



# DASH

Disease, Activity and Schoolchildren's Health

2014 - 2017



## KaziBantu

Healthy Schools for Healthy Communities

2017 onwards





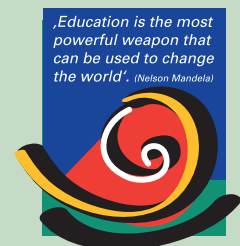
UNIVERSITY OF BASEL  
Department of Sport, Exercise and Health



Swiss Tropical and Public Health Institute  
Associated Institute of the University of Basel



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# The project in a nutshell

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***“Education is the most powerful weapon which can be used to change the world”*** Nelson Mandela (2003)



Health is a basic human right, but for many children, it is not that simple. Across the world, poor health has been linked to poverty and inadequate nutrition, poor sanitation and physical inactivity. In 2014, the Nelson Mandela University, the University of Basel and the Swiss Tropical and Public Health Institute partnered to explore the implementation of a multi-fold school-based intervention toolkit that aimed to contribute to the improvement of the health and well-being of schoolchildren in disadvantaged

neighbourhoods of Port Elizabeth in South Africa. The intervention was applied in two 10-week blocks, and comprised four elements: weekly physical activity and dancing-to-music lessons, health and hygiene lessons, nutritional supplementation and deworming. Additionally, bathroom facilities were renovated where necessary and food preparers were trained in basic hygiene and food safety. The DASH project was successfully completed and is continued by the *KaziBantu* project.

# Introductory words

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## **Professor Uwe Pühse, principal investigator, Switzerland**

It is a worldwide trend that the daily physical activity of children is decreasing. Lifestyle changes have led to living conditions where media use, sedentary activities and other environmental factors reduce the need and possibilities for an active lifestyle. According to the Healthy Active Kids South Africa Report Card 2016 this is also true for South Africa. These new developments lead to considerable challenges for the health sector as the existing burden of communicable diseases like HIV and worm infections persist, and new non-communicable diseases (NCDs) like hypertension are on the rise. This is also what the DASH study reveals. Consequently, it is more than apparent that the physical activity of children should be of major importance for education in schools. Children do not just bring their heads to school - they also have a body which needs to be taken care of. Children like to move and play. Therefore, we should give them the chance to be physically active: for their development, their health and their wellbeing.



## **Professor Cheryl Walter, principal investigator, South Africa**

Research has shown that NCDs are among the leading causes of death in South Africa. Cardiovascular diseases (CVDs) are the leading category of NCDs and there is a strong call for preventative strategies to tackle the problem. The government has already implemented policies for tobacco control, salt and fat reduction, and more recently a tax on sugar-sweetened beverages has been instituted. Patterns of an unhealthy lifestyle, the forerunner to NCDs, are present in South African children and adolescents. Overweight and obesity are on the rise, especially in girls and children in urban settings. In the latest Healthy Active Kids South Africa Report Card (2016), South African children scored a D-grade for organised sports participation, and F-grades for sedentary behaviour, sugar-sweetened beverage intake, added sugar and salty snacks and for fast food intake. Participating in regular physical activity and eating a healthy diet are key behaviours for reducing the risk factors for NCDs. A multi-faceted approach from government, non-governmental organisations (NGOs), schools and parents is needed to fight this epidemic. The previous DASH project and the follow-up *KaziBantu* project are endeavours to make a difference, through their intervention toolkits.



### **Professor Rosa du Randt, former Director of the School of Lifestyle Sciences at the Nelson Mandela University, South Africa**

A recent media release by Statistics South Africa pertaining to poverty trends in the country revealed that in 2015 an estimated 30.4 million people (55.5%) lived in poverty. The report further indicated that the most vulnerable population groups are children below 17 years old, females, Black Africans, and rural dwellers. Focusing research and interventions to improve child health on a cohort of children from low socioeconomic neighbourhoods in Port Elizabeth in the province of the Eastern Cape, addresses a problem that is not only relevant to the province but also to the many other children from poor communities in South Africa. Identifying, among others, the health status and successful interventions to address potential risk factors and thereby facilitate improved health and wellbeing in adulthood, will not only benefit the children concerned, but also the country.



### **Professor Jürg Utzinger, Director of the Swiss Tropical and Public Health Institute in Basel, Switzerland**

Four out of the five main drivers of the burden of disease in South Africa are communicable diseases, namely HIV/AIDS, diarrhoeal diseases, lower respiratory infections and tuberculosis. Although neglected tropical diseases (NTDs) do not feature prominently in the burden of disease statistics of South Africa, some NTDs are common in disadvantaged populations, especially children growing up in poor neighborhoods. Chronic helminth infections not only cause morbidity but also negatively affect the cognitive and physical development and school performance of children. Combined with the risk from unhealthy lifestyle choices and a lack of physical activity, the affected children face adverse conditions which have a direct impact on their current wellbeing and prospects to realize their full socioeconomic potential. Addressing these conditions in an integrated project offers these children a chance to escape the vicious cycle of poverty and disease.



