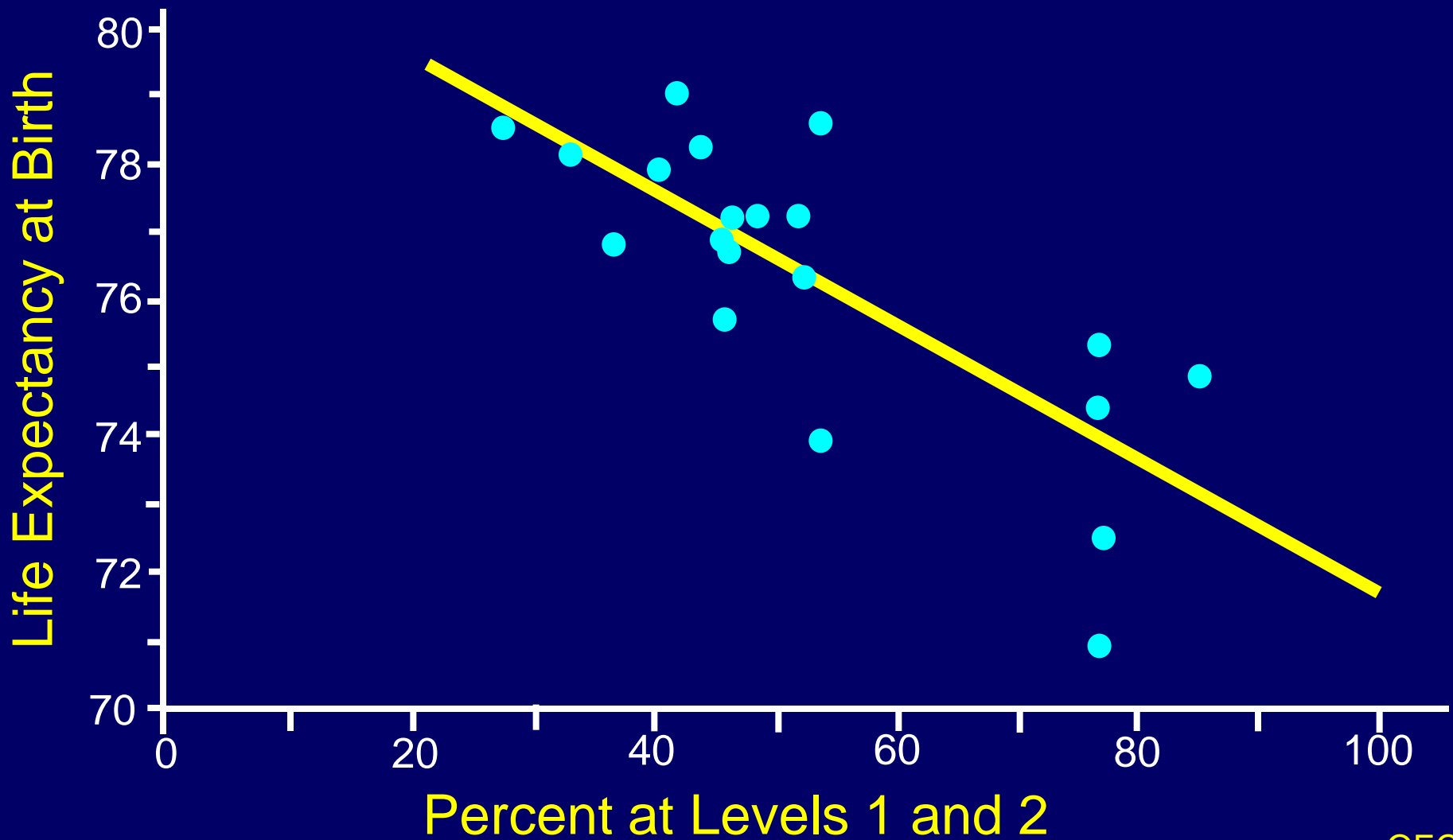


Socioeconomic Gradients for Adult Document Literacy Scores (16 to 65)

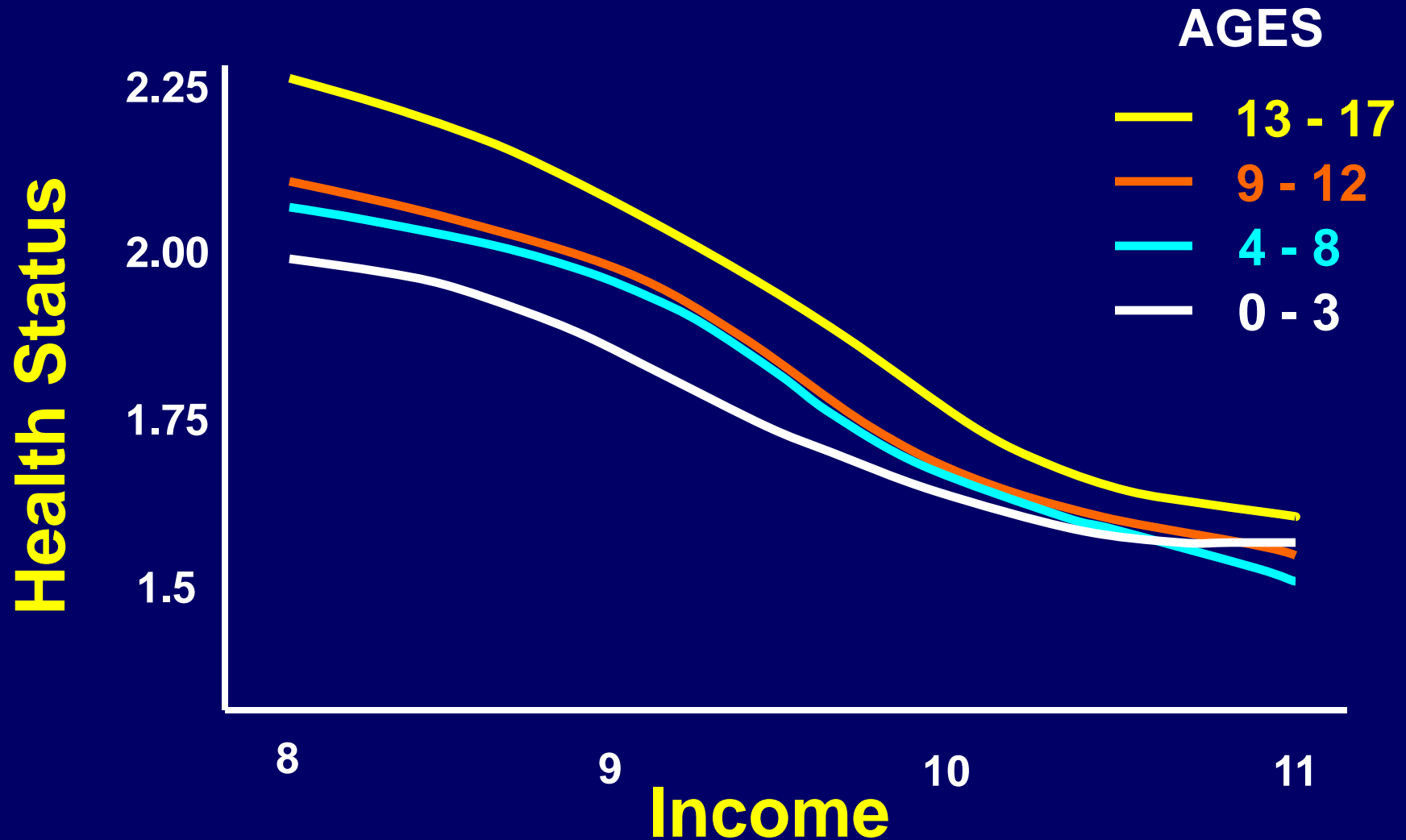
Mean Scores



Life Expectancy & Literacy



Health Gradients



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

- Health
- Learning (literacy)
- Behaviour

Why do we care about brains?

You are your brain.

BUT

Your brain is not just produced by your genes.

Your brain is sculpted by a lifetime of experiences. The most important time in brain development is the first few years of life.

What is experience?

Everything that you encounter both pre- and postnatally as well as in adulthood...

