

Swiss TPH Winter Symposium 2017

**Helminth Infection – from Transmission to Control**

# Influence of Helminths and Physical Fitness on Cognitive Performance

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# The DASH study

## Disease, Activity and Schoolchildren's Health





# Rationale for the DASH Study



RESEARCH ARTICLE

# Associations between selective attention and soil-transmitted helminth infections, socioeconomic status, and physical fitness in disadvantaged children in Port Elizabeth, South Africa: An observational study

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# 1. BACKGROUND



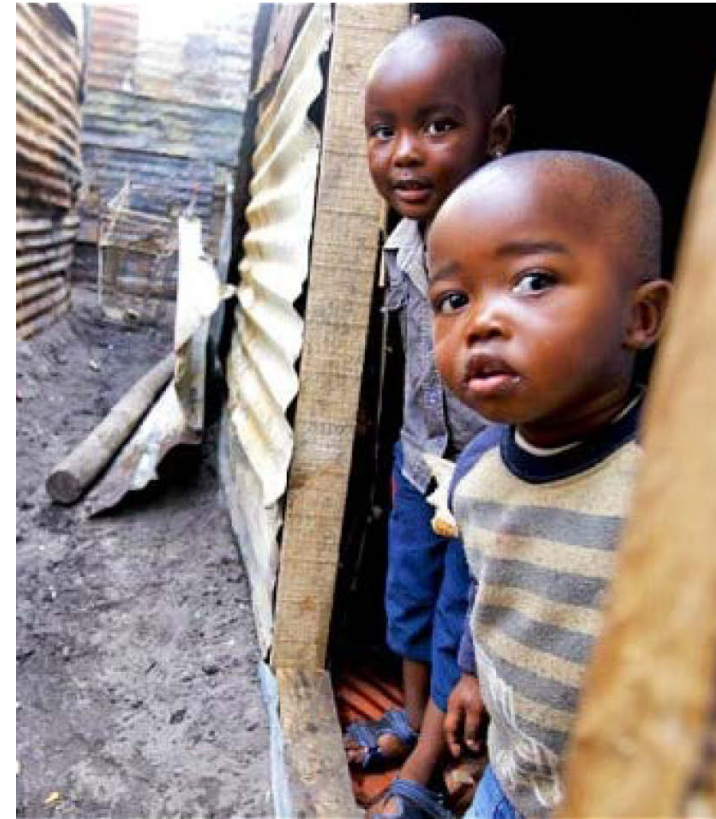
## Importance of selective attention

- ✓ **Attention skills** are key for successful learning
- ✓ Selective attention = **ability to select and focus** on particular tasks and to **suppress irrelevant or distracting information**
- ✓ **Linked with important domains** in education: language processing, literacy, numeracy



## Factors associated with selective attention

- ✓ Major influences: **health, nutritional status, socio-economic status**
- ✓ Children growing up in **socio-economically deprived** environments with **higher risk of attention deficits**
- ✓ Parents provide less supportive and safe **learning environment**
- ✓ Limited access to cognitively **stimulating materials** (books, toys)
- ✓ Higher **risk for chronic malnutrition**



## Poor living conditions

- ✓ Favour occurrence of **parasitic worm infections**
- ✓ Soil-transmitted helminths infections (STHs) associated with **poor cognitive performance**





- ✓ In Filipino children, **Ascaris lumbricoides** infection linked with poor performance in memory, **Trichuris trichiura** infection with poor performance in verbal fluency (Ezeamama et al., 2005)
- ✓ **Few studies in African countries**, focussing on selective attention, and taking into account physical fitness