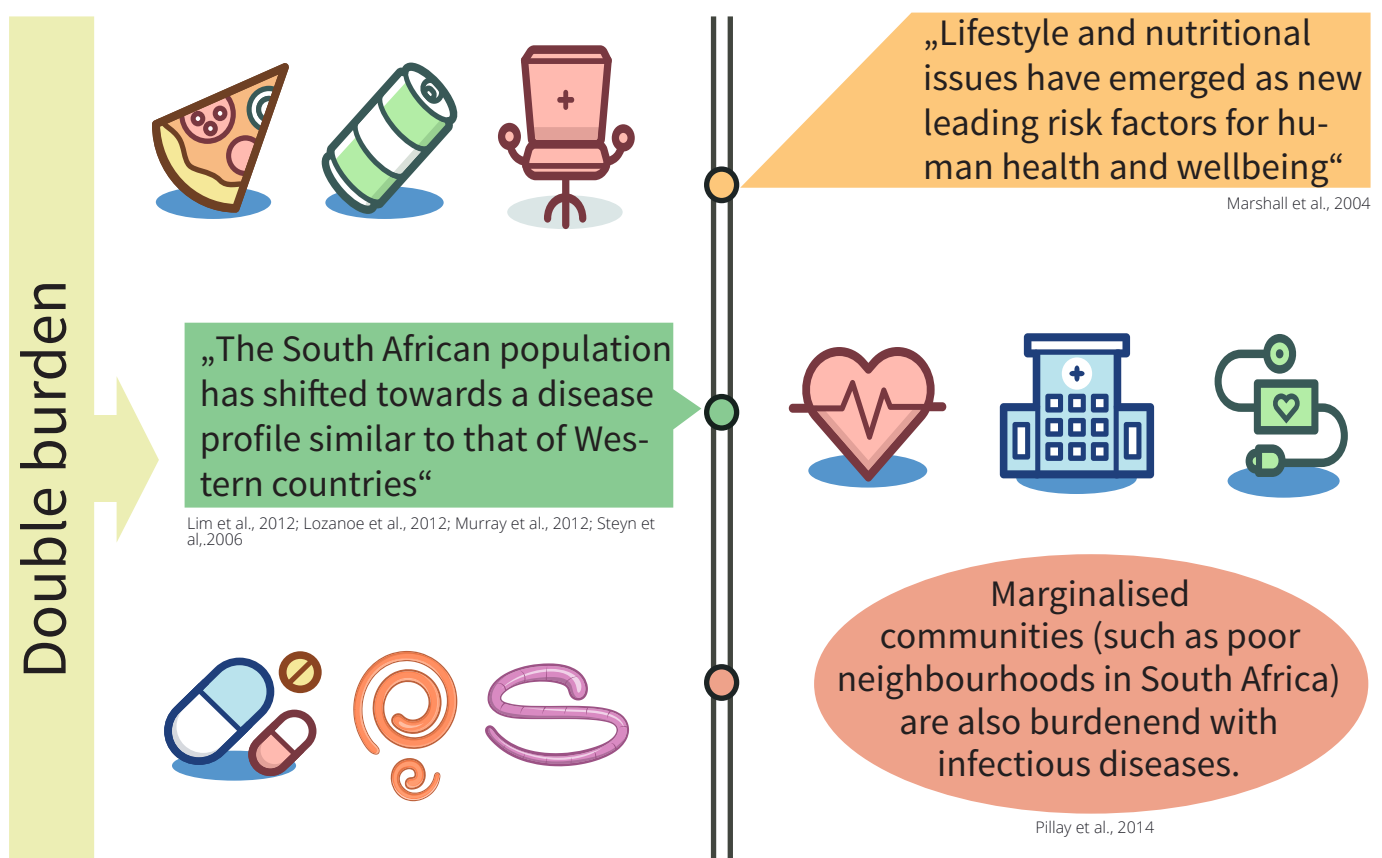
### **Professor Markus Gerber, Department of Sport, Exercise and Health, University of Basel, Switzerland**

Compared to adults, chronic diseases are still relatively seldom among young children although risk factors might already be acquired at young age. Studies with South African children show that many children are hypertensive and/or classified as overweight or obese. Not feeling fit or being overweight can have a severe negative impact on children's health-related quality of life (HRQoL). Therefore, policy makers are challenged to find ways how to enhance children's physical fitness as well as reducing their body weight. Given that regular physical activity has a positive impact on children's HRQoL, promoting intra- and extracurricular physical activity seem worthwhile. However, current reports show that the implementation of physical education in disadvantaged schools is still unsatisfactory. Efforts to improve this situation are urgently warranted.



# Background & challenge

“ Low- and middle-income countries are starting to experience a **double burden** of communicable and non-communicable diseases in the face of weak health systems.



Many low- and middle-income countries (LMICs) still struggle to meet the existing challenges stemming from infectious diseases, such as malaria and intestinal parasitic infections. As traditional lifestyles and diets change with socioeconomic development, LMICs are starting to experience a double burden of communicable and NCDs in the face of weak health systems. An in-depth epidemiological

investigation on intestinal parasite infections in an impoverished area of Port Elizabeth, South Africa provided a unique opportunity for research on its impact on the children's physical fitness, cognitive performance and psychosocial health. Additionally, children were screened for risk factors for the development of diabetes and hypertension in adulthood and for allergies.



# Aims & objectives

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## Investigate health indicators and their relationship

A 3-year longitudinal cohort study was conducted, consisting of three cross-sectional surveys (baseline and two follow-ups), in eight historically black and coloured (mixed-race) primary schools located in different neighbourhoods in Port Elizabeth, South Africa. Approximately 1 000 grade 4 primary schoolchildren, aged 8 to 12 years, were enrolled and monitored. At each survey,

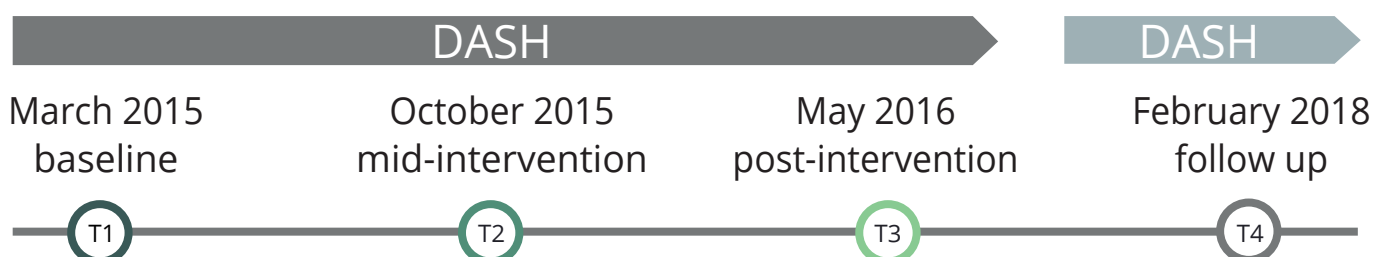
disease status, anthropometry and levels of physical fitness, cognitive performance and psychosocial health were assessed. After each survey, individuals diagnosed with parasitic worm infections were treated with antihelmintic drugs, while children with other infections or with high glycated haemoglobin levels, indicative of potential diabetes, were referred to local clinics.

## Intervene and measure effects

Through a physical fitness, nutrition and hygiene intervention, a first attempt has been undertaken to improve the overall health of schoolchildren. In order to document the effectiveness of the school-based health programme, a thorough assessment and analysis is crucial.