Examples: sounds, touch, vision, smell, food, thoughts, drugs, injury, disease...

Does Experience have the Same Effects on Brain Development at Different Times in Life?

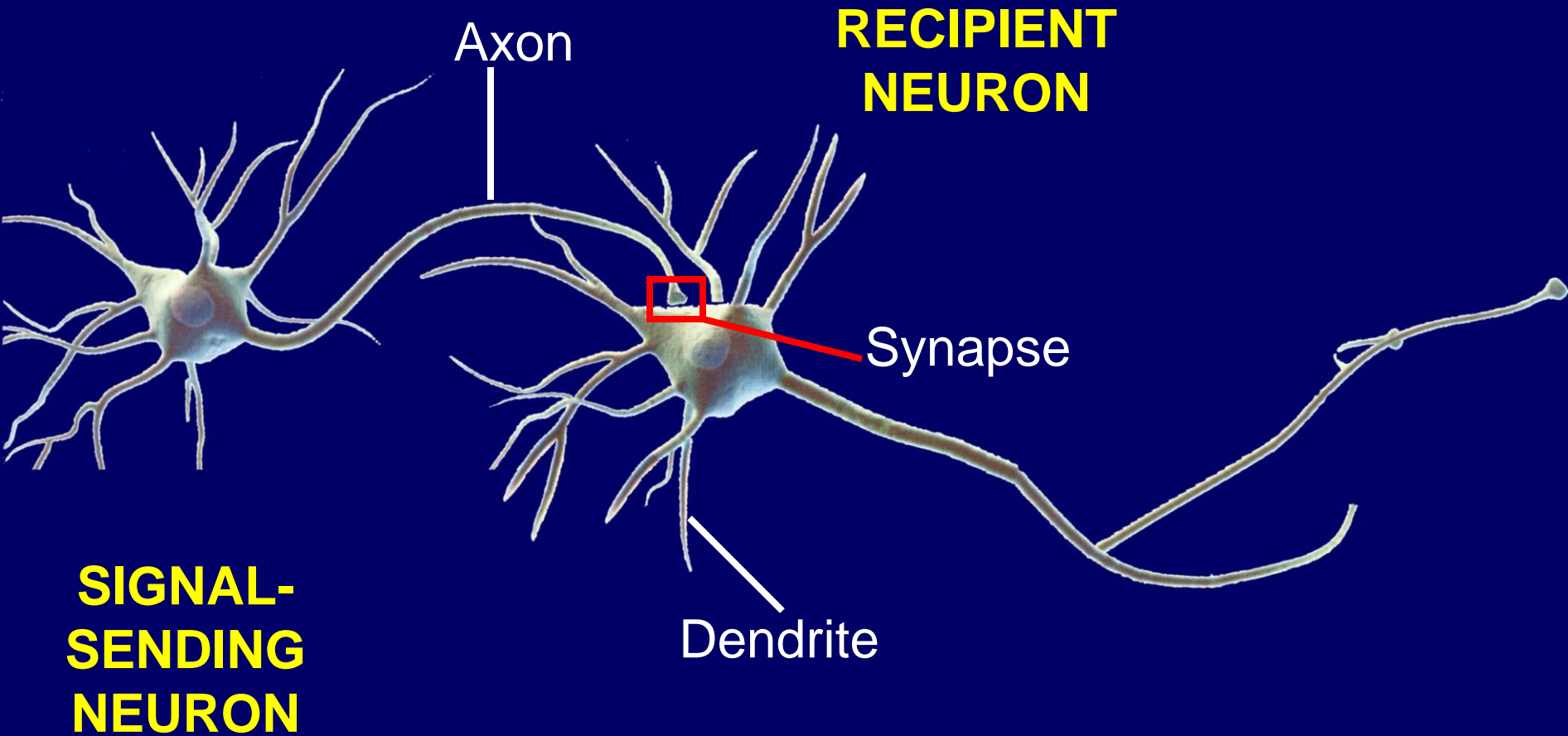
No !

There are qualitative differences at different stages of life.

There is something fundamentally different prenatally vs infancy vs juvenile vs adult.

One difference is gene expression.

Two Neurons



Vision and Hearing Critical Period

Eye cataracts at birth prevent normal development of vision neurons in the occipital cortex

(Hubel and Wiesel)

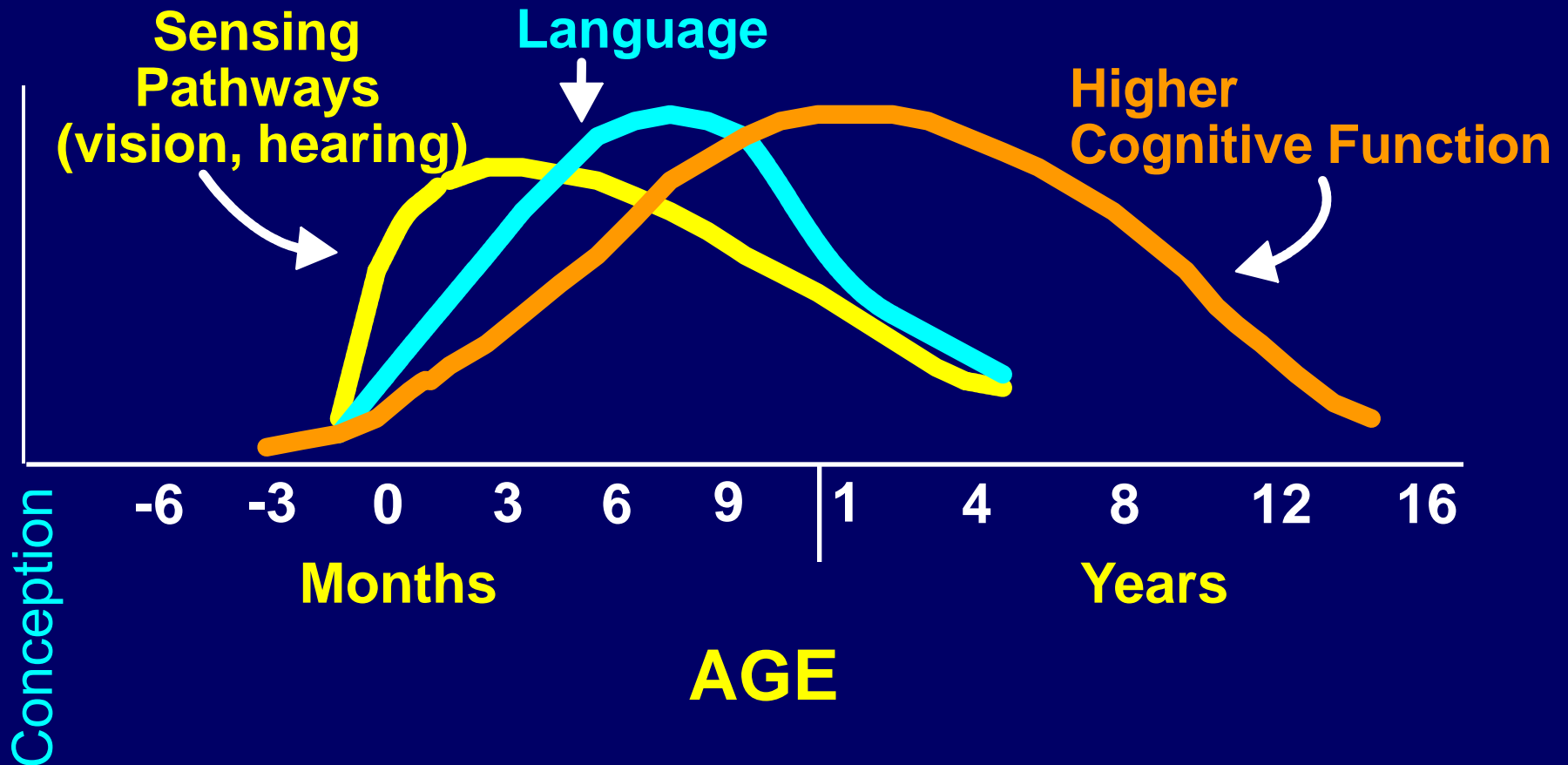
Cochlear defects at birth impair hearing development

(Rauschecker and O'Donoghue)

Brain Pathways

- “Higher levels of brain circuits depend on precise, reliable information from lower levels in order to accomplish their function.
- Sensitive periods for development of lower level circuits ends early in life.
- High level circuits remain plastic for a longer period.”

