

# A HEALTHY START FOR EVERY CHILD



**TNO** innovation  
for life

Children with delayed development during infancy and early childhood can experience a lifetime of challenges. Of all children living in low- and middle-income countries, about 43% are at risk for developmental delay. The effort to improve the health and well-being of children around the world begins with a single way to measure and track child development, and compare it with that of children throughout the world. TNO and its partners came together to determine how it could be done.

#### TRACKING CHILD DEVELOPMENT

All parents enjoy their child's early milestones: first smile, first steps, first word and more. Healthcare professionals use such milestones to assess a baby's development and identify potential deficits. Healthcare providers, governments and NGOs use them to track child health nationwide. But milestones used can vary across countries. Only when all children are measured on the same scale, can we take effective action for those who need help most.

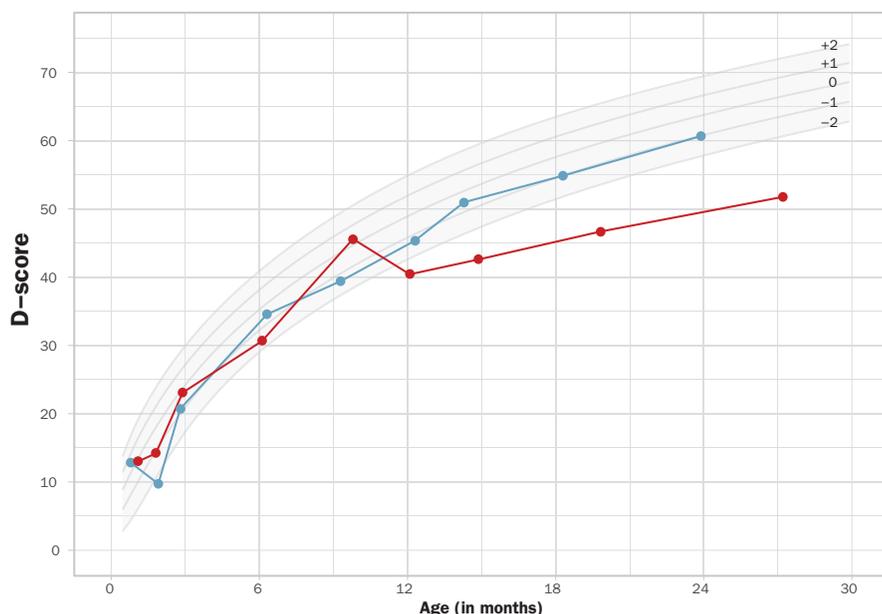
The World Health Organisation (WHO) sought a single, agreed-upon unit for measuring global child development. This would help detect delays at an early stage, and make intervention impact measurable. To advance child health across the world, the WHO aimed for a unit of child development that does not depend on the milestones used, and

whose interpretation is independent of culture.

#### INSIDE THE D-SCORE

TNO proposed a method to quantify child development as a single number, the D-score. This single, global system measures a child's physical, intellectual, social and emotional development on a universal, continuous scale. The WHO elected the D-score as the global standard. Together with international partners, TNO had established the first, globally acceptable system for tracking child development.

The D-score is based on the difficulty of each milestone. Difficulty estimates are known for 800 milestones in children aged 0-3 years. The D-score algorithm calculates the child's D-score from performance on a subset of these milestones. Since all D-scores are



Charting D-scores can identify unusual development early. Boy 1 (blue curve) shows consistent development, just below the mean. Boy 2's score (red) is similar until 9 months, but there is a substantial drop at month 12.

plotted on the same scale, it can track development of a single child over time, or compare the child's D-score to other children his or her age.

**CHARTING CHILD DEVELOPMENT**

Just because there is now an agreed global standard, doesn't mean it is instantly accessible in every corner of the world. And even those who are willing to adopt the D-score still need to visualise the information and make it easy to understand.

To address this need, TNO created JAMES: the Joint Anthropomorphic Measurement and Evaluation System. JAMES is an online platform that takes a child's milestone measurement information, turns it into a D-score, and maps it on a chart. JAMES can analyse and predict individual growth and development curves, potential deviations, national averages and more, giving healthcare providers and organisations the tools to visualise child health in their region and predict healthcare needs for the future. All while protecting the privacy of individual users.

Now in the pilot phase, TNO aims to expand JAMES into a full-service offering with curve matching capabilities, a reference library, protocol evaluation capabilities and much more. In short, JAMES aims to help improve a child's chances of a healthier life by making information and resources available with a simple mouse click.

**EARLY INTERVENTION IS KEY**

In an ongoing programme to contribute to the UN's Sustainable Development Goals, TNO is working on a series of initiatives called 'First 1,000 Days'. The initiatives aim to improve child health and well-being during the first, crucial 1,000 days of their lives, thereby improving the child's prospects for a healthier, happier life. The WHO's search for a global measuring system fits perfectly with these ambitions. Supported by the Bill & Melinda Gates Foundation and led by the WHO, TNO collaborates with – amongst others – Harvard University, Johns Hopkins University, Stanford University and the Inter-American Development Bank to enhance the lives of children worldwide.

**INNOVATION THAT IMPROVES LIVES**

Both the D-score and JAMES use TNO's strengths in applied research and technological expertise to address the UN's goals for child health and development. Using the latest techniques and insights, D-score is already in use in the Netherlands and is currently part of validation projects in Tanzania, Bangladesh, Ivory Coast, Pakistan and Brazil, to show its ability to work across borders.

Once the validation projects are completed, TNO aims to distribute these effective tools to as many (developing) countries as possible, and further expand JAMES's capabilities. In shared innovation projects, the open-source JAMES

technology can be used as the computational backbone in monitoring apps for parents, in platforms for paediatricians and physicians to track patient development, and in monitoring systems for healthcare organisations, NGOs and governments. With further development, JAMES offers a low-cost, global methodology for monitoring and improving child health and well-being, one child at a time, one country at a time.

**A BETTER LIFE FOR CHILDREN EVERYWHERE**

Every country in the world wants healthier, happier children. But defining and enhancing health and happiness can be a challenge. With D-score and JAMES, parents and healthcare professionals can use millions of data points and refined technology to precisely map a child's development and identify issues at an early stage. And, when milestones are missed, users can get access to resources that can help them fill in the gaps and get a child back on track.

Want to contribute to healthier, happier children in your country or a developing region? Contact us to find out how D-score and JAMES can lead to better child health, or how you can help to bring D-score and JAMES to their full potential.

**TNO.NL**

**FIRST 1,000 DAYS**

First 1,000 Days aims to give children the best possible start in life, regardless of where they are born. Together with the WHO, Harvard University, the Bill & Melinda Gates Foundation and more, this TNO initiative offers innovative solutions.

TNO  
 Schipholweg 77  
 Postbus 3005  
 2301 DA Leiden  
 T 088 866 90 00

Roelinde Bakker  
 E roelinde.bakker@tno.nl  
 T + 31 623 22 85 39