## Timeline DASH



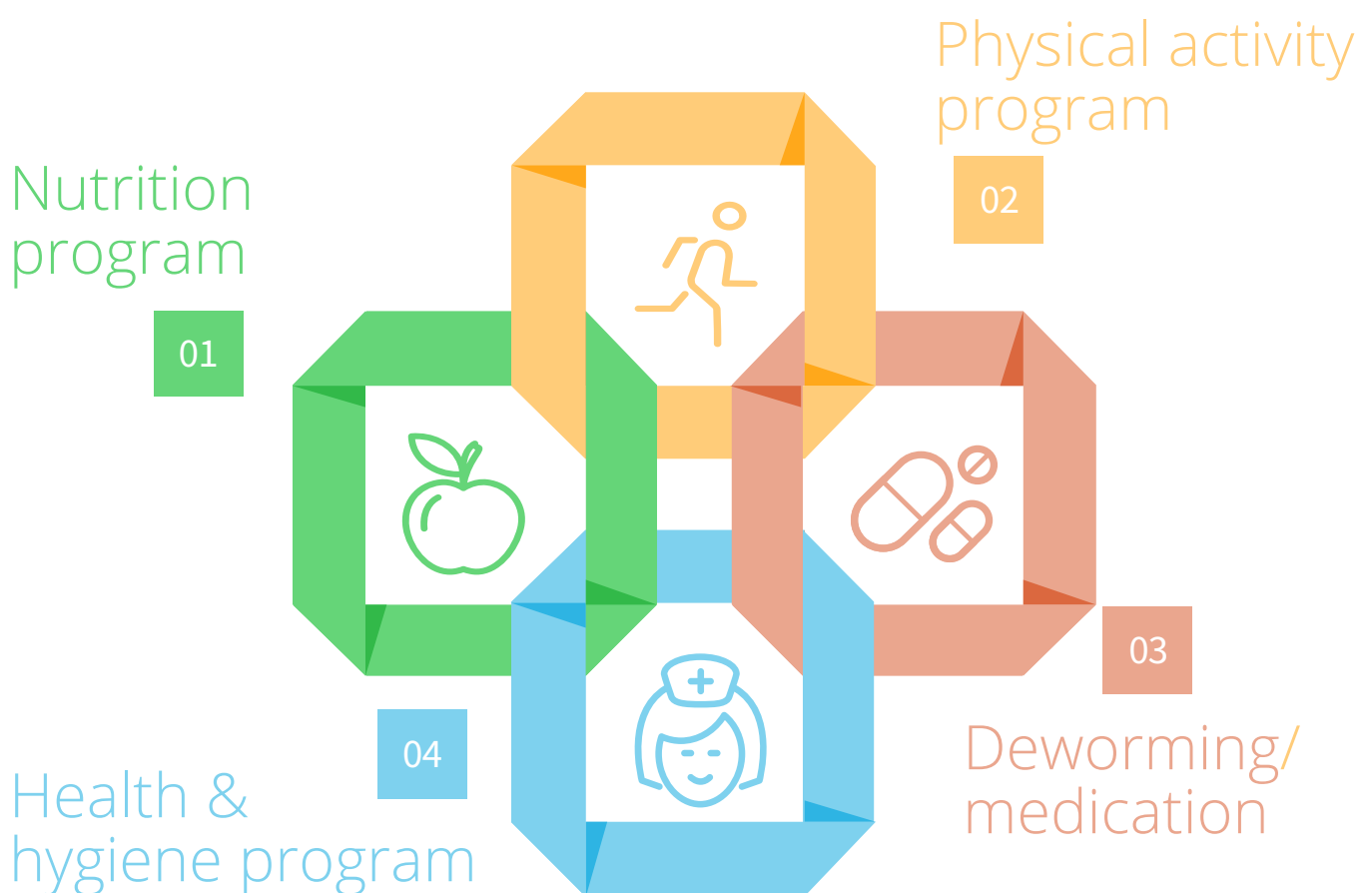
# Toolkit modules

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## School-based health promotion program

The toolkit encompasses physical activity, health and hygiene, deworming and nutrition education modules. Project schools and teachers were provided with the necessary resources and assistance to implement the modules and promote healthy active lifestyles. Two physical education and one dancing-to-music lessons per week were led by Nelson Mandela University staff and students during

each of the two 10-week block periods of intervention. Children were provided with deworming medication after the assessment and the schools were supported with a meal plan and hygiene instructions for food preparation. Activity breaks were performed in class whenever possible and a hygiene routine, such as hand-washing, was practised on a regular basis.



# Leading results

T1

*Parasites & Vectors* (2016; 9:488)

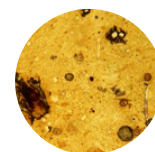
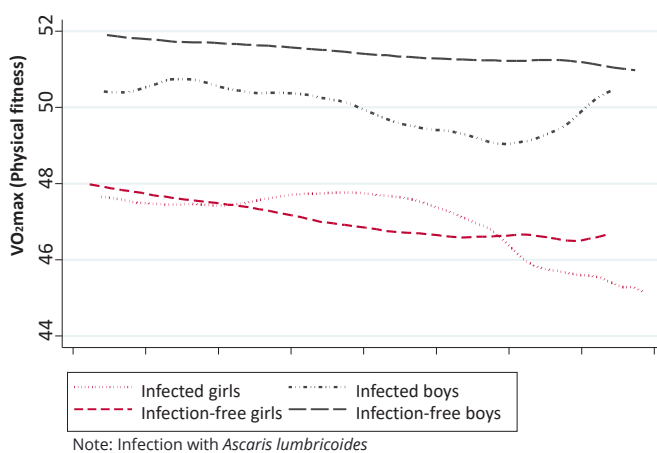
## Intestinal parasites, growth and physical fitness of schoolchildren in poor neighbourhoods of Port Elizabeth, South Africa: a cross-sectional survey

The relationship between physical fitness and infections with soil-transmitted helminths (STHs), intestinal protozoa and *Helicobacter pylori* was investigated. Physical fitness was determined using field-deployable examinations of the Eurofit fitness test battery. Stool samples were analysed utilising the Kato-Katz thick smear technique to diagnose STHs as well as with rapid diagnostic tests (RDTs) to detect intestinal protozoa and *H. pylori* infections. Complete data was available for 934 children (92%). In two schools, high STH prevalences were recorded (*Ascaris lumbricoides* 60% and 72%; *Trichuris trichiura* 65% each). For boys



and girls co-infected with *A. lumbricoides* and *T. trichiura* ( $n = 155$ ), the maximal oxygen uptake ( $VO_{2max}$ ) was estimated to be  $50.1 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  and  $47.2 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ , compared to  $51.5 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  and  $47.4 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  for their non-infected peers ( $n = 278$ ), respectively. On average, children without helminth infections were heavier, had greater height and an increased body mass index (BMI), and were less often stunted. However, they were not significantly less wasted compared to their peers with a single or dual species infection. Among 9-year-old boys a negative correlation between helminth infections and  $VO_{2max}$ , grip strength and standing broad jump distance was observed.