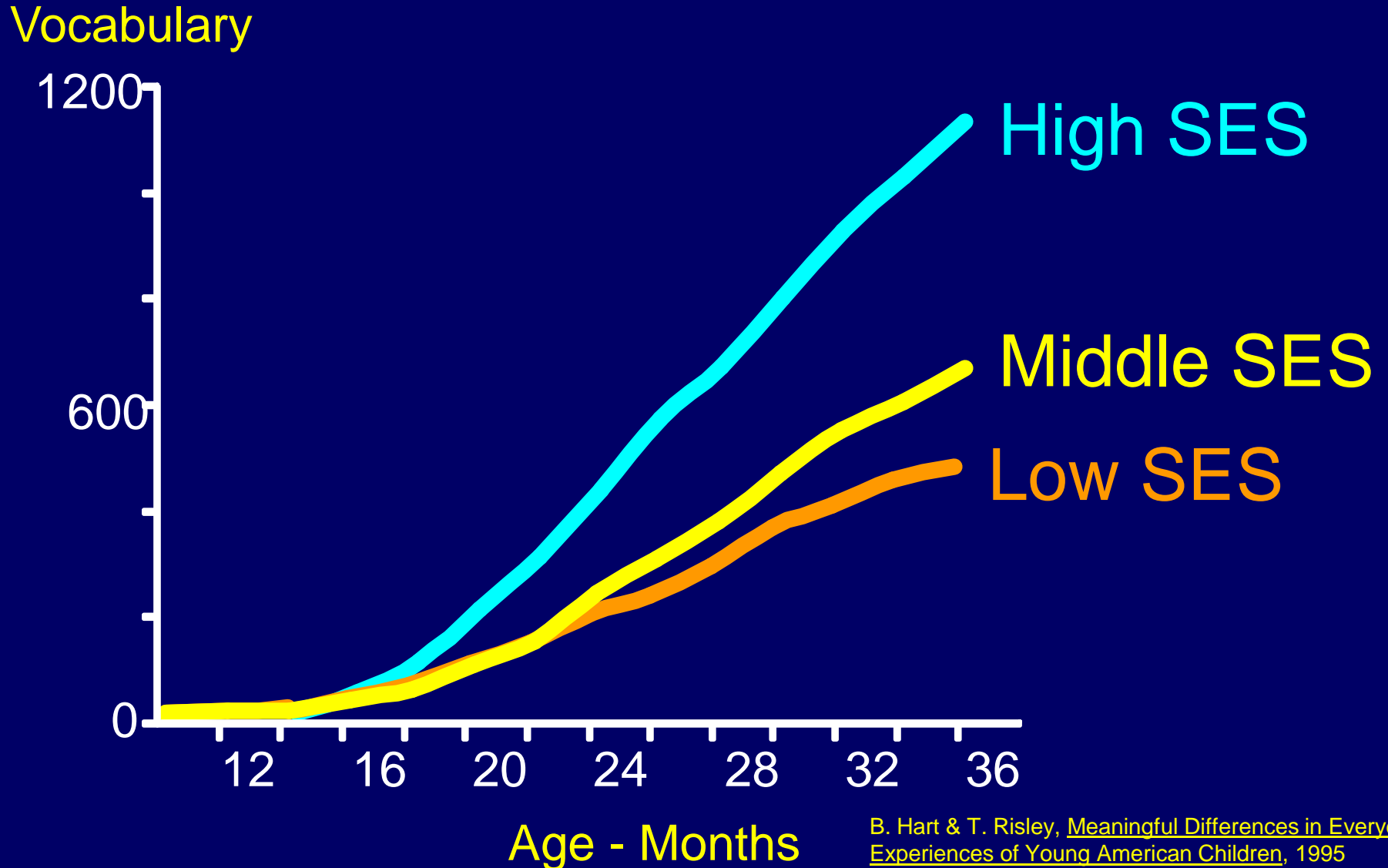
Human Brain Development – Language and Cognition



Early Child Development and Language

- Starts early – first 7 months
- Sets capability for mastering multiple languages
- Sets literacy and language trajectories

Vocabulary Growth – First 3 Years



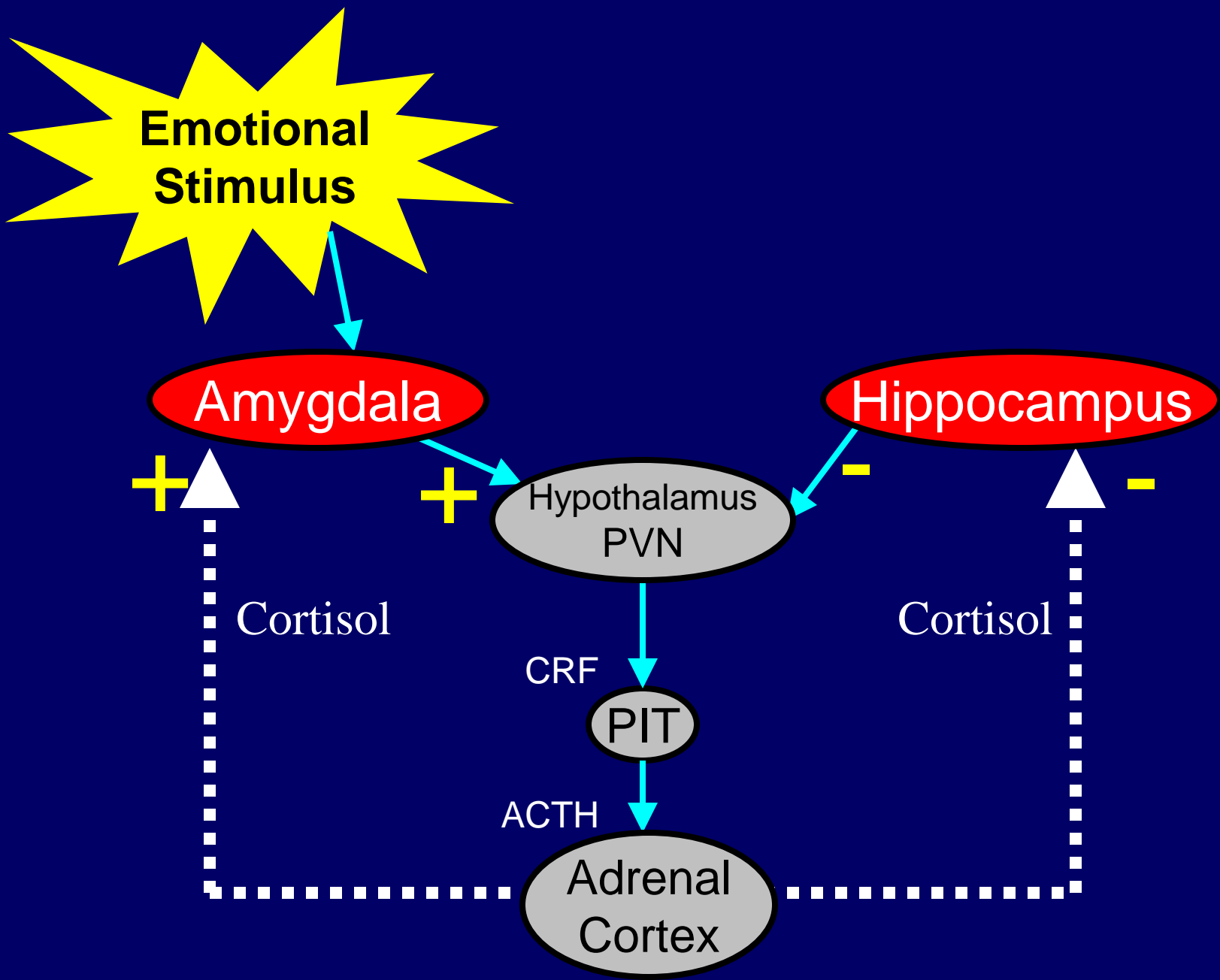
Test of Language Development (TOLD) at Age 9

Correlation between vocabulary growth at Age 3 and TOLD at Age 9.

