# Cognitive and educational problems in extremely preterm or tiny survivors

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# Cognitive and Educational Problems

- survivors <32 weeks
  - DQ/IQ
  - language
  - memory
  - attention
  - executive function
- Educational
  - Academic achievement
- Behavioural

# Cognitive and Educational Problems

- survivors <26 weeks?
  - DQ/IQ
  - language
  - memory
  - attention
  - executive function
- Educational
  - Academic achievement
- Behavioural

# Cognitive and Educational Problems

- Preschool age
  - cognitive
  - neurosensory
- School-age
  - cognitive
  - educational
  - behavioural

# Preschool development

- Victoria, Australia


INDONESIA
PAPUA NEW GUINEA
TIMOR SEA
ARAFURA SEA
Torres Strait
C. York
Melville I.
Bathurst I.
Darwin
C. Arnhem
Arnhem Land
Gulf of Carpentaria
Joseph Bonaparte Gulf
Daly
Roper
Croote Eylandt
Wellesley Is.
INDIAN OCEAN
CORAL SEA
Buccaneer Archipelago
Drysdale
Victoria
Barkly Tableland
Mitchell
Gilbert
Norman
Flinders
Georgina
Diamantina
Thomson
Barcoo
Belyando
Cairns
Townsville
Proserpine
Mackay
Rockhampton
Bundaberg
Fraser I.
Brisbane
Toowoomba
Gold Coast
Grafton
Coffs Harbour
Maitland
Newcastle
Sydney
Wollongong
Canberra
AUSTRALIAN CAPITAL TERRITORY
Wagga Wagga
Mildura
Lachlan
Darling
Culgoa
Barwon
Warrego
Cooper Creek
L. Eyre
L. Torrens
L. Gairdner
L. Everard
Nullarbor plain
Great Victoria Desert
Great Australian Bight
Spencer Gulf
Kangaroo I.
Adelaide
Port Lincoln
Whidbey Pt.
Ceduna
Laverton
Geraldton
Kalgoorlie-Boulder
Perth
Fremantle
Bunbury
Albany
Pt. Culver
C. Naturaliste
C. Leeuwin
Archipelago of the Recherche
Mount Gambier
Ballarat
Melbourne
Geelong
C. Otway
Wilson's Promontory
King I.
Bass Strait
Flinders I.
Cape Barren I.
Burnie
Devonport
Launceston
Queenstown
TASMANIA
Hobart
South East C.
TASMAN SEA
NORTHERN TERRITORY
QUEENSLAND
NEW SOUTH WALES
VICTORIA
SOUTH AUSTRALIA
WESTERN AUSTRALIA
A U S T R A L I A
MACDONNELL RANGES
Alice Springs
MUSGRAVE RANGES
Ayers Rock
Simpson Desert
Finke
Alberga
Great Sandy Desert
Gibson Desert
Eighty Mile Beach
Broome
Kimberley Plateau
Fitzroy
De Grey
Ashburton
Fortescue
Mt. Bruce
Barrow I.
Dampier
L. Macleod
Carnarvon
Murchison
C. Levêque
0 500 1000 Mi
0 500 1000 1500 Km
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# Preschool development

- **Victoria <26 weeks**

| | 1991-92 n=77 | 1997 n=62 | 2005 n=61 |
|---|---|---|---|
| DQ <-2SD | 26% | 31% | 18% |
| No dev. delay | 48% | 47% | 46% |
| CP | 14% | 8% | 10% |
| blind | 1% | 3% | 0% |
| deaf | 1% | 2% | 6% |

# Preschool development

- **Epicure**

**<26 weeks UK and Ireland, 1995**
**At 30 months**
**n=283**
**– mean MDI 84**
**– mean PDI 87**
**Overall 30% moderate/severe delay**
**Only 36% developing normally**
**CP 18%, blind 2%, deaf 2%**

# Preschool development

- **NICHD - USA**

**<25 weeks**
**1993-96; 1996-99**
**18-22 months**

| | 93-96 | 96-99 |
|---|---|---|
| Severe cognitive delay | 40% | 47% |
| No developmental delay | 21% | 21% |
| CP | 23% | 21% |

# Cognitive and Educational Problems

- Preschool age
  - cognitive
  - neurosensory
- School-age
  - cognitive
  - educational
  - behavioural

# IQ and Behaviour

**Bhutta et al** (*JAMA*. 2002;288:728-737.)

- Meta-analysis preterm infants
- assessed > 5 years age
- follow-up rate > 70%
- n=15 cognitive; n=16 behavioural

IQ 2/3 SD below controls

Internalising and externalising problems

ADHD increase

- Born <1990

# VICS Subjects - born 1991-92

- 298 consecutive survivors of either gestational age <28 weeks or birthweight <1000 g born in Victoria 1991 and 1992
  - 275 (92%) assessed at 8 years of age
  - 73 < 26 weeks GA

- 262 normal birthweight (NBW) controls
  - 223 (85%) assessed at 8 years of age

# Cognitive – middle childhood

- IQ
- Academic achievement
- Behaviour

# Cognitive Outcomes

- **Cognitive**

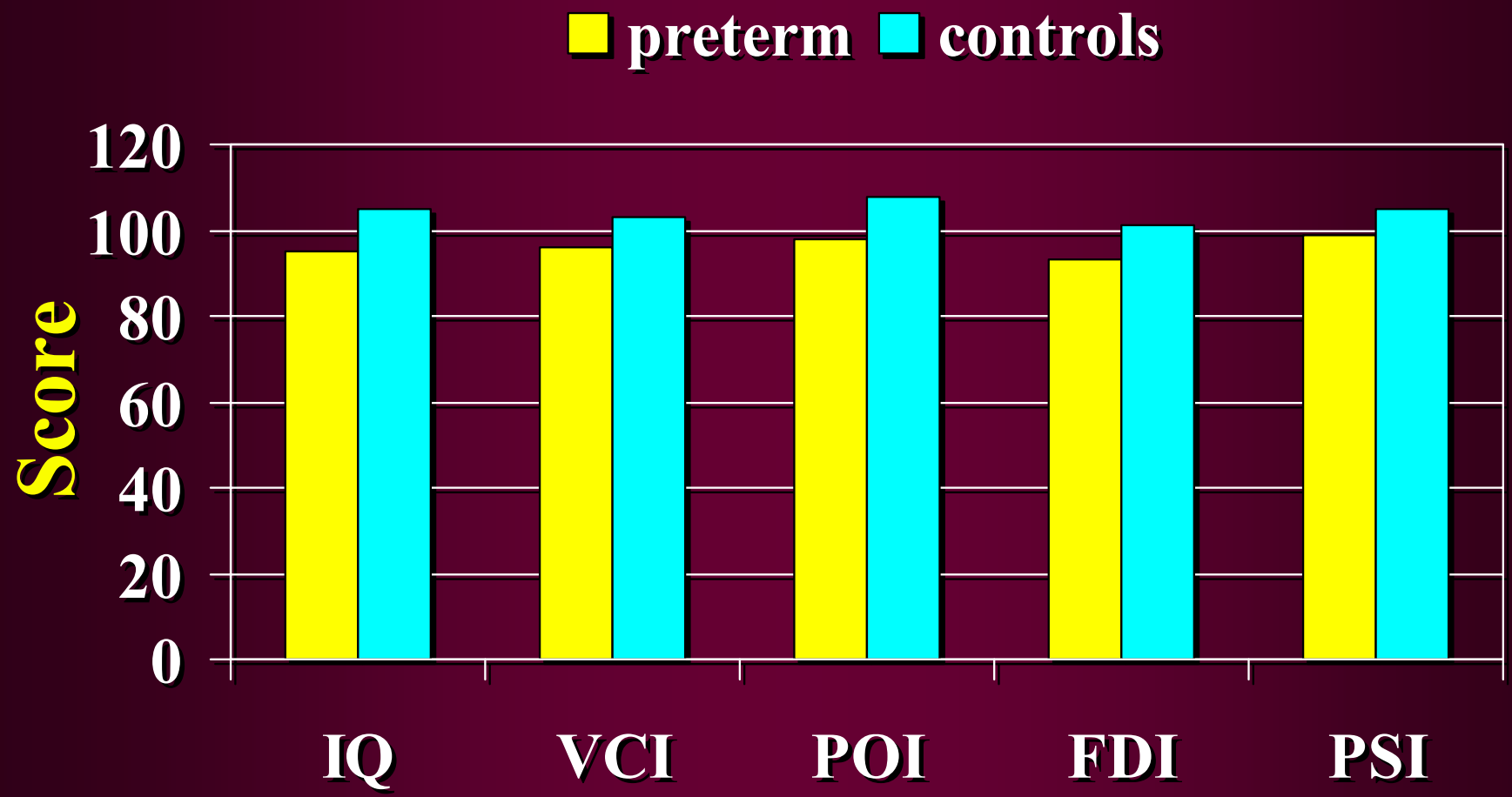
– IQ score (WISC-III) relative to NBW controls
– VCI – verbal reasoning ability
– POI – visual-spatial reasoning
– FDI – attention and working memory
– PSI – information processing