STH infection and physical fitness



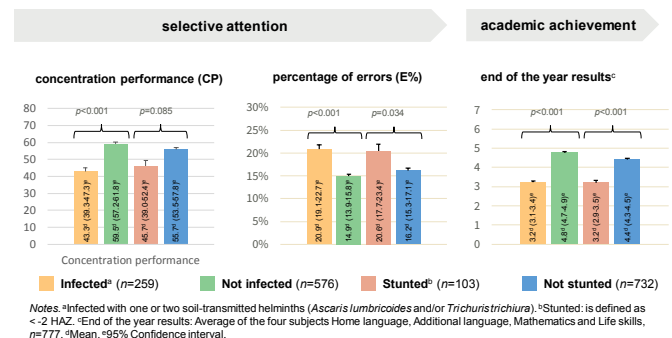
“ Intestinal parasite infections appear to have a small, but significant, negative effect on the physical fitness of infected children, as expressed by their maximum oxygen uptake. A clear impact on anthropometric indicators was observed.

*PLoS Neglected Tropical Diseases* (2017; 11:e0005573)

## 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

Children growing up in challenging environments, such as lower socioeconomic neighbourhoods in South Africa, are at an increased risk of ill-health associated with sedentary behaviour, poor nutrition, growth retardation and infections with parasitic worms. Negative factors such as limited educational resources, insufficient health care and nutrition, are exacerbating the effects of poverty and, taken together, might cause developmental delays and school failure. A total of 835 school children aged 8-12 years were examined for soil-transmitted helminth infection,

physical fitness, selective attention, stunting, household socioeconomic conditions and food security. Furthermore, the children's academic achievement scores were utilised as a proxy for academic achievement. The multivariate analyses showed that low selective attention was associated with soil-transmitted helminth infection and low shuttle run performance, whereas higher academic achievement was observed in children without soil-transmitted helminth infection and with higher shuttle run performance.



“ Soil-transmitted helminth infections and low physical fitness appear to hinder the children's capacity to pay attention and thereby impede their academic performance. Poor academic achievement will make it difficult for children to realise their full potential, perpetuating a vicious cycle of poverty and ill health.



*Quality of Life Research (2017; in press)*

## **Physical activity and health-related quality of life among schoolchildren from disadvantaged neighbourhoods in Port Elizabeth, South Africa**

Physical activity and cardiorespiratory fitness are important indicators of health. A central aspect of health is health-related quality of life, which can be seen as a subjective representation of wellbeing and the overall functioning of the body. Health-related quality of life of children is an important predictor of future illness and subsequent health costs, as it is characterised by remarkable stability over time. The baseline data (832 children) from the DASH study showed that schoolchildren who are physically active for more than 60 minutes on at least six days of the week report a significantly higher health-related quality of life (in all five assessed dimensions) than their



peers with lower physical activity levels. In the 2013/2014 European HBSC study, which used the same item to assess physical activity, 30% of boys and 21% of girls aged 11 years reported at least one hour of moderate-to-vigorous physical activity on all days of the week. In our sample, the number of children who achieved recommended physical activity levels was similar in girls (20%), but slightly lower among boys (24%). Nevertheless, our findings also show that almost every third child (27.5%) failed to accumulate 60 minutes of physical activity on almost all days of the week, which is far below the recommended standards.



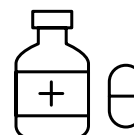
“ The findings indicate that there is a positive association between self-reported physical activity and health-related quality of life which is important for two reasons. Firstly, good health-related quality of life influences a child’s health and wellbeing positively and secondly, it has measurable positive effects later in life on both an individual and societal level.

*Submitted***Physical activity and dual disease burden among South African primary schoolchildren**

People from LMICs face challenges stemming from parasitic infections. Additionally, NCDs are rapidly becoming prominent, which puts South African children at an elevated risk of compromised health due to a dual disease burden, with negative consequences for child development and wellbeing. Epidemiological studies show that regular physical activity is associated with decreased cardiovascular disease risk markers. We examined whether physical activity is associated with a dual disease burden in South African schoolchildren. 801 children (402 boys, 399 girls; mean age 9.5 years) from eight schools from disadvantaged neighbourhoods were included. We compared children who met physical activity recommendations (physically active on 6-7 days/week for at least 60 min), who were active, but below recommended standards (2-5 physically active days/week), or who were insufficiently active on almost all days (0-1 physically active days/week). Systolic and diastolic blood pressure, body mass index, percent body fat and infection with soil-transmitted helminths were considered as outcome measures.



Moderate and high self-reported physical activity levels were negatively associated with risk factors for NCDs (lower body fat and lower risk of being hypertensive). Conversely, high self-reported physical activity was associated with a significantly higher risk of being infected with soil-transmitted helminths.



Taking into account that South African schoolchildren might be facing a dual disease burden of both infectious diseases and NCDs, promoting PA in disadvantaged areas is worthwhile, but should be combined with regular anthelmintic treatment to comprehensively improve children's health.

*Acta Tropica* (2017; 174:49-55)

## PCR-based verification of positive rapid diagnostic tests for intestinal protozoa infections with variable test band intensity

Diarrhoea and abdominal pain in South African children are frequently caused by infections with parasites that live in the children's intestinal tract. Stool samples can be sent to laboratories for detection of these infections, but this is rarely done in daily practice. Thus, many infected children are not diagnosed and do not receive anti-parasitic treatment. For some parasites such as *Giardia intestinalis* and *Cryptosporidium*, rapid diagnostic tests have been developed that can be directly carried out at the site of sampling and therefore help to facilitate a diagnosis. The latter tests require only a dipstick that is brought into contact with a human stool sample and the appearance of a specific line on the test indicates the presence of an infection. The whole test procedure can be performed in less than 20 minutes,



however it is not clear whether the appearance of a 'weak' test line always represents a true infection or whether this may also be an unspecified test reaction. During the DASH study, a rapid test (*Crypto/Giardia* DuoStrip) was used for the screening of 1 428 stool samples in schoolchildren across Port Elizabeth. Approximately 10% of all samples were positive for *G. intestinalis*. The stool samples with positive results were sent to a reference laboratory where a special molecular test (polymerase chain reaction) was performed. Overall, 93% of the positive rapid diagnostic tests for *G. intestinalis* were confirmed.