0.74

Health, Behaviour and Limbic HPA Pathway

Allostasis & Allostatic Load (Stress)



Limbic HPA Pathway - Stress

Cortisol – Over Production

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

Cortisol – Under Production

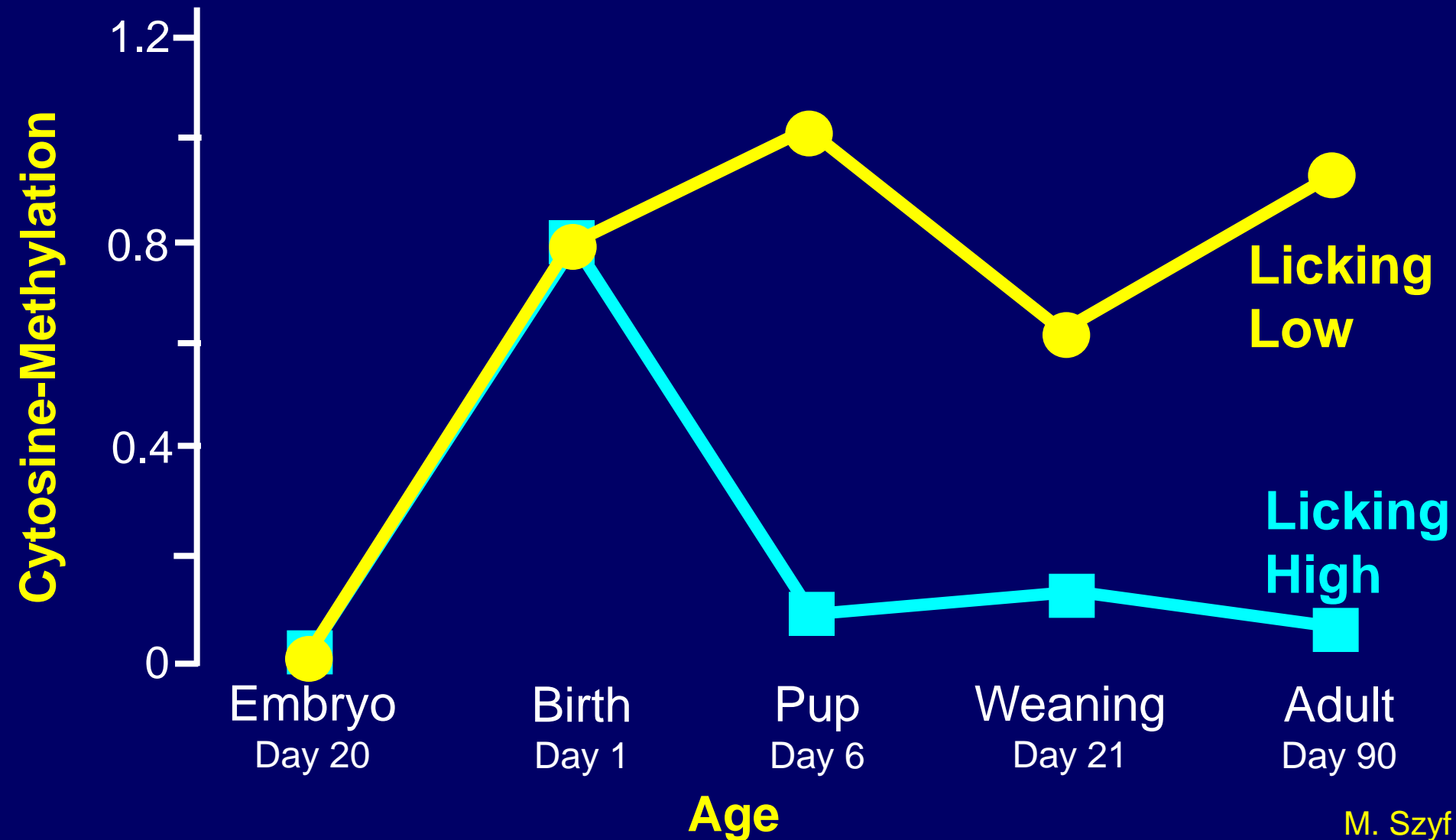
Chronic fatigue syndrome, fibromyalgia, immune system (autoimmune disorders) rheumatoid arthritis, allergies, asthma

Epigenetics – Regulation of Normal Gene Function

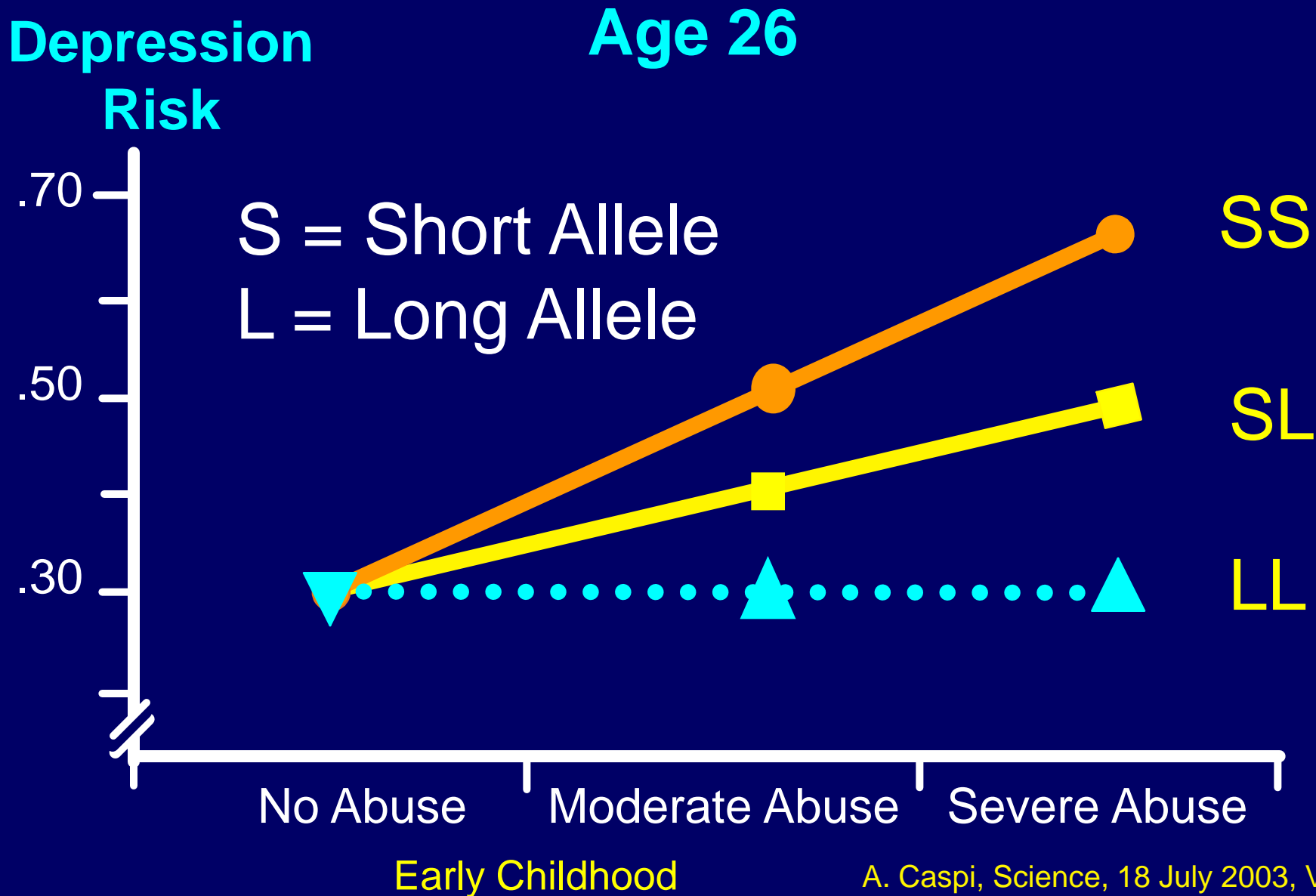
Nature and Nurture

- Epigenetics
- MicroRNAs

Rats – Gene Methylation



Serotonin Transporter Gene Experience in Early Life - Depression



Early Experience and Brain Architecture and Function

- Affects gene expression and neural pathways
- Shapes emotion, regulates temperament and social development
- Shapes perceptual and cognitive ability
- Shapes physical and mental health and behaviour in adult life
- Shapes physical activity (e.g. skiing, swimming, etc.)
- Shapes language and literacy capability

EARLY BRAIN and HUMAN DEVELOPMENT

Outcome Measures

a) Neurobiology

- Cortisol – Epigenetics – Imaging

b) Brain functions – Population-based

Pregnancy

Age 0 - 18 months

Age 0 – 5/6 years - EDI

EDI is a crude macro
measure of early brain
development

Early Development Instrument (EDI)

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

Physical Health, Physical Activity and Well-being

This is a measure of brain development in connection with how it affects physical health, physical activity, coordination and well-being.