- **Educational**

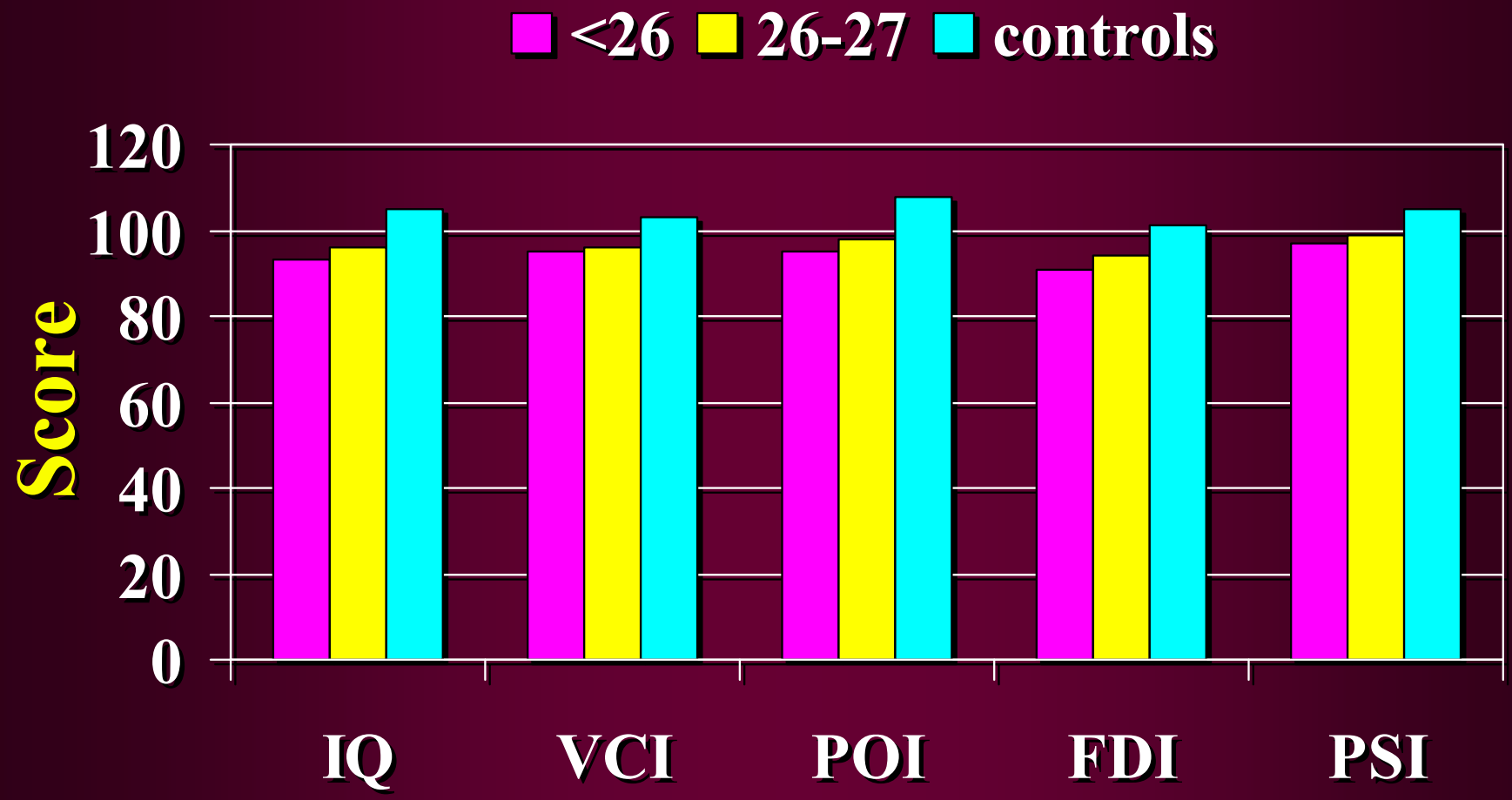
– Wide Range Achievement Tests (WRAT)
Spelling, Reading, Arithmetic

Mean 100 (SD 15)