“ We conclude, that the employed rapid diagnostic test for *Giardia intestinalis* is accurate and can be utilised as a reliable diagnosis of this intestinal infection in South African schoolchildren.



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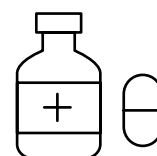
Submitted

## Association between infections and glycated hemoglobin in schoolchildren of poor neighbourhoods in Port Elizabeth, South Africa

The objective of this study was to determine the presence of any epidemiological relationship that may exist between different common intestinal infections and glycaemic conditions assessed by glycated haemoglobin status among children from underserved neighbourhoods in South Africa. A cross-sectional survey was conducted to determine this association and the effect of anthelmintic treatment on glycated haemoglobin levels six months after treatment with albendazole. Our multivariate regression analysis showed that *Helicobacter pylori* infections were positively



associated with glycated haemoglobin, however, other infections showed no associations. There was also a statistically non-significant increase of glycated haemoglobin levels after albendazole administration.



“Therefore, the potential role of *H. pylori* infections in diabetic patients needs to be confirmed in the context of a longitudinal treatment intervention.

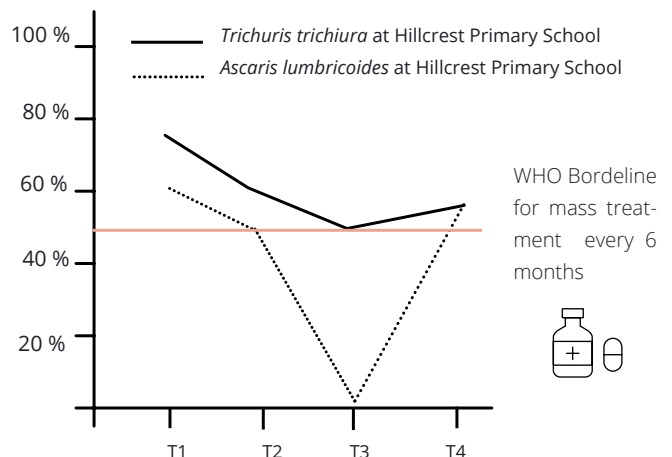


*Transactions of the Royal Society of Tropical Medicine & Hygiene* (2016; 110:676–678)

## Low efficacy of albendazole against *Trichuris trichiura* infection in schoolchildren from Port Elizabeth, South Africa

Albendazole is one of two standard drugs for the treatment of soil-transmitted helminthiasis. A study assessed the efficacy of albendazole against STH infections in Port Elizabeth, South Africa. A total of 149 schoolchildren, were examined for soil-transmitted helminth infections before and 2 weeks after treatment with albendazole (400 mg). *Trichuris trichiura*

was the predominant soil-transmitted helminth species (prevalence of 60.4%), followed by *Ascaris lumbricoides* (47.4%). While albendazole was highly efficacious against *A. lumbricoides* (cure rate (CR): 97.2%; egg reduction rate (ERR): 94.5%), it lacked efficacy against *T. trichiura* (CR: 1.1%; ERR: 46.0%).



“Taken together, our findings from Port Elizabeth in South Africa suggest that a single 400 mg oral dose of albendazole is efficacious against *A. lumbricoides* but does not effectively manage *T. trichiura* infections in children. To control STH infections among school-aged children, public health measures are required, such as preventive chemotherapy, along with improvements in water, sanitation and hygiene (WASH). Moreover, there is a pressing need to use alternatives and to develop novel drugs and drug combinations that are safe and efficacious against *T. trichiura*.

### *Under review*

## **Sensitization to common allergens in schoolchildren from different townships in Port Elizabeth, South Africa**

According to the World Allergy Organization (WAO) about 40% of the world's population is suffering from allergic rhinoconjunctivitis and the World Health Organization (WHO) estimates that 300 million people world-wide are afflicted with asthma, resulting in roughly 250 000 asthma-related annual deaths. For decades, allergies have been considered as disorders of western civilization and were, due to the lack of epidemiological data, underestimated and neglected in regions beyond Europe and North America. Innovative studies, however, have shown that allergies have become an important burden in developing countries. More recently, there has been much debate about the impact of chronic infections, particularly with helminths, during childhood and the developing of allergic diseases. As the so-called hygiene hypothesis claims that frequent exposure to certain pathogens and infections with helminths could prevent the development of allergies, one of the objectives of the DASH study was to establish whether this phenomenon applies to the schoolchildren examined in this study. For this reason, sensitization patterns of the



children were determined by performing skin-prick tests with the most common allergens prevalent in the Port Elizabeth area, and by completing questionnaires especially designed for this study to collect information on symptoms and signs of allergies, housing conditions, socioeconomic status and ethnicity. It was found that stool parasites in general, particularly helminth infections, protected children from developing sensitizations to house dust mites, German cockroach and grass pollen. Moreover, those with helminth infections exhibited less often sensitizations less often to more than one of the allergens (poly-sensitizations) investigated.

“ Neither associations with the socioeconomic status of the children, nor with gender or ethnicity were detected, therefore it was concluded that parasitic infections alone are responsible for this phenomenon. Further factors that might impact the development of sensitization and allergies in these children will be investigated in the follow-up *KaziBantu* project.

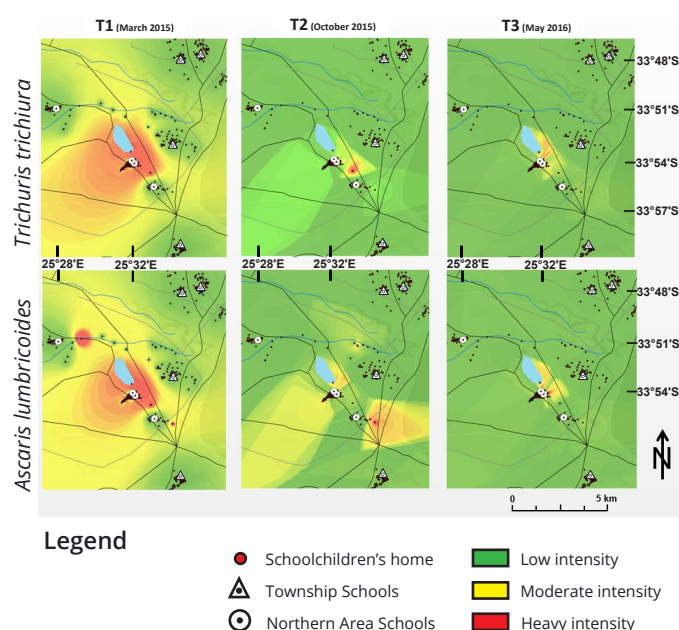
Submitted

## Description and visualization of changing risk profile patterns of *Ascaris lumbricoides* and *Trichuris trichiura* in Port Elizabeth, South Africa

Soil-transmitted helminths (*Ascaris lumbricoides*, hookworm and *Trichuris trichiura*) are among the most common infections in humans.