Social Competence

Social competence includes ability to get along with others, respect for adults, self confidence, ability to control own behaviour, follow routines and capable of pro-social behaviour.

Emotional Maturity

Emotional maturity includes the ability to reflect before acting, the ability to concentrate, and is often helpful to other children.

Language and Cognitive Development

This includes interest in books, reading and writing, rudimentary mathematics, ability to count and recognize numbers and geometric shapes.

Communication and General Knowledge

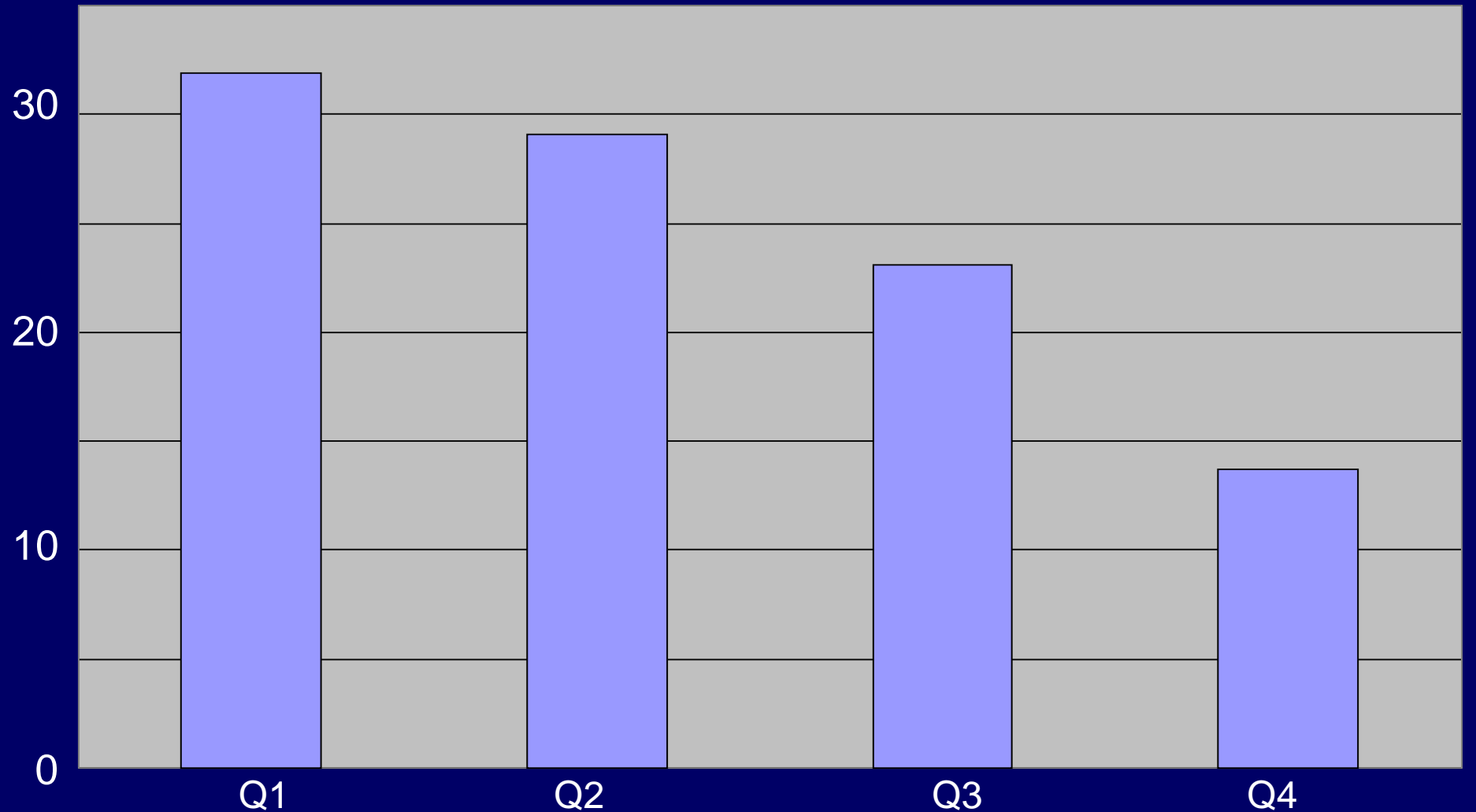
This includes communication skills such as telling a story, and having knowledge about the world around them, and being able to communicate with children and adults.

EDI Vulnerable Children

- Score in the bottom 10% of any of the five assessments.