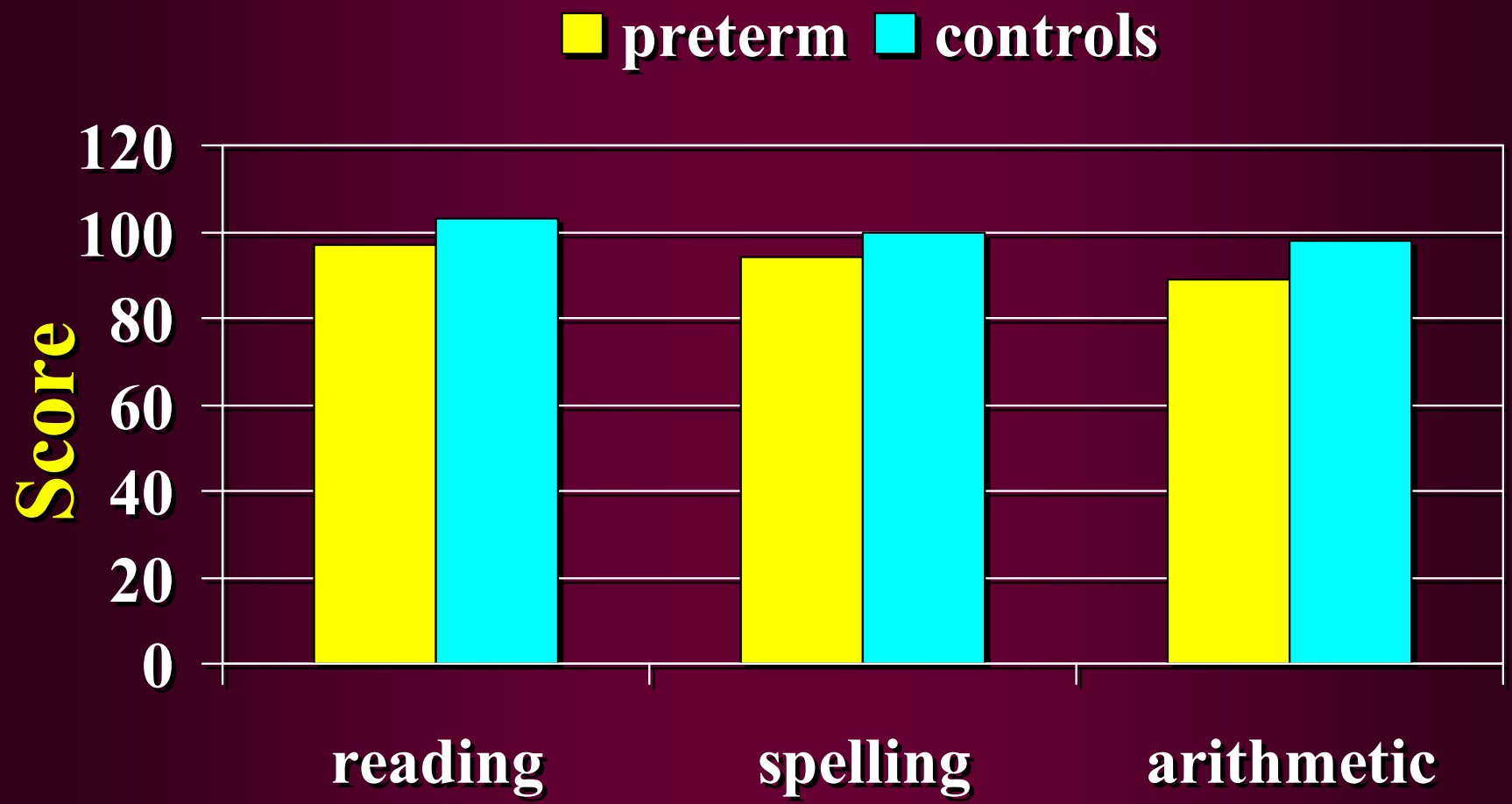
# WISC-III



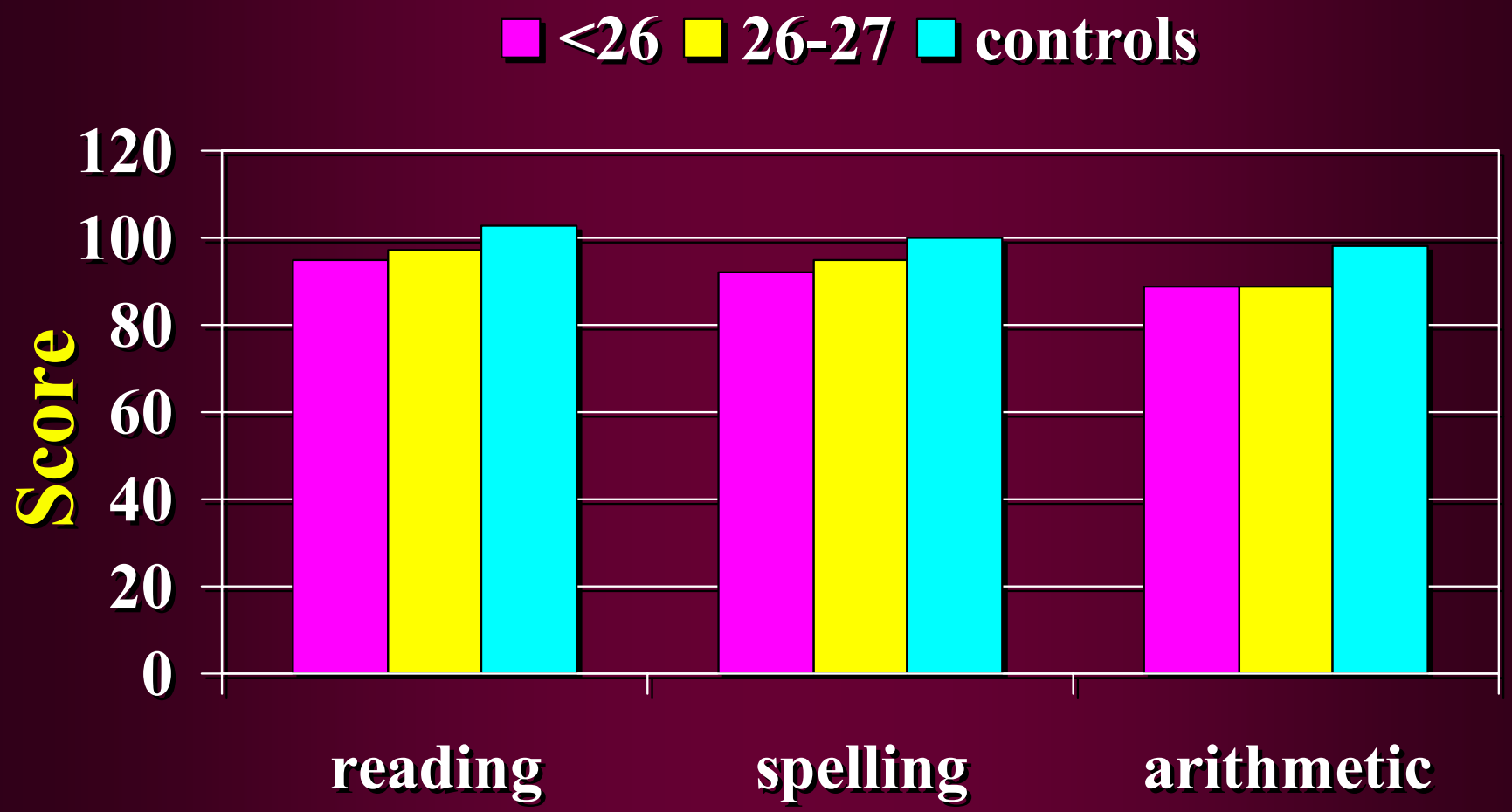
# WISC-III



# Academic achievement



# Academic achievement

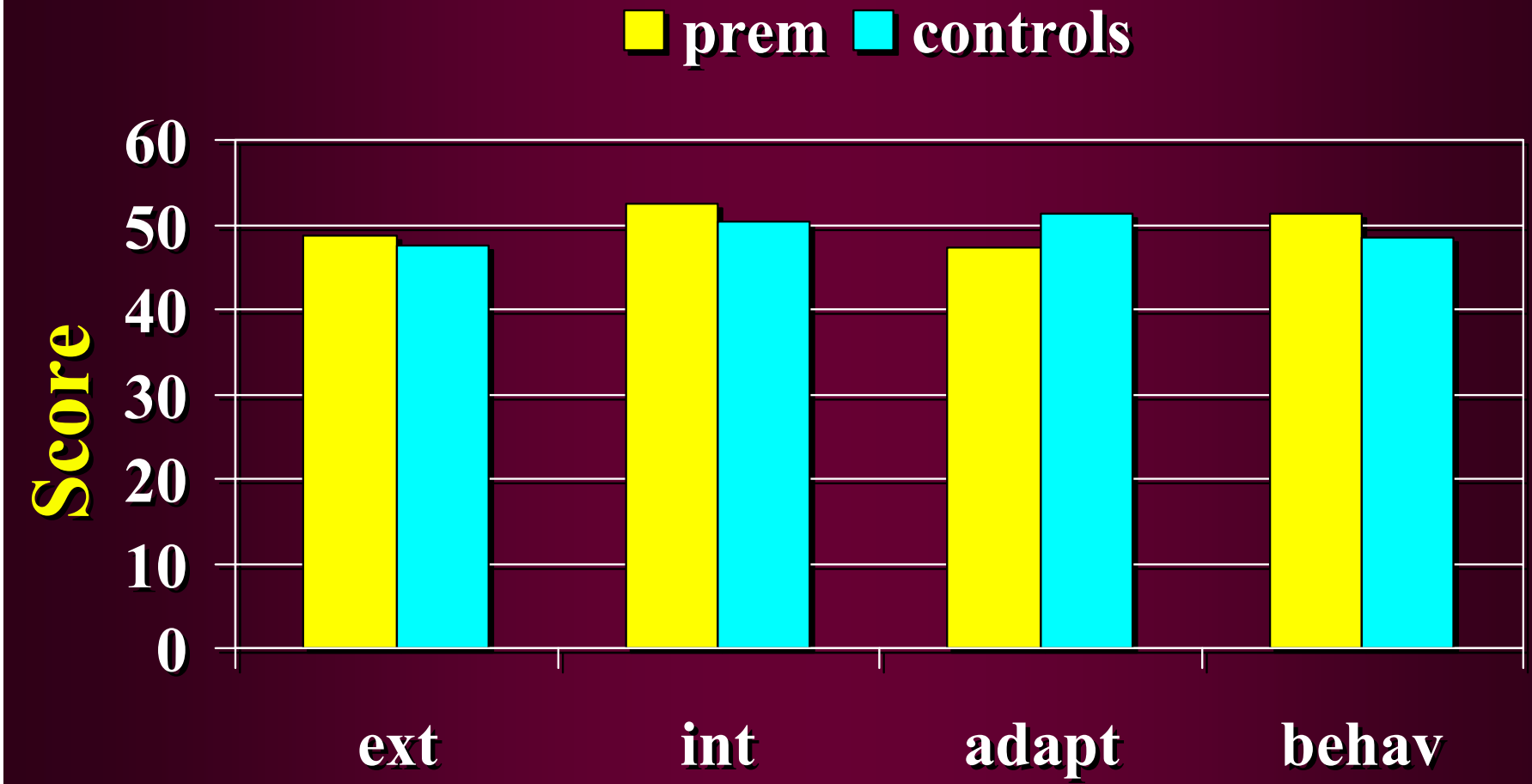


# Cognitive Outcomes

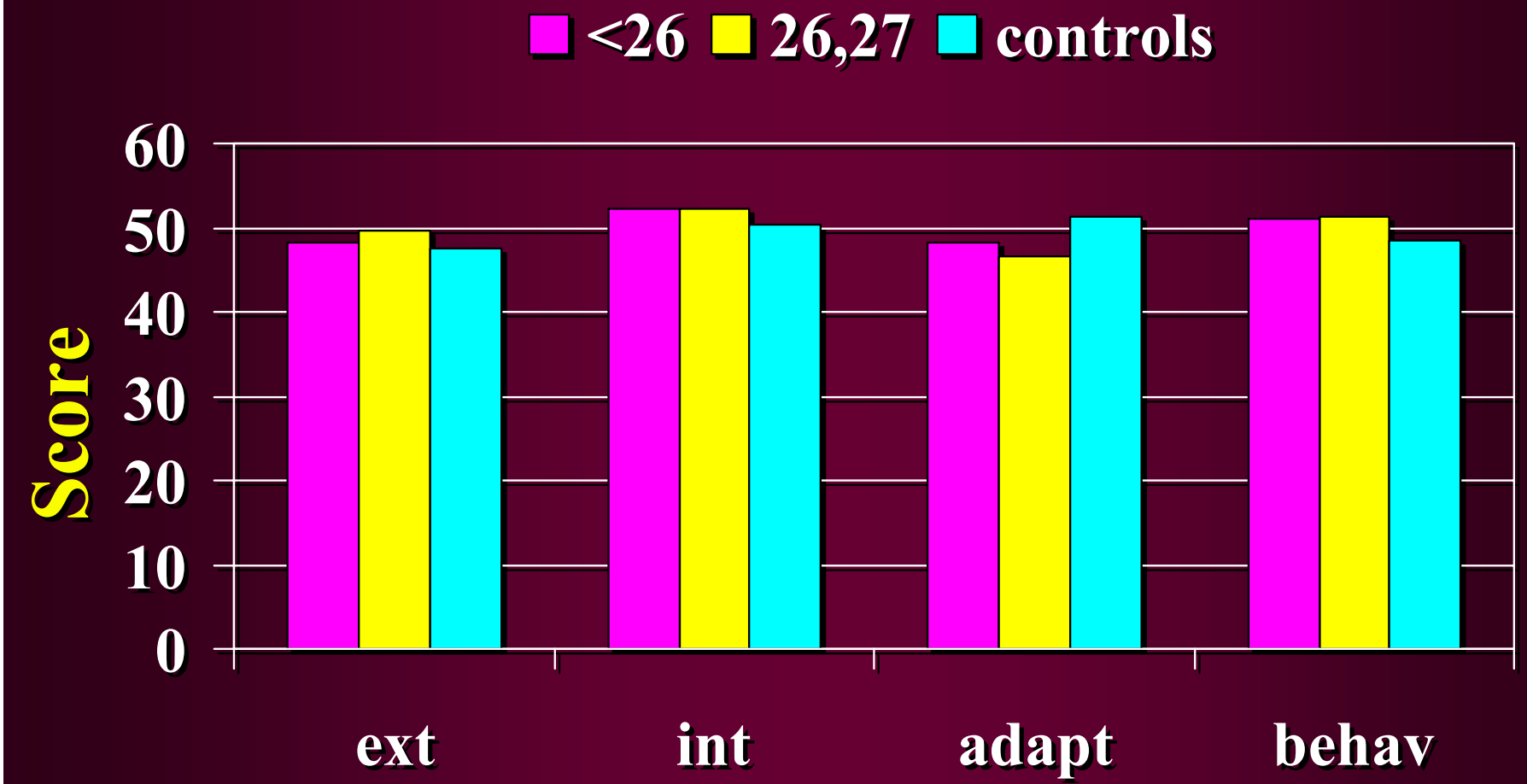
- **Behaviour**

**Behavior Assessment System for Children (BASC)**
**Adaptive and behaviour problems**
**Parents – home and community**
**Teachers - school**
**•Externalising ⬆**
**•Internalising ⬆**
**•Adaptive skills ⬇**
**•Behavioural symptoms ⬆**
**Mean 50 (SD 10)**