The highest prevalence and intensity of soil-transmitted helminth infections is typically observed in school-aged children. However, hookworm infections might peak in older age groups. South Africa is classified as a country with a moderate burden of soil-transmitted helminthiasis. Yet, there is a paucity of high-quality data on the risk of soil-transmitted helminth infections in school-aged children in the face of deworming interventions. Risk maps facilitate discussions amongst different stakeholders and provide a tool for spatial targeting of health interventions. We show spatial images of soil-transmitted helminthiasis intensity reduction among schoolchildren from disadvantaged neighbourhoods in Port Elizabeth, South Africa, as a result of the deworming interventions applied in the DASH study. Children were examined for

soil-transmitted helminth infections in March 2015, October 2015 and May 2016, using duplicate Kato-Katz thick smears and treated with albendazole after each survey. The mean infection intensities for *Ascaris lumbricoides* and *Trichuris trichiura* were 9 554 eggs per gram of stool (EPG) and 664 EPG in May 2015, 4 317 EPG and 331 in October 2015 and 1 684 EPG and 87 EPG in May 2016, respectively.

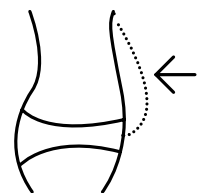
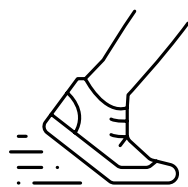


“Repeated deworming treatment caused a shrinking of the risk of soil-transmitted helminthiasis, however the treatment should be supplemented by other public health measures such as water, sanitation and hygiene (WASH). The high spatial heterogeneity suggests that data from additional schools in different neighbourhoods will be required to determine a locally appropriate intervention strategy, which ideally is not only carried out at school level, but covers the entire local population.

*Submitted*

## Effect of a multidimensional physical activity intervention on BMI, skinfolds, and fitness in South Africa: a cluster randomised controlled trial

Obesity-related conditions impose a growing burden on LMICs and affect people from all socioeconomic strata. This study assessed the effect of two 10-week blocks of multidimensional school-based physical activity interventions on schoolchildren's health in South Africa. A total of 579 children completed the baseline and end line assessments (the mean age at baseline was 10.0 years). In the intervention group, a significantly lower increase in the mean BMI and a reduced increase in the mean thickness of skinfolds, was observed compared to the control group. No significant group differences occurred in the mean 20-meter shuttle run and  $VO_{2\max}$  performance.



“ A multidimensional, school-based physical activity intervention can reduce the increase in cardiovascular risk factors (BMI and skinfold thickness) in disadvantaged South African schoolchildren. However, to achieve a positive effect on cardiorespiratory fitness, a persistent and more intensive intervention might be necessary.



# Masters theses

## South Africa

T1

### **The physical fitness profile of primary schoolchildren from lower socioeconomic communities in Port Elizabeth**

One of the objectives of the DASH study, with respect to the gathering of baseline data from the selected schools, was to describe the physical fitness of the children and to compare the learners' performances with reference to gender, ethnicity and the two originating neighbourhoods, namely the Northern Areas and Township Areas. The latter was the focus of this masters' degree study. It was found that girls were heavier and had a higher BMI and body fat percentage (BF%) in all age categories. Between ethnic groups, black learners were taller and heavier and had higher BMI and BF% values than coloured learners for all ages. Comparisons between the schools revealed that children attending Northern Areas schools had the highest prevalence of thinness, stunting



and underweight. In contrast, children from the Township Areas had the highest prevalence of obesity. Fitness measures revealed that boys presented with higher values for all the physical fitness components except for flexibility, in which girls presented with higher values across all ages. Black children performed better than Coloured children in all fitness tests, except in



the case of the standing broad jump test. From these results, children from the Northern Areas may be at a higher risk than children from the Township Areas, as a result of low fitness levels and undernutrition. This highlights the significance of promoting dual interventions for healthy eating and physical education. Physical education should be a vehicle to promote health for children that encourages healthy eating habits and participation in regular physical activity.



## The effect of a school-based physical activity intervention on the body composition of grade 4 children from lower socioeconomic communities

This study determined the effect of various combinations of school-based interventions on the body composition of grade 4 children from lower socioeconomic communities in Port Elizabeth, South Africa. After the first 10-week intervention period, only BMI and body fat % changed significantly from pre-to-post intervention assessments. Children participating in the nutrition intervention, had a statistically significant increase in BMI compared to the control groups. Body fat % decreased significantly in children who were exposed to the physical activity intervention when compared to the control group. For nutritional indicators, the health education intervention had an effect on children's



underweight status, with statistically significant body weight increases when compared to the control group, who showed no such changes. Findings suggest that participating in various combinations of school-based interventions have beneficial effects on body composition.

## The effect of a school-based physical activity intervention on the physical fitness of primary schoolchildren

The aim of this study was to investigate the effect of a school-based physical activity intervention on the physical fitness and body composition of 198 primary schoolchildren (95 boys and 103 girls) at two schools in the Motherwell Township in Port Elizabeth. The schools were randomly assigned to the intervention or control group. Physical fitness was measured along with body composition at baseline and then following two 10-week intervention cycles. The physical activity intervention proved to be successful with regards to body composition factors, as there was a decrease in body mass index, body fat

percentage, weight-for-age and BMI-for-age measures. With regards to the physical fitness parameters, the intervention increased the coordination and speed parameters, which were evaluated through the sideways jump test. The intervention had no significant effect on grip strength and standing broad jump, which represents upper and lower body muscular strength. Furthermore, no increase in cardiorespiratory fitness or flexibility was evident. It was therefore recommended that future physical activity interventions need to be of a longer duration and of higher intensity.