Canada – EDI Children 5-6 yrs

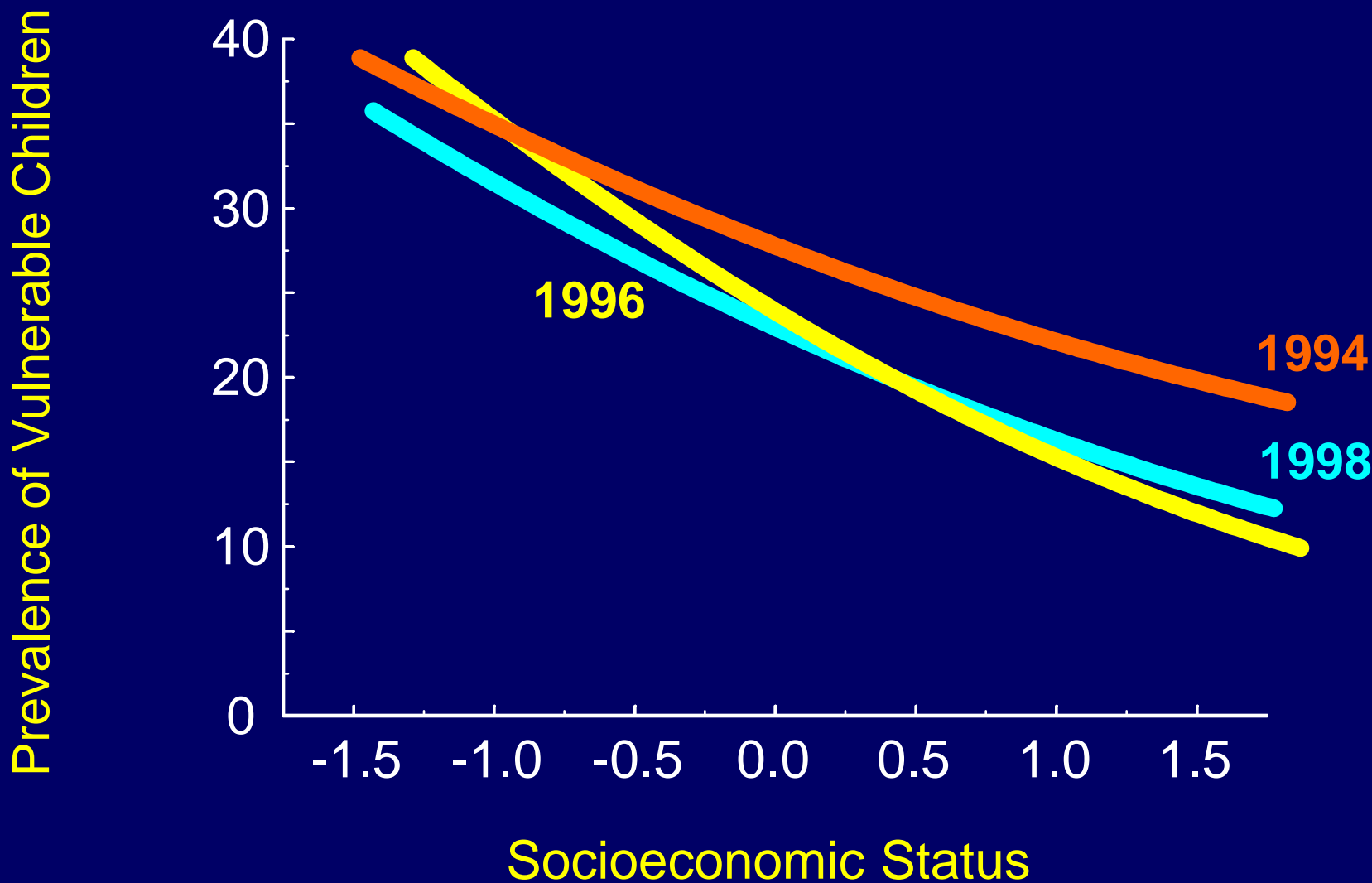
% Vulnerable



SES - Income

Adapted from NLSCY/UEY 1999-2000;
EDI 1999-2000

Vulnerable Children Aged 4 to 6 – Ontario - NLSCY 1994-1998

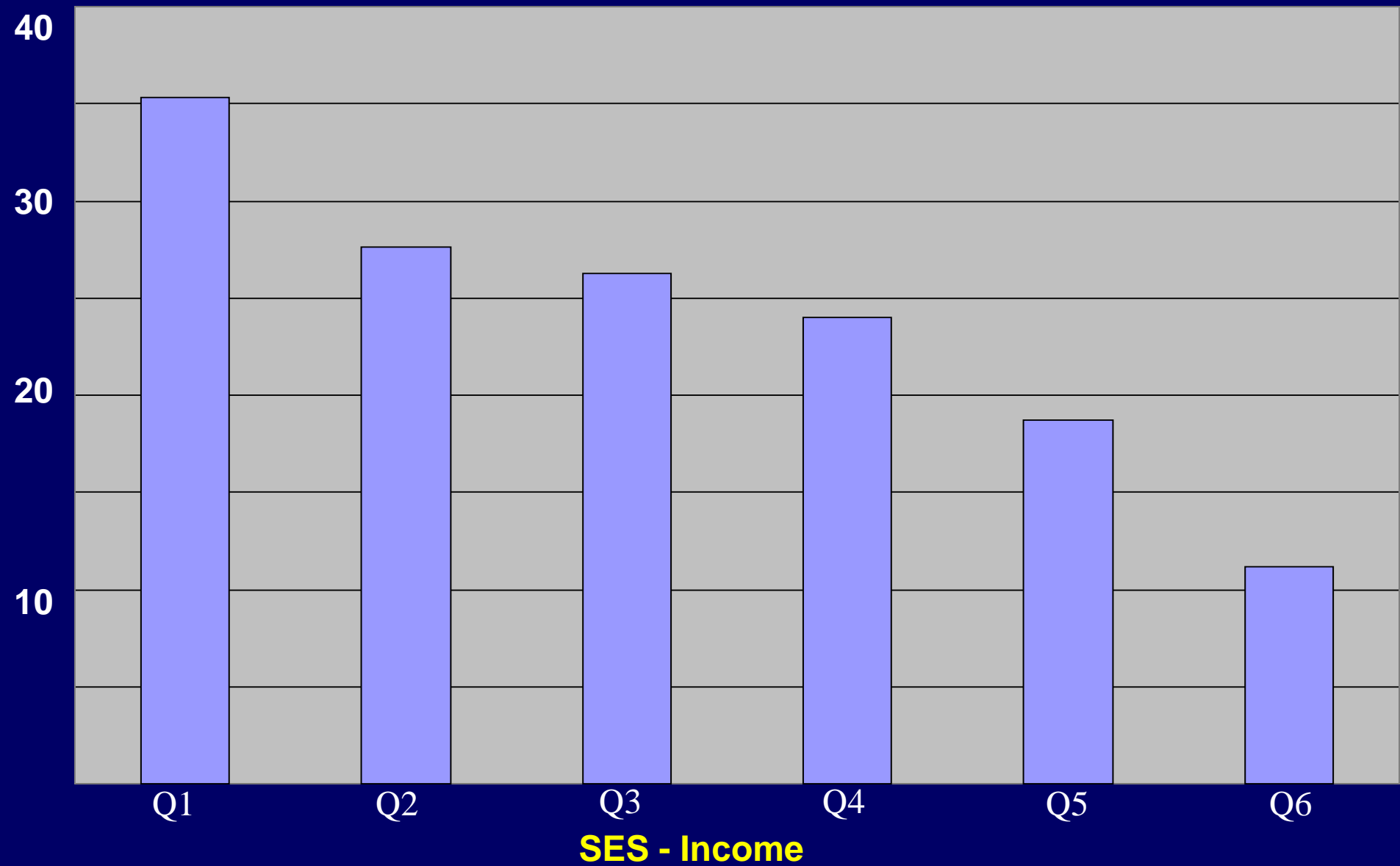


British Columbia by District

District	% vulnerable on one test	Families' Income
Kootenay	13.3	58,000
W. Vancouver	14.1	90,000
Kootenay Lake	18.1	45,000
Boundary	18.6	43,000
Richmond	26.7	58,000
Vancouver	37.9	51,000
Prince Rupert	39.6	55,000

Australia – AEDI Children 5-6 yrs.

% Vulnerable



Proportion of Vulnerable Children Age 5, Perth - AEDI

Suburb	SES	Vulnerability	
		1 test	2 tests
Canningvale	5	17.6	7.8
Thornlie	4	17.8	10.9
Huntingdale	4	20.0	8.4
Gosnells	3	27.6	10.0
Langford	2	39.3	19.6
Maddington	1	46.9	29.7