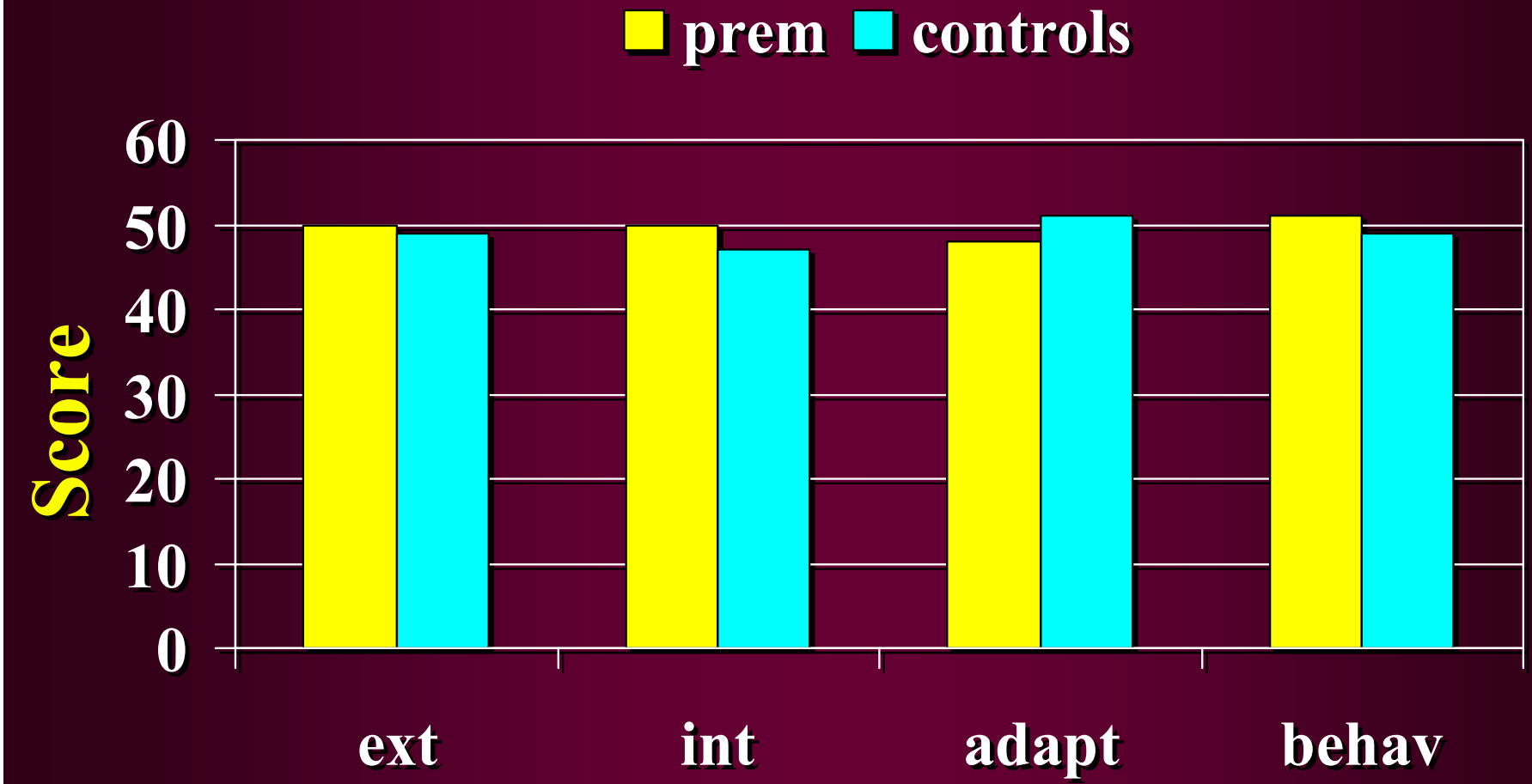
# BASC-teacher



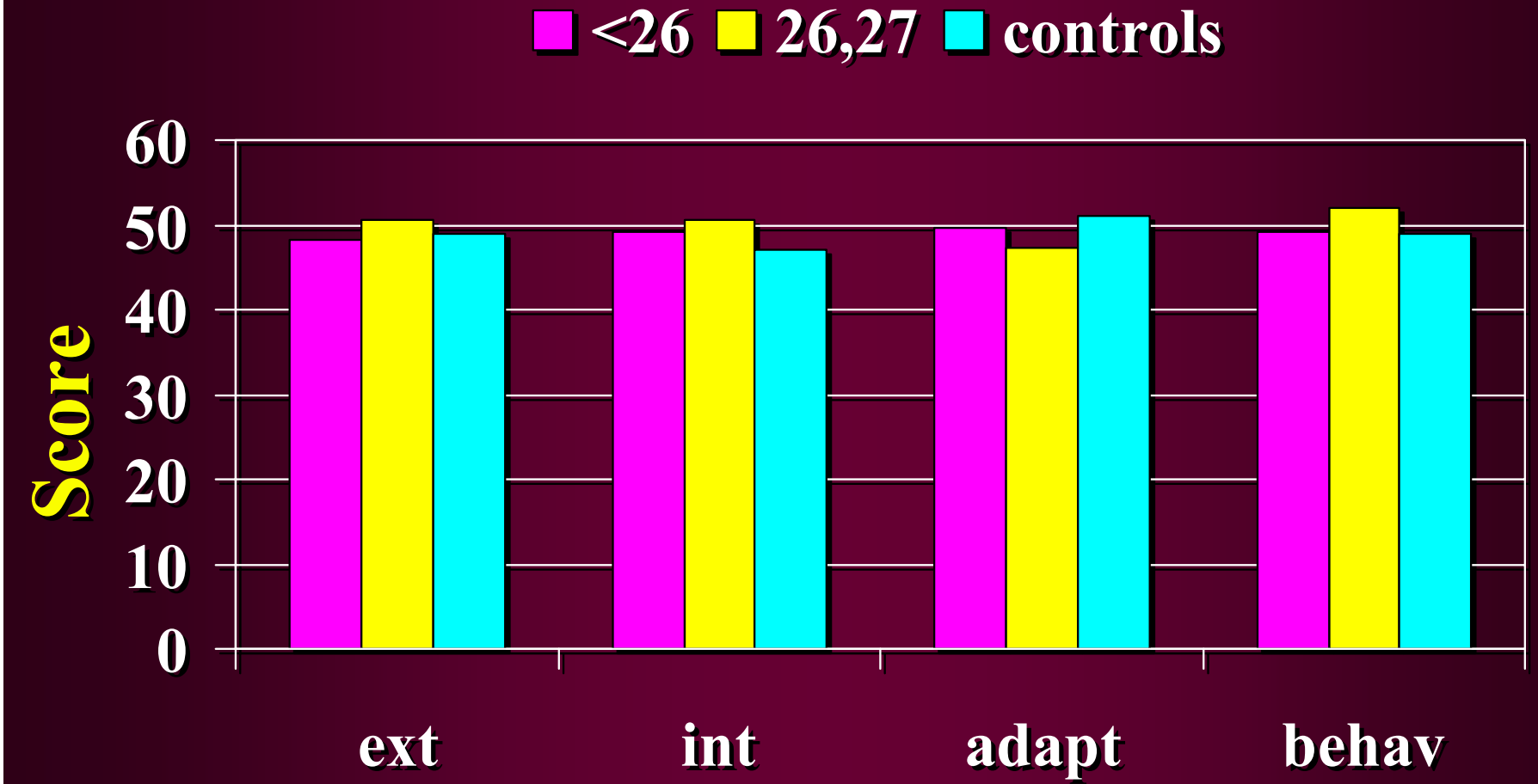
# BASC-teacher



# BASC-parent



# BASC-parent



# Grade repetition

Prems 20%
Controls 7%
*P*<0.001

| | |
|---|---|
| <26 weeks | 22% |
| 26, 27 weeks | 19% |

# Cognitive outcomes

- Consistency over time between cohorts?

# VICS Subjects – born 1997

201 consecutive survivors of either gestational age <28 weeks or birthweight <1000 g born in Victoria 1997

189 (94%) assessed at 8 years of age

199 normal birthweight (NBW) controls

173 (87%) assessed at 8 years of age

# Cognitive Outcomes

assessed at 8 years of age (corrected)

- Cognitive

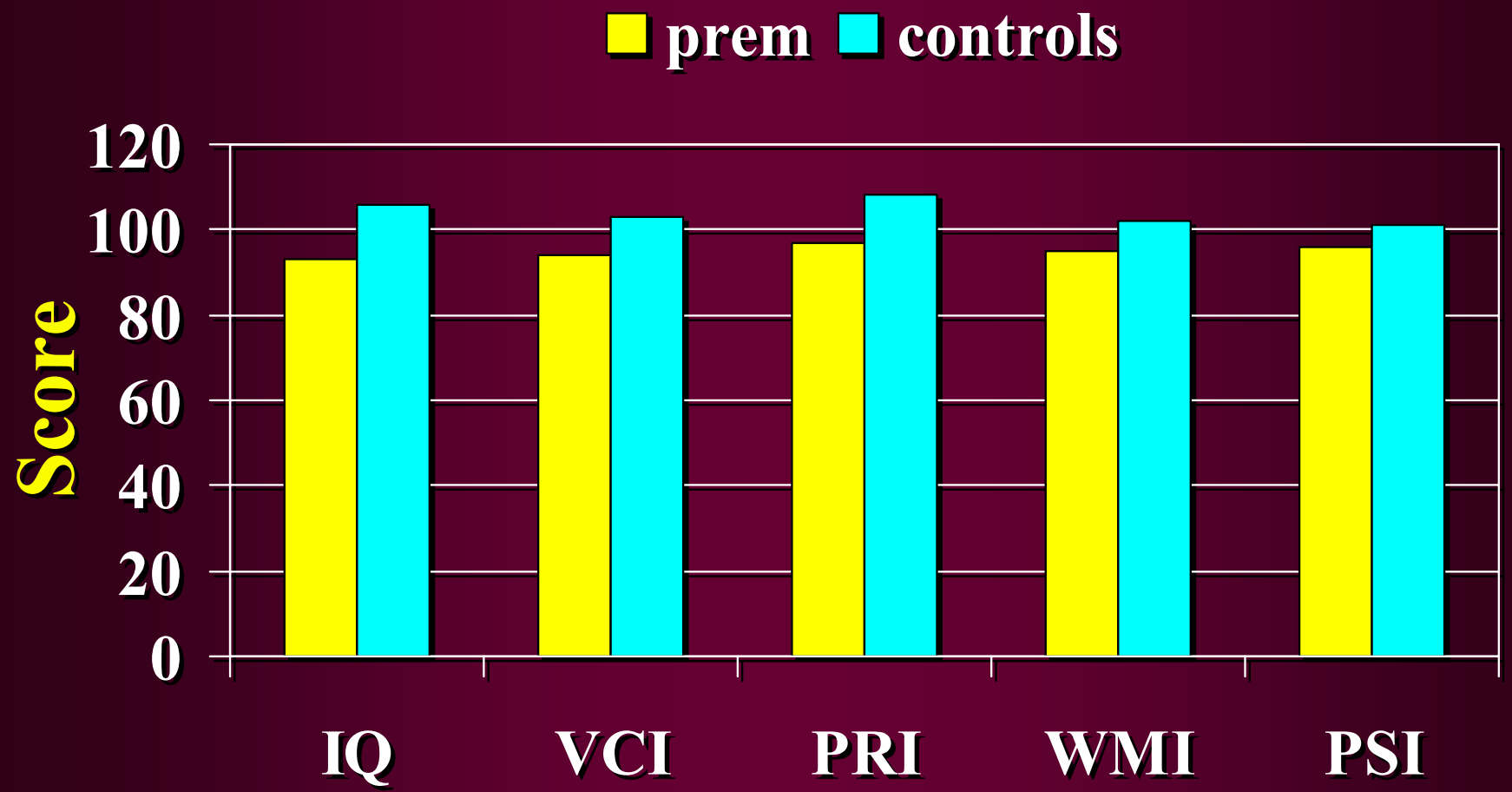
– IQ – WISC-IV
– VCI – verbal reasoning ability
– PRI – perceptual reasoning
– WMI – working memory
– PSI – information processing