## Goals of the present study

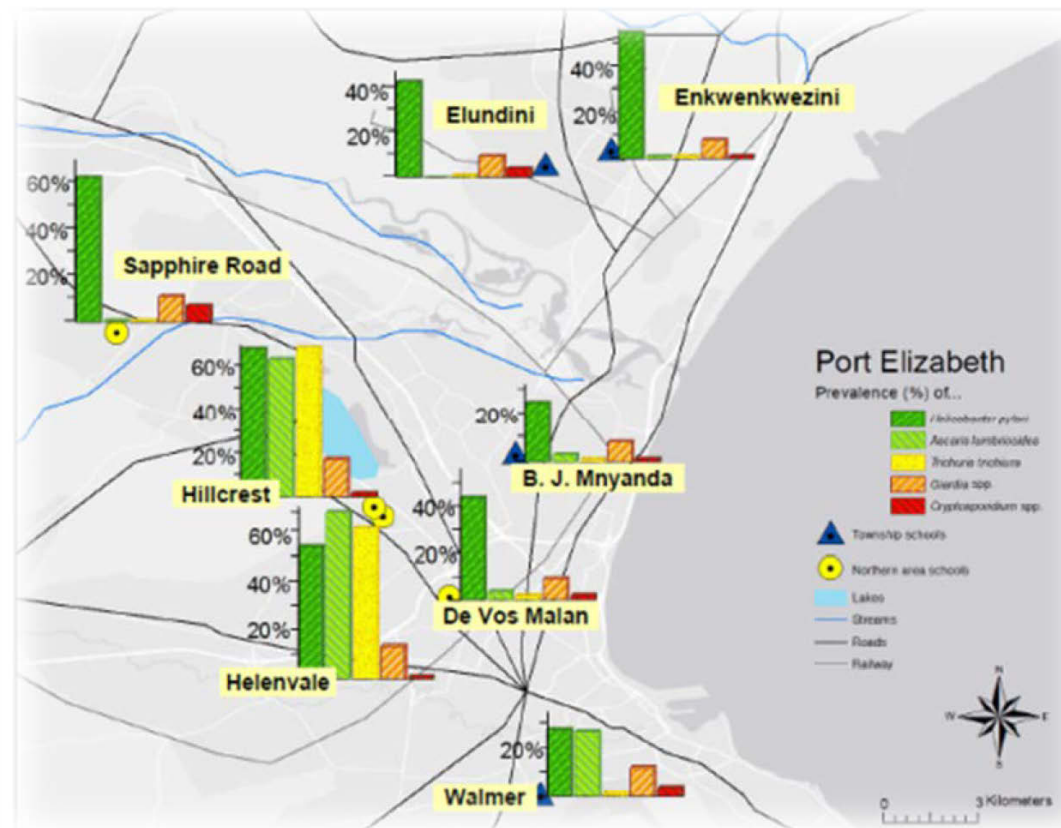
To examine the ...

1. ... bivariate association between **physical fitness** and **STHs**
2. ... bivariate associations between **STHs, stunting and cognitive performance**
3. ... **multivariate association** between **STHs, stunting, and physical fitness as predictors of selective attention** and academic performance

## 2. METHODS

# Participants

- ✓ **835 children**  
(417 girls, 418 boys)
- ✓ Port Elizabeth region
- ✓ 8 quintile 3 schools  
(underprivileged)
- ✓ Mostly coloured
- ✓ Grade 4 ( $M=9.5$  years)



Müller, I., Yap, P., Steinmann, P., Damons, B.P., Schindler, C., Seelig, H., et al. (2016). Intestinal parasites, growth and physical fitness of schoolchildren in poor neighbourhoods in Port Elizabeth, South Africa: A cross-sectional survey. *Parasites & Vectors*, 9(488), doi:10.1186/s13071-13016-11761-13075.