# The effect of school-based physical activity interventions on the attention and academic performance of grade 4 children from lower socioeconomic communities in Port Elizabeth

The aim of this study was to determine the effect of school-based physical activity interventions on the cognitive performance and academic achievement of grade 4 children from lower socioeconomic communities in Port Elizabeth. The school-based interventions incorporated three focal elements, namely, a broad PA intervention which included physical education and dance, a health and hygiene intervention as well as a nutrition intervention. Cognitive performance was assessed using the d2 test of attention which measures sustained, selective visual attention and concentration under stressful, time-constrained settings. The outcomes measured were accuracy (percentage of errors), processing speed (quantity of work) and concentration performance. Academic achievement was assessed using the end of



year results of four academic subjects. The comparison between pre- and post-intervention assessments indicated that the accuracy measures (attention) improved significantly after the nutrition intervention. Furthermore, a positive change in the academic performance was noted after the physical activity intervention. Hence, the implementation of school-based interventions, particularly that of physical activity, is recommended as an attractive and feasible method to not only increase children's physical activity status, but also to maintain cognitive attention levels and improve academic achievement. These findings suggest that the intervention programme had positive effects on the learner's concentration.





# Masters theses

## Switzerland

T1

T1

### **Comparing physical fitness, overweight and underweight respectively in disadvantaged schoolchildren in Port Elizabeth, South Africa: A field study**

The study investigated the correlation and differences between socioeconomic status, physical fitness and parasitic worm infections with regards to BMI. The data suggests that an infection with parasitic worms is associated with a lower shuttle run performance and a lower BMI percentile category. Furthermore, overweight children showed a weaker shuttle run performance. It is, however, possible that the worm infections are partly responsible for lower BMI results.

### **Cardiorespiratory fitness in 9-12 year-old children from eight disadvantaged schools: An international comparison**

The aim of this study was to investigate the differences between socioeconomic status and cardiorespiratory fitness among grade 4 schoolchildren at baseline. The results indicated that the socioeconomic status had no significant influence on cardiorespiratory fitness in the study population. A comparison of the data to international results showed that the shuttle run performance of the South African schoolchildren is comparable with results from international studies of the same age group.



T1

T2

### **Associations between physical fitness, socio-economic status and a school-based physical activity intervention**

The data from 772 grade 4 schoolchildren (382 boys and 390 girls) was compared before and after a physical fitness intervention was applied at the first 10-week block. Results indicated that for girls, lower body strength improved significantly between baseline and midline testing, whereas no significant effect

was seen on the other fitness components such as cardiorespiratory fitness and upper body strength. For boys, a significant improvement was seen in lower body strength and in the shuttle run tests, whereas no significant effect was seen on the other fitness components.



# Impact of DASH

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## Interview with the grade 5 Teacher and Head of Department (HOD) from Hillcrest Primary School, Ms Dorelle Isaacs

Hillcrest Primary School has 1084 learners attending the school. The neighbourhood is densely populated and overcrowded, with a high rate of unemployment. Gangsterism and drug abuse is rife and teenage pregnancy rates are high. Gangs often have “turf” wars over the trade of illegal drugs. These factors greatly affect the community, pupils and teachers at the school. Absenteeism is common due to many issues including parental neglect and the lack of shelter, clothes, school uniforms or shoes. Some learners are sometimes so hungry, they collapse during assembly. Learners are often traumatised by the prevalence of crime, including rape, murder, domestic violence and gang wars.

The intervention programmes from DASH improved the learners’ concentration, confidence and appearance, as well as their toilet routine, including hand washing hygiene. Teachers and learners thoroughly enjoyed the dance lessons which were conducted once a week. Teachers believe that it is easier to teach a happy learner and found that through



the intervention package, learners appeared to be happier and more co-operative during class. The deworming of the learners created an element of safety and health amongst the teachers.

I would recommend the DASH programme to other schools, since the school has improved in terms of physical education and personal health. The school’s nutrition has also improved in terms of utensil choice and cleanliness in the kitchen, as well as the menu that is chosen. Our learners were dewormed twice in 2016 and once in 2017. A second deworming will be conducted in September 2017. The new playground installations are very valuable and used extensively by all the schoolchildren.



*All these interventions improved the learners’ quality of life, and teachers’ too. Pupils were more attentive and this in turn was less stressful for the teachers.* Grade 4 teacher  
Grade 5 physical education teacher

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## Head of the Department of Medical Laboratory Sciences at the Nelson Mandela University, Mrs Leyli Zondie

The staff and students in the Medical Laboratory Science (MLS) department helped complete specific diagnostic tests on urine and stool samples collected during the DASH research project. Some of the diagnostic procedures are not routinely performed in the

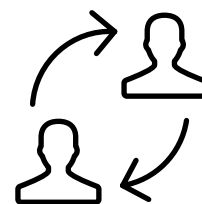
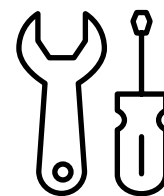


department and insight was gained through extensive training. Two groups of students assisted during the testing. These students were in the process of completing their BTech: Biomedical Technology (4<sup>th</sup> year) on a full time basis. The first group consisted of five female students that came from different local communities in the Nelson Mandela Metropole. The second group of students consisted of five male students that came from a South African Development Community (SADC) country (namely, Malawi) to complete their BTech qualification on a full time basis at Nelson Mandela University. The participation in the DASH project had a multi-fold impact, such as enhancing the diagnostic experience of the MLS department and by raising awareness for the parasitic burden linked to the local schools in the Nelson Mandela Metropole.

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## Director of the Centre for the Community School (CCS), Faculty of Education at the Nelson Mandela University, and former principal of Sapphire Road Primary, Dr Bruce Peter Damons

As a school principal, the project was extremely valuable for the school as an organisation on several levels. The project informed us about the impact of health and physical wellbeing not only on the life of the child, but on how it affected our learners' cognitive development as well. What made the project unique from other projects was that it did not only identify these difficulties, but provided complementary tools to be responsive to the challenges identified. Although there were challenges, our schooling community saw the DASH project as a great complementary tool. The findings of the project were shared with our parents, in parent meetings, and the broader community, through newsletters. As Director of the CCS, I am now able to share the knowledge gained through DASH with other schools across the country, and I am looking forward to engaging with the next phase of the project.