- Educational

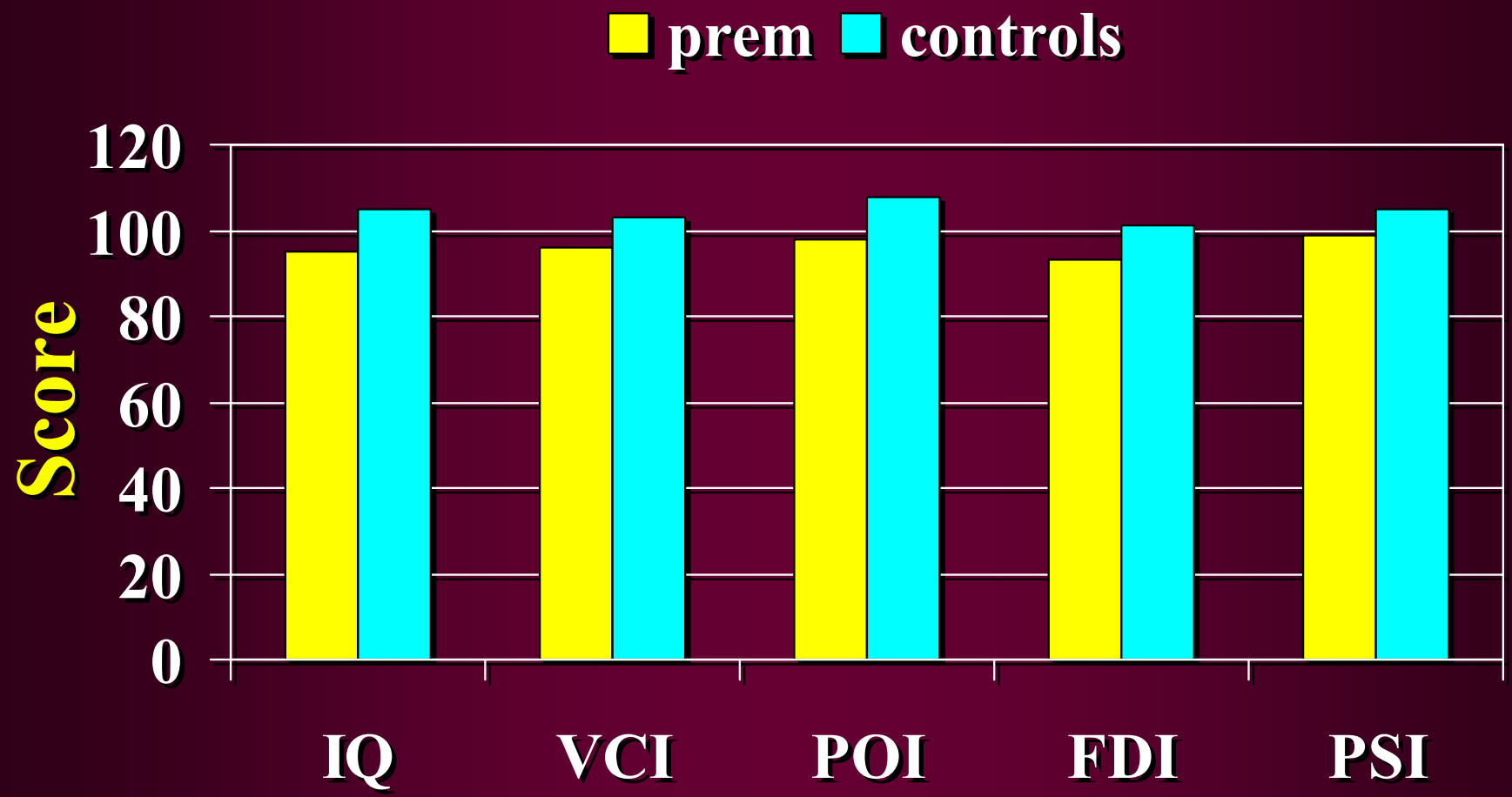
– Wide Range Achievement Tests (WRAT)
Spelling, Reading, Arithmetic

Mean 100 (SD 15)