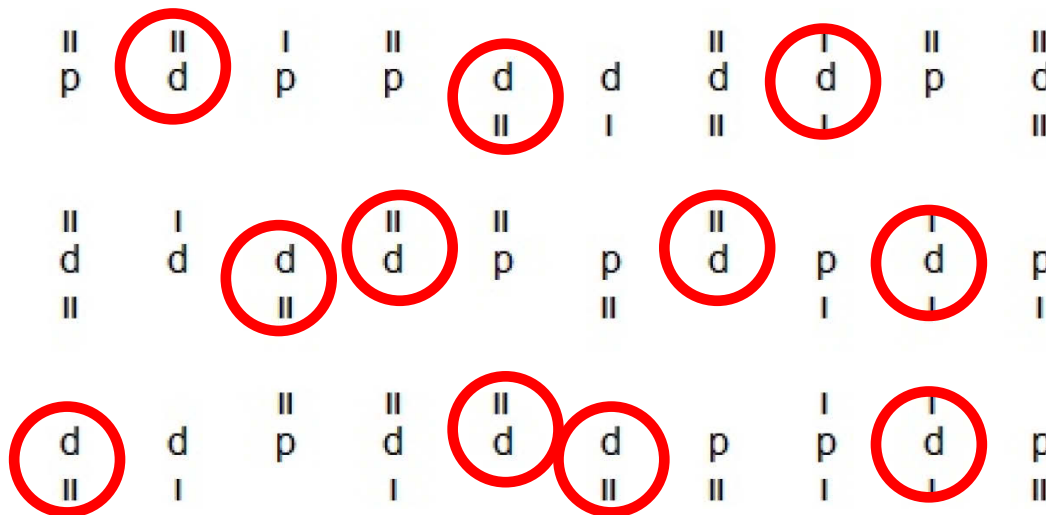
## Measures

- ✓ **Body weight and height:** Stunting
- ✓ **Socioeconomic status** (9 items; household living standards)
- ✓ **Food insecurity** (4 items; adapted from Household Hunger Scale)
- ✓ **Stool sample:** Kato-Katz thick smears
- ✓ **Fitness:** 20m Shuttle run test & grip strength test
- ✓ **Selective attention:** d2 attention tests
- ✓ **End of the year results:** Average of home language, additional language, maths, life skills



# Shuttle Run and Grip Strength

## d2 Attention Test



| d2 test measures          | Acronym | Description of measure               | Computation   |
|---------------------------|---------|--------------------------------------|---|
| Processing speed          | TN*     | Total number of characters processed | Sum of number of characters processed before the final cancellation on each trial |
| Processing speed          | TN-E*   | Total correctly processed            | Total characters processed minus total errors made                                |
| Inattention               | O*      | Errors of omission                   | Sum of number of target symbols not cancelled                                     |
| Impulsivity               | C*      | Errors of commission                 | Sum of number of non-targets symbols cancelled                                    |
| Accuracy                  | E%*     | Percentage of errors                 | Total number of errors divided by the total number of characters processed        |
| Concentration performance | CP*     | Concentration performance            | Total number of correctly cancelled minus total number incorrectly cancelled      |

## 3. RESULTS



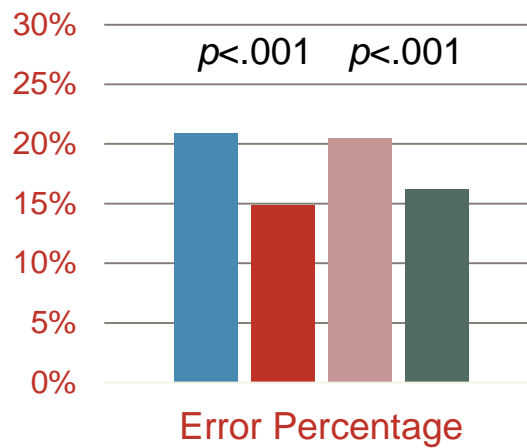
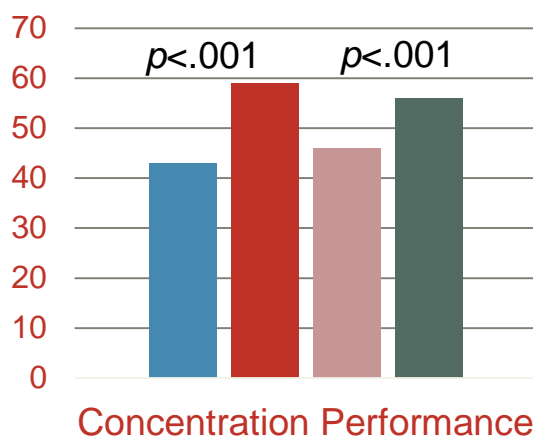
## Fitness, STH infections and stunting