Adapted from
Brinkman, 2006

AEDI Results - SA

% Vulnerable on 1 or more Test

Roxby Downs 15.6

Port Augusta 43.1

Ingle Farm 32.5

Salisbury East 16.9

Alberton 10.5

Croydon Park 43.3

Seaton 50.0

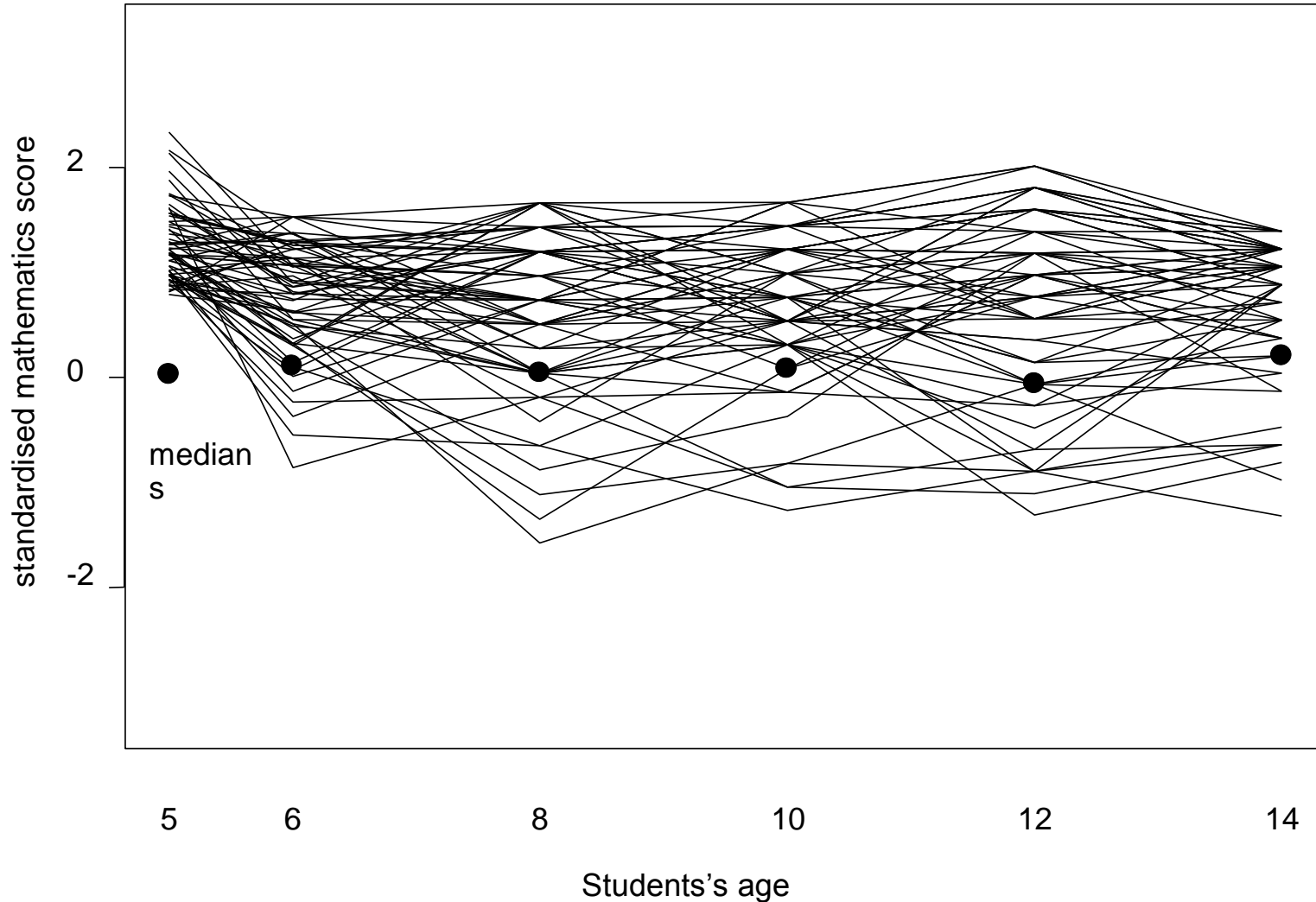
Vancouver EDI Reading

# of EDI Vulnerabilities	% Failing Grade 4	% Not Passing Grade 4
0	13.6	17.8
1	26.7	33.9
2-3	29.5	43.1
4-5	48.4	68.3

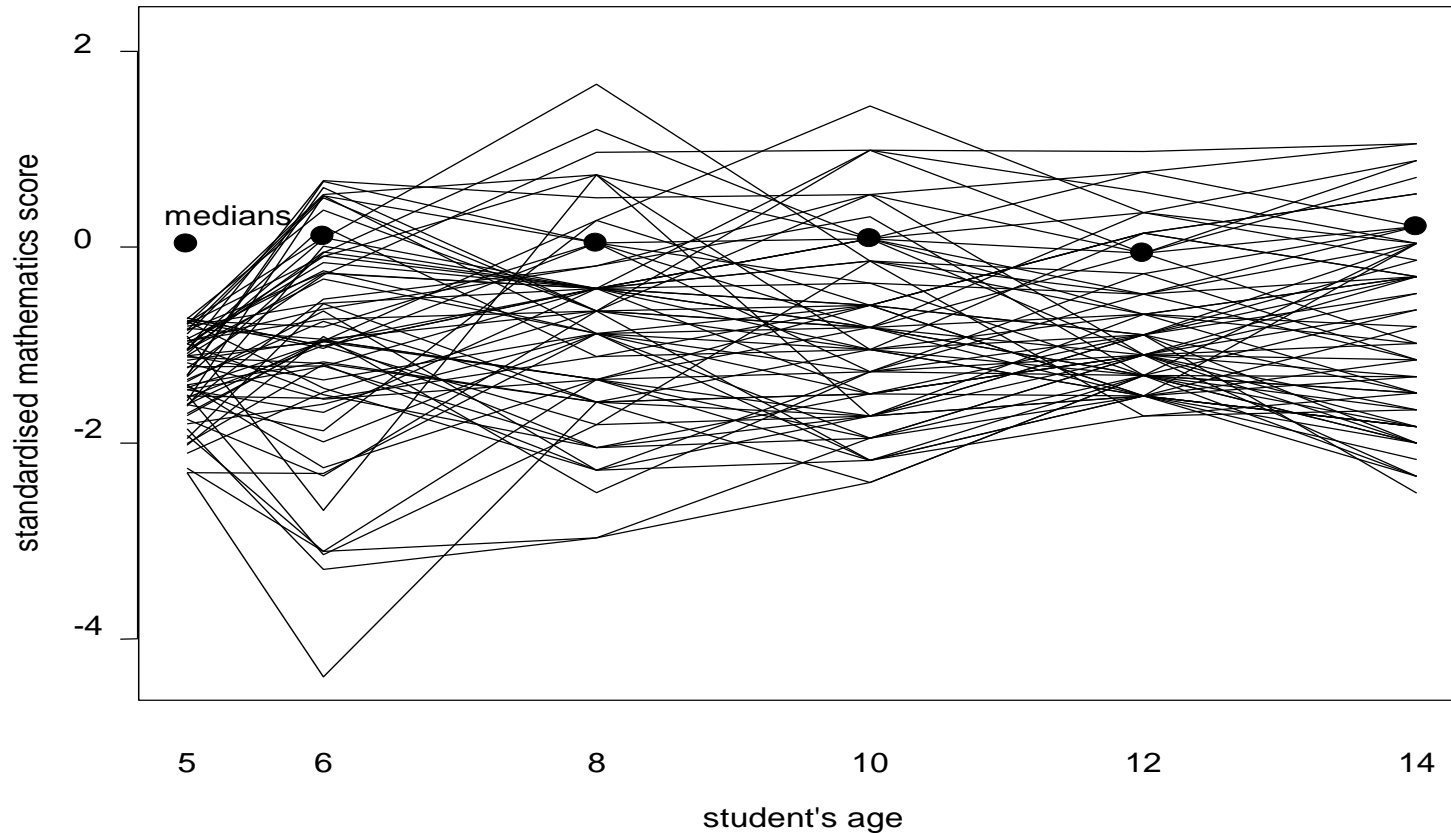
Vancouver EDI Numeracy

# of Vulnerabilities	% Failing Grade 4	% Not Passing Grade 4
0	7.5	12.3
1	11.8	22.2
2-3	18.7	33.8
4-5	27.5	55.6

Math Scores, Ages 5-14 (High SES)



Math Scores, Ages 5-14 (Low SES)



Decrease in the % of vulnerable children in middle class districts as a result of improved ECD in Western Australia

District	Year	
	2003	2006
	Vulnerable on one test	
Floreat	47.22%	14.3%
Wembley	47.11%	11.8%

Success by Ten

Early Child Development

- Intervene early
- Intervene often
- Intervene effectively

A “Natural” Experiment: Romanian Orphans Adopted

Children adopted after 8 months of age show at 11 years in contrast to children adopted early:

1. Abnormal brain development (small brain, low metabolic activity, abnormal EEG)
2. Social and cognitive problems (IQ loss)
3. High vulnerability to behavioural problems (ADHD, aggression)

Romania – BEIP Project

The cognitive outcome of children who remained in the orphanages was markedly below that of non orphanage children and children taken out of the orphanage and placed in foster care.