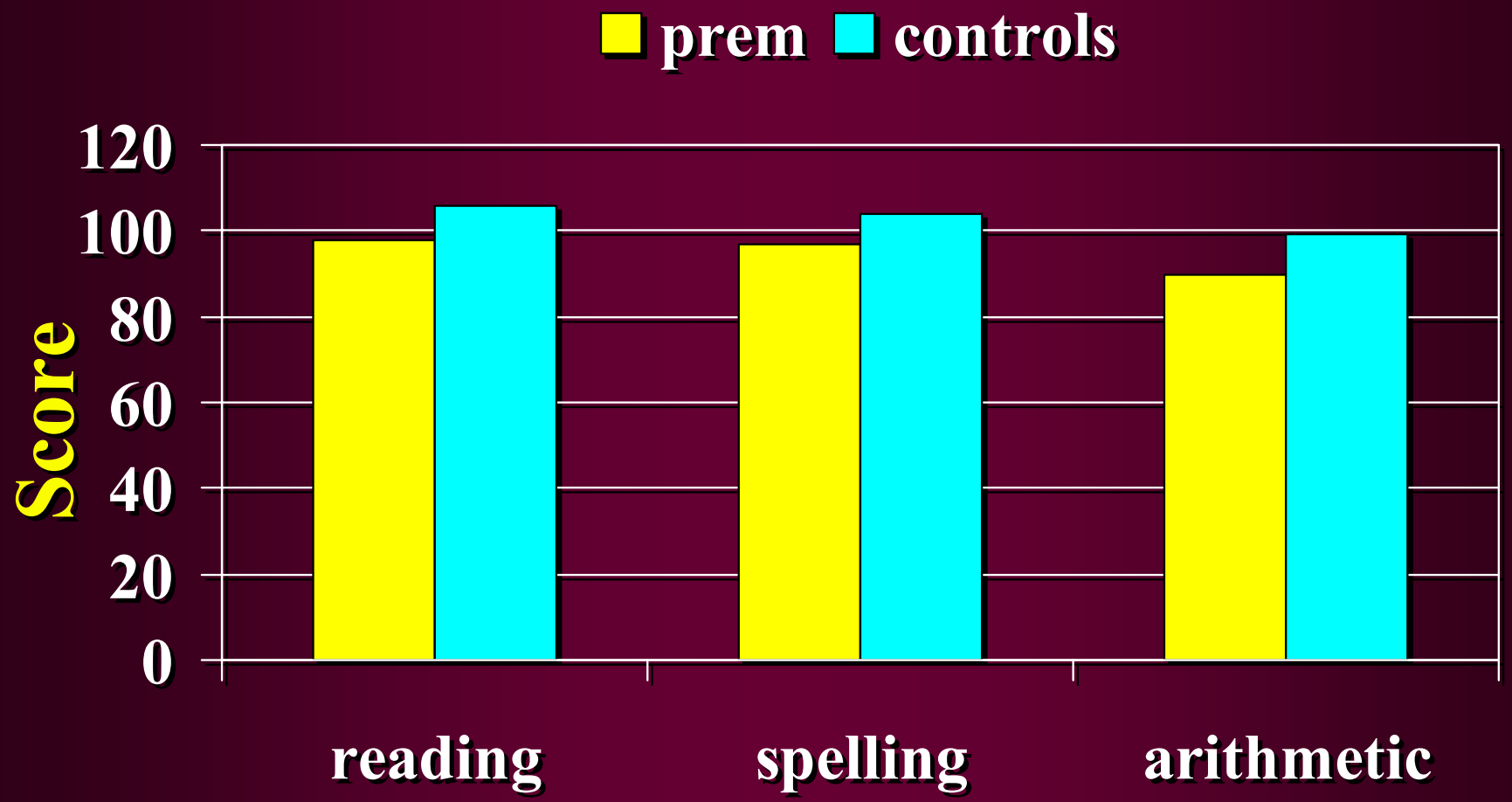
# WISC-IV – 1997 cohort



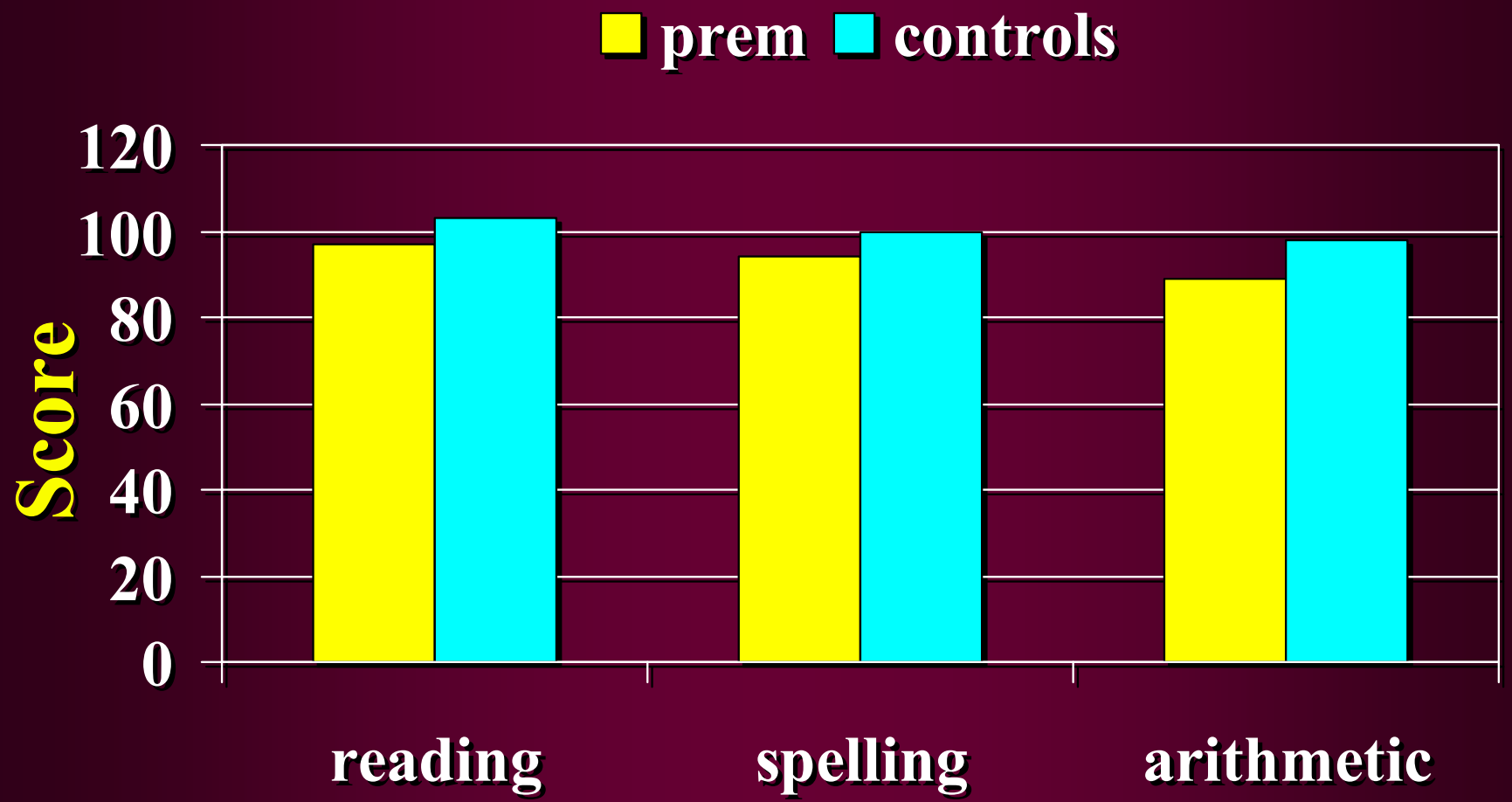
# WISC-III – 1991-92 cohort



# Academic achievement - 1997



# Academic achievement – 1991-92



# Cognitive outcomes

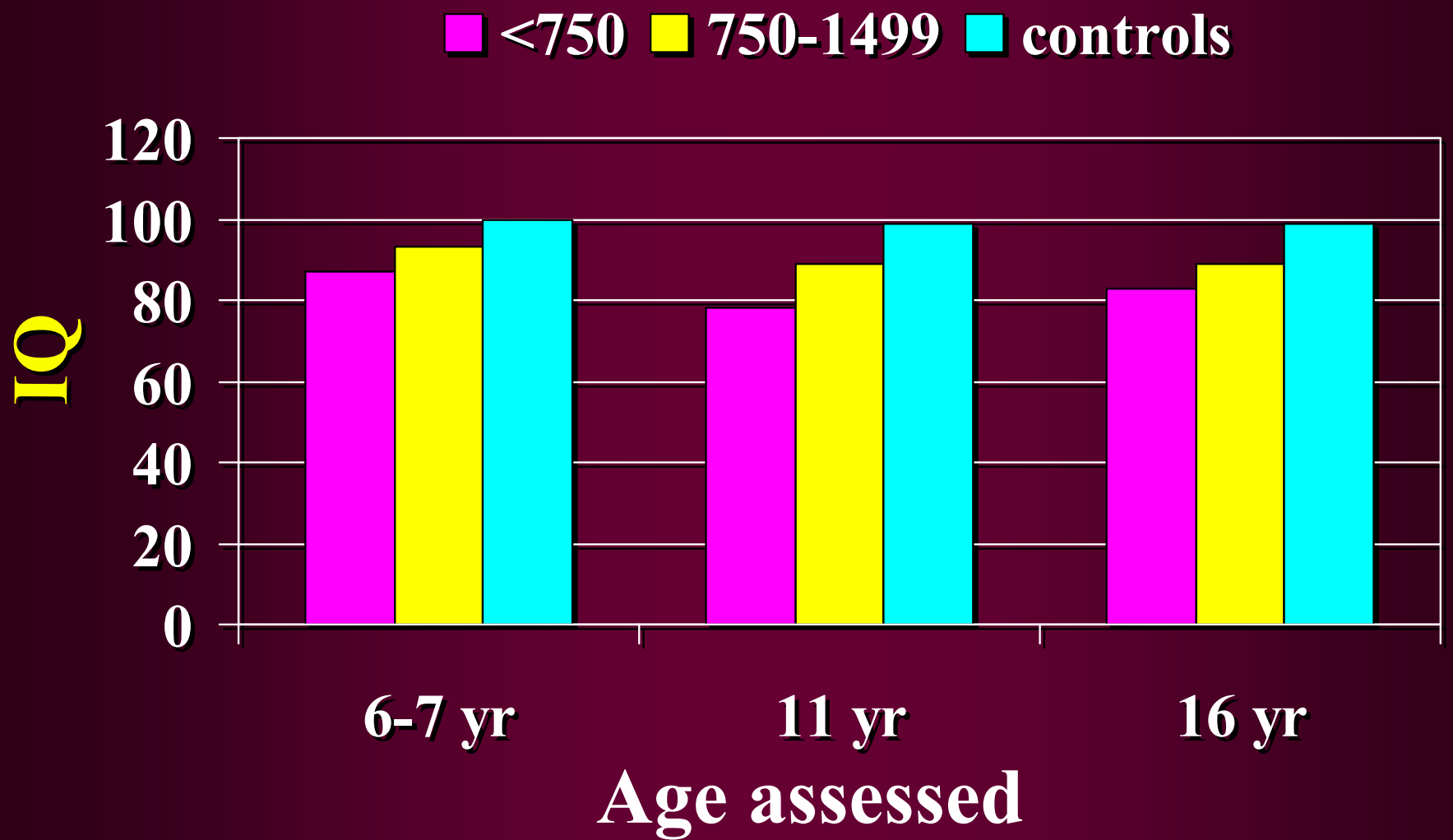
- Consistency over time between cohorts?

  Yes!

# Other cohorts

- EPICure – 6 years of age
  <26 weeks IQ 1.6 SD lower than controls
  41% <-2 SD, 31% -2 SD to <-1SD
  VICS IQ 0.8 SD lower than controls
  Finland – 5 years of age
  <27 weeks IQ 94 (no controls)

# Cleveland


<750
750-1499
controls
120
100
80
60
40
20
0
IQ
6-7 yr
11 yr
16 yr
Age assessed

# Other cognitive outcomes

- Language delay - Cleveland
  early school age – phonological processing, vocabulary, verbal comprehension, verbal memory 0.4 SD lower
  middle school-age – 0.7 to 0.8 SD lower
  adolescence – 0. 5 SD lower
- Visuomotor difficulties – Cleveland
  17% <750 g, 5% 750-1499 g, 0% term