|  | Non-infected<br>( <i>n</i> = 576)<br><i>M</i> (95% CI) | Infected <sup>d</sup><br>( <i>n</i> = 259)<br><i>M</i> (95% CI) | <i>p</i> -value <sup>c</sup> |
|--|--|---|------------------------------|
| <b>Fitness</b>   |  |   |                              |
| VO <sub>2</sub> max (in ml kg <sup>-1</sup> min <sup>-1</sup> ) <sup>a</sup> | 49.3 (48.9–49.6)                                       | 48.6 (48.1–49.1)  | 0.149                        |
| Grip strength (in kg) <sup>b</sup>   | 12.4 (12.2–12.7)                                       | 11.2 (10.9–11.54)   | <b>0.013</b>                 |

|  | Non-stunted<br>( <i>n</i> = 732)<br><i>M</i> (95% CI) | Stunted <sup>e</sup><br>( <i>n</i> = 103)<br><i>M</i> (95% CI) | <i>p</i> -value <sup>c</sup> |
|--|---|--|------------------------------|
| <b>Fitness</b>   |   |  |                              |
| VO <sub>2</sub> max (in ml kg <sup>-1</sup> min <sup>-1</sup> ) <sup>a</sup> | 49.0 (48.7–49.4)                                      | 49.1 (48.2–49.9)   | 0.664                        |
| Grip strength (in kg) <sup>b</sup>   | 12.3 (12.1–12.5)                                      | 10.2 (9.7–10.7)  | <b>&lt;0.001</b>             |



## d2 Test of Attention



***Infected***



***Not infected***

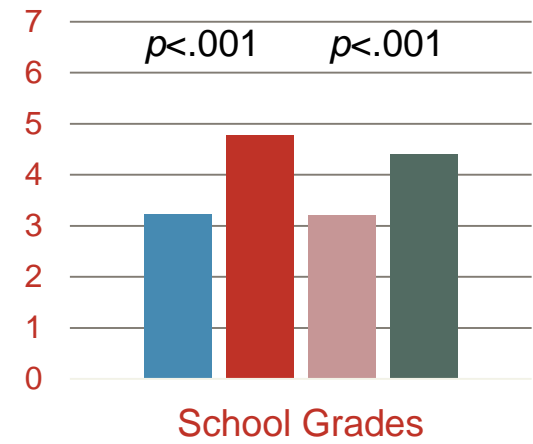


***Stunted***



***Normal Growth***

## End of the Year Results



**Table 5. Demography, socioeconomic status, helminth infection, nutrition, and physical fitness as risk factors for selective attention and academic performance.**

| Mean concentration (CP)  | Multiple linear regression |                 |                              |
|--|----------------------------|-----------------|------------------------------|
|  | B                          | 95% CI          | <i>p</i> -value <sup>i</sup> |
| Explanatory variables  |                            |                 |                              |
| <b>Sex (reference: male)<sup>b</sup></b>                                       | 5.47                       | 1.05 to 9.89    | <b>0.015</b>                 |
| <b>Helminth infection (reference: uninfected)<sup>c</sup></b>                  | -7.99                      | -14.15 to -1.84 | <b>0.011</b>                 |
| <b>VO<sub>2</sub> max (in ml kg<sup>-1</sup> min<sup>-1</sup>)<sup>f</sup></b> | 0.98                       | 0.47 to 1.50    | <b>&lt;0.001</b>             |
| <b>Grip strength (in kg)<sup>g</sup></b>                                       | 0.92                       | 0.08 to 1.77    | <b>0.032</b>                 |

■ Infected<sup>a</sup> (n=259)

□ Non-infected (n=576)

■ Stunted<sup>b</sup> (n=103)

■ Non-stunted (n=732)



## 4. CONCLUSIONS



## Key findings

- ✓ **STH infections** and **low physical fitness** associated with **lower selective attention** and **lower academic performance**
- ✓ The association between **stunting and cognitive performance** disappeared in the multivariate analyses
- ✓ **Stunted children** at increased risk of being **infected with STHs**

**Combining physical activity interventions with anti-helminthic treatment** seems a **promising avenue** to improve children's cognitive performance and health status





From DASH to KAZIBANTU

Thank you for your attention!

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