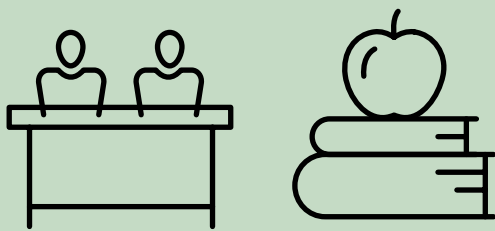
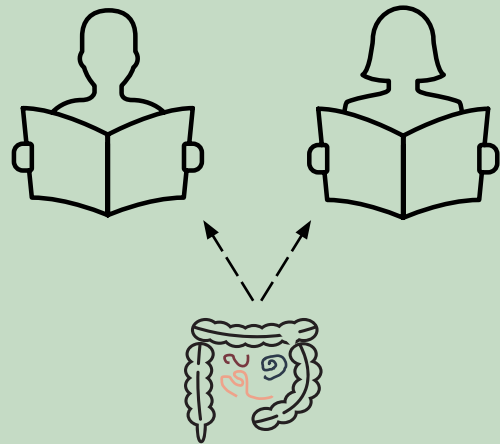


# Media release

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*“Worms partly responsible for lower academic results among children”*

Newspaper article in Dispatch Live;  
May 10<sup>th</sup>, 2017

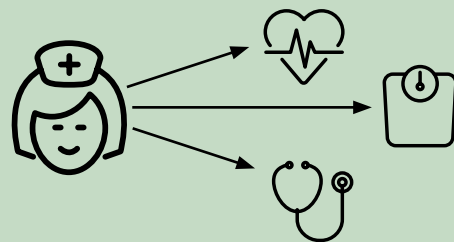


*“Little appetite for study on an empty stomach”*

Magazine article in UNI NOVA;  
October, 2015

*“Leerders se gesondheid bekyk”*

Newspaper article in BURGER (Oos Kaap);  
February 16<sup>th</sup>, 2016



*“NMMU in big takkie drive for schools”*

Newspaper article in HERALD;  
August 14<sup>th</sup>, 2015



# Awards & grants

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*2016 Grant from  
Freiwillige Akademische  
Gesellschaft, Basel*



**Freiwillige Akademische  
Gesellschaft** Basel  
Fonds zur Förderung von  
Lehre und Forschung

*2016 Award from  
aha! Swiss Allergy  
Centre, Berne*



ALLERGIEZENTRUM SCHWEIZ  
CENTRE D'ALLERGIE SUISSE  
CENTRO ALLERGIE SVIZZERA

*2017 Engagement  
Excellence Award,  
Port Elizabeth*

**NELSON MANDELA**  
UNIVERSITY



# Conclusion

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According to our results soil-transmitted helminth infections seem to affect South African schoolchildren in several ways. On the one hand, infected children have lower BMI, are more stunted, have a lower cardiorespiratory fitness, and perform worse in academics and attention measures. On the other hand, it was found that stool parasites in general, and especially helminth infections, have protective function with regards to developing sensitisations to house dust mites, German cockroach and grass pollen. Furthermore, a well-designed, multidimensional physical activity programme can lower the average increase in BMI and the thickness of skinfolds



in school-aged children from disadvantaged communities. To increase effectiveness and sustainability of the results, the intervention should be extended to cover the entire school term and adapted to additional age groups. As overweight is caused by diverse lifestyle behaviours, there is a need for longitudinal monitoring, relating to age, gender and school-grade specific assessments. Likewise, the dissemination of this school-based physical activity programme in South Africa may help to reduce risk factors for the development of chronic diseases among socioeconomically deprived children.

# Outlook *KaziBantu*

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Healthy Schools for Healthy Communities – *KaziBantu* builds on existing evidence that school-based health interventions can improve the health of schoolchildren and teachers in low-resource settings. The goal is to improve overall and cardiovascular health of students and their teachers by promoting health literacy, ensuring a formalized physical exercise program, providing access to medical examinations, monitoring cardiovascular risk, dispensing anthelmintic treatment, and offering nutritional supplementation where necessary. The joint efforts of different partners enable Healthy Schools for Healthy Communities – *KaziBantu* to scale more rapidly, whilst providing a key support network from the Swiss and South African partners, so that many more schoolchildren and teachers in low-income communities can live healthy and active lives.





# Novartis Foundation

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## Outlook of Healthy Schools for Healthy Communities; the *KaziBantu* Project

### Overview of Novartis Foundation and strategic priorities

The Novartis Foundation is a philanthropic organization which strives to have sustainable impact on the health of low-income communities through a combination of programmatic work, health outcomes research, and its translation into policy to tackle global health challenges. We work hand-in-hand with local and global partners to catalyze sustainable healthcare models to improve access and health outcomes, and to accelerate efforts to eliminate leprosy and malaria by focusing on interventions that aim to interrupt transmission. Everything we do is grounded in evidence and innovation, and our work is a continuous cycle of evaluation, adaptation and application.

Evidence exists showing that an improvement in children's nutrition and physical activity can reduce hypertension, heart disease, and as such overall cardiovascular risk. To date, there have been little to no comprehensive interventions that address cardiovascular health among students and teachers in low-income school settings. The learnings and successes from DASH shed light on the burden of both infectious disease and low physical health on childhood performance. Taking these learnings, the Novartis Foundation, Nelson Mandela University, University of Basel and the Swiss Tropical and Public Health Institute



have expanded the DASH program into the Healthy Schools for Healthy Communities initiative, which is called "*KaziBantu*" in Port Elizabeth, South Africa. The expansion of Healthy Schools for Healthy Communities to more schools in South Africa, as well as its potential replication in other geographical settings, offers an important opportunity to improve the health and academic performance of many schoolchildren around the world, while evaluating the impact of such interventions at large.





# Closing words

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## **Dr Ann Aerts, Head of the Novartis Foundation**

We know all too well that non-communicable diseases including cardiovascular disease (CVDs), present the new global health crisis.

At the Novartis Foundation, we realize that the complex nature of CVDs makes achieving impact, scale and sustainability extremely difficult. In addition, we know that study-based pilot methods have proven effective in testing new approaches and generating evidence for addressing their root causes. The enormous burden of CVDs, particularly in LMICs means that no single actor can tackle hypertension alone, but also that we have no time to lose. To address hypertension and its complications a multisector and multidisciplinary action is needed. This is why we are excited for the Healthy Schools for Healthy Communities – *KaziBantu* initiative to enter a new phase, and work with our partners to develop a toolkit for students and teachers.



## **Ms Christina Wadhwani, Head Incubator Models in Public Health, Novartis Foundation**

As the Novartis Foundation expands its incubator portfolio to innovate health service delivery in LMICs, Healthy Schools for Healthy Communities – *KaziBantu* provides us with the opportunity to make an impact on the health of young populations, starting in Port Elizabeth, South Africa. This initiative will finalize the toolkit to include interventions for all primary school grades, and to improve cardiovascular health among both students and teachers. This is the first Novartis Foundation incubator model that includes the education sector, bringing new opportunities for impact.



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