# Other cognitive outcomes

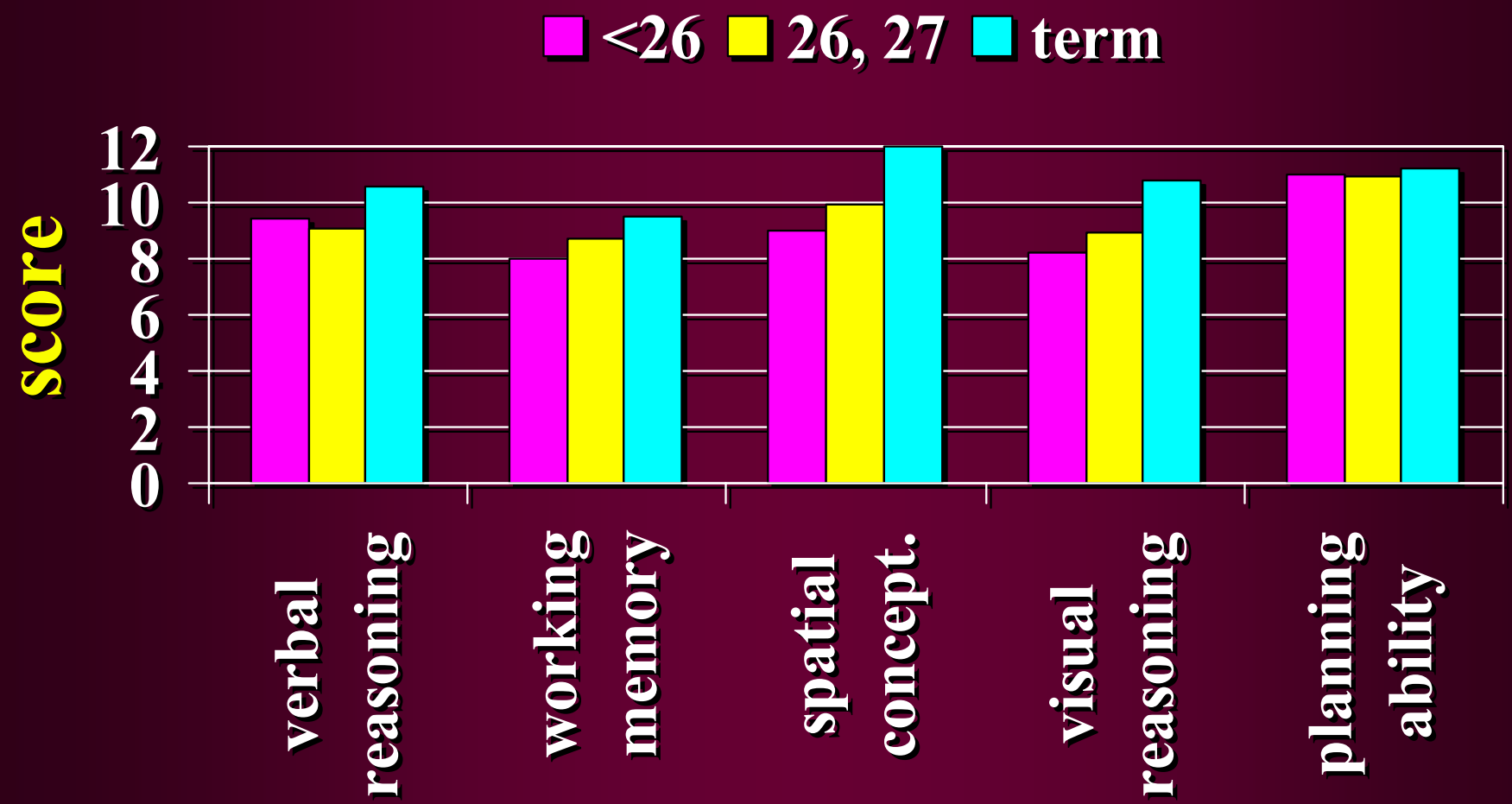
- fine and gross motor problems
- verbal memory and learning skills poorer
- inattention – more impulsive, less accurate, problems shifting attention

# Other cognitive outcomes

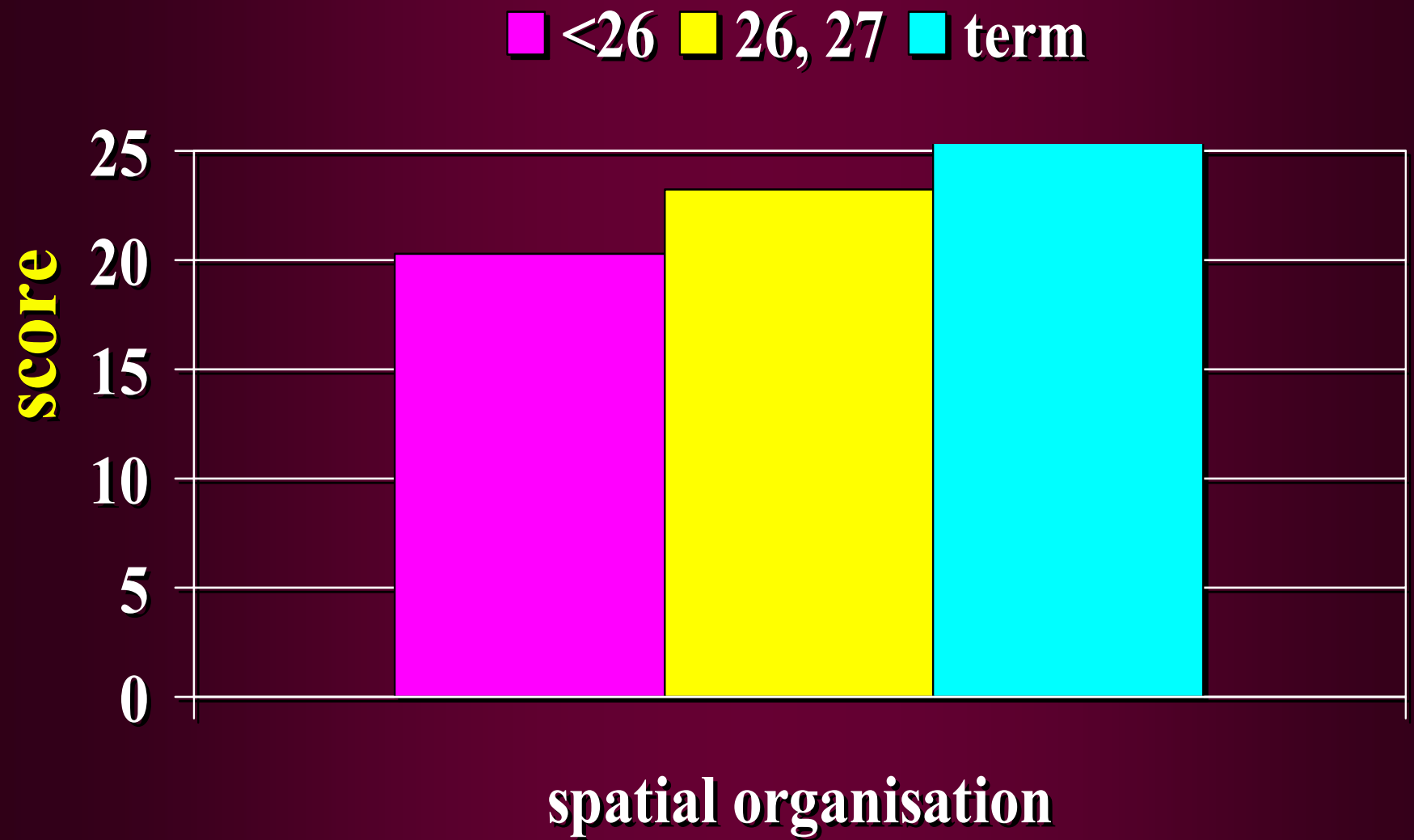
- executive function – responsible for goal-directed or future-orientated behaviour

1. attention
2. self-regulation
3. initiation of activity
4. working memory
5. mental flexibility
6. planning ability

# VICS 1991-92


<26
26, 27
term
score
0
2
4
6
8
10
12
verbal reasoning
working memory
spatial concept.
visual reasoning
planning ability

# VICS 1991-92



# Summary of Middle Childhood Outcomes

- IQ, academic achievement, behaviour all worse in preterm survivors
- More grade repetition
- Other cognitive problems – language, visuomotor, motor, memory, attention, executive function

# Risk factors

- Biological – IVH, PVL, white matter injury, BPD, postnatal corticosteroids, sepsis (NEC)
- male gender
- Social – higher social risk, parenting

# Cognitive and Educational Problems

- Preschool age
  - cognitive
  - neurosensory
- School-age
  - cognitive
  - educational
  - behavioural

# Victorian Infant Collaborative Study (VICS) Group

- Lex Doyle, Peter Anderson, Catherine Callanan, Elizabeth Carse, Margaret P Charlton, Mary-Ann Davey, Noni Davis, Cinzia de Luca, Julianne Duff, Rod Hunt, Maree Hayes, Esther Hutchinson, Elaine Kelly, Marion McDonald, Gillian Opie, Gehan Roberts, Michael Stewart, Linh Ung, Andrew Watkins, Amanda Williamson, Heather Woods.
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