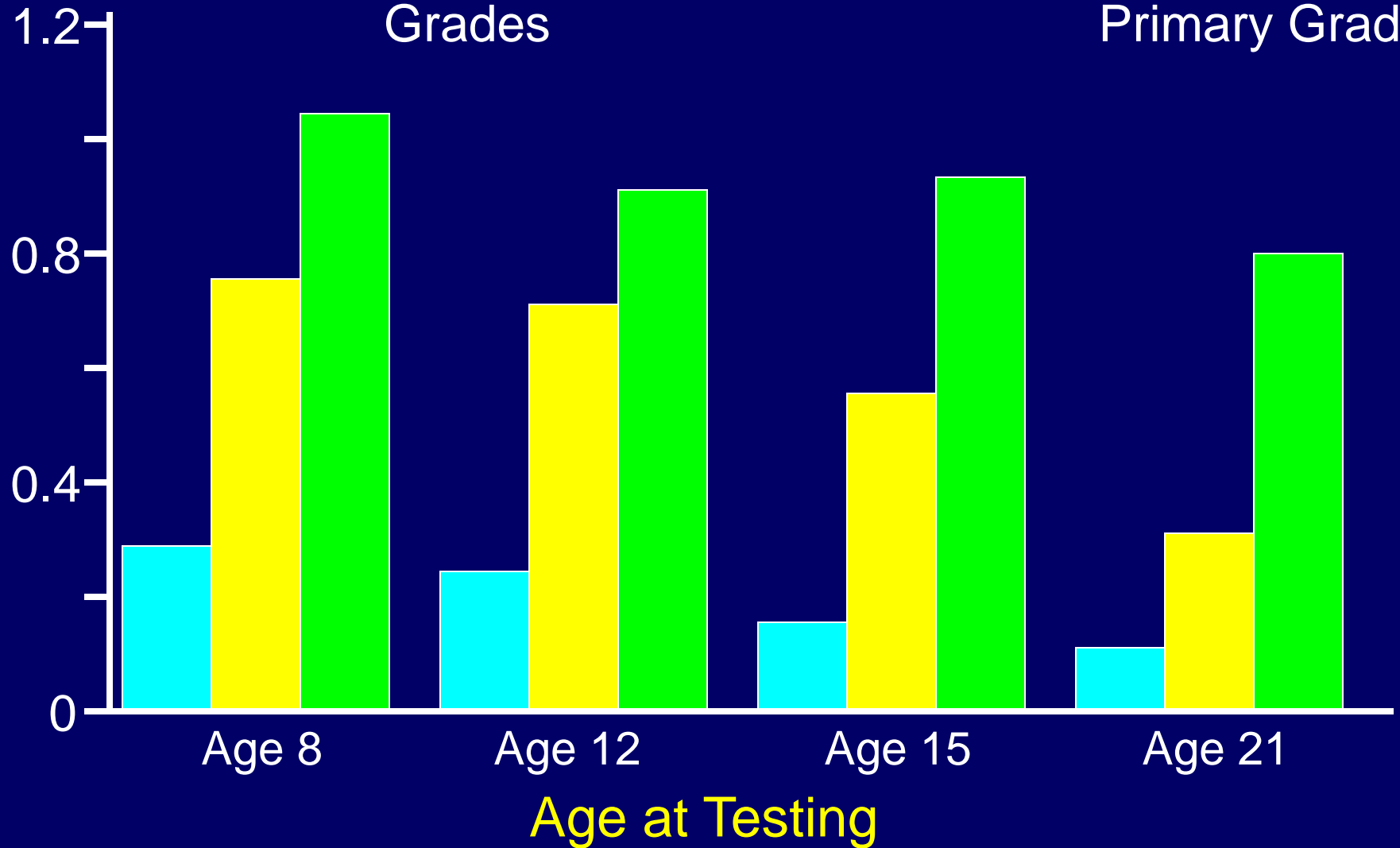
Abecedarian Study – Reading

Effect Size

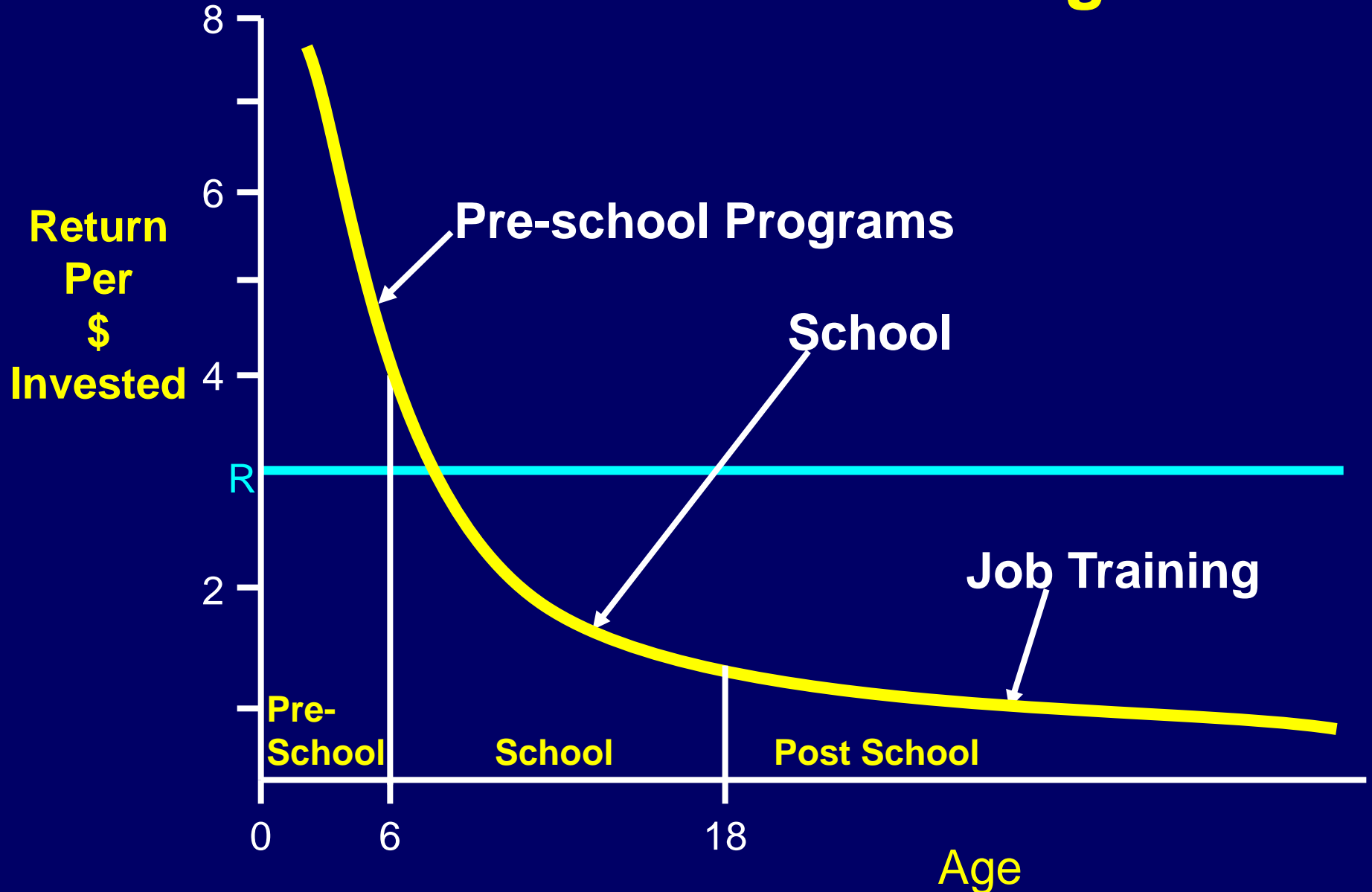
Primary
Grades

Preschool

Preschool &
Primary Grades



Rates of Return to Human Development Investment Across all Ages



WHO – Marmot Commission on Social Determinants of Health

Chapter 5 – Equity from the Start

Recommendation 5.2:

Governments build universal coverage of a comprehensive package of quality early child development programmes and services for children, mothers, and other caregivers, regardless of ability to pay.

The principle of free education for school-age children is already entrenched throughout the rich world; there would be nothing incongruous about extending it further down the age range.

The Economist, pg 16, July 18, 1998

www.founders.net

To download this presentation, go to:
Slides - Slide Shows

References

Mustard, J.F. Early child development and experience-based brain development: the scientific underpinnings of the importance of early child development. Washington: The Brookings Institution. 2006. Available at:

wwwFOUNDERS.net

McCain, M.N., J.F. Mustard and S. Shanker. Early Years Study 2: Putting Science into Action. Toronto: Council for Early Child Development. 2007. www.councilecd.ca

Mustard, J.F. Investing in the Early Years: Closing the gap between what we know and what we do. Adelaide: State of South Australia. 2008. www.thinkers.sa.gov.au

Mustard, J.F. Literacy: Passport to Prosperity. Council of Ministers of Education, Canada. Pan-Canadian Interactive Literacy Forum. 2008. <http://literacy.cmec.ca/>