

## **Building Human Capacity through Early Childhood Intervention: The Child Development Research Programme at the Tropical Medicine Research Institute, The University of the West Indies, Kingston, Jamaica**

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### **ABSTRACT**

*Research conducted by the Child Development Research Group in the Tropical Medicine Research Institute has made significant contributions to the understanding of the importance of early nutrition and the home environment for children's development and the impact of psychosocial stimulation for disadvantaged and/or undernourished children. The work has provided critical evidence that has contributed to the increasing attention given to early childhood development in the work and policies of agencies such as the World Bank, World Health Organization (WHO) and United Nations Children Fund (UNICEF). This review concerns research which documented the impact of malnutrition on children's development and for the first time demonstrated the benefits and necessity of psychosocial stimulation for improvement in development. Subsequent research was critical in establishing the importance of linear growth retardation (stunting) as a risk factor for poor child development. A twenty-two-year study of stunted children has demonstrated benefits through to adulthood in areas such as educational attainment, mental health and reduced violent behaviour, from an early childhood home visiting programme that works through mothers to promote their children's development. The group's research has also demonstrated that it is feasible and effective to integrate the stimulation intervention into primary care services with benefits to children's development and mothers' child rearing knowledge and practices. The group is currently conducting a study to provide information needed for scaling-up of parenting programmes through evaluation of a new approach to improving parenting through health centres and a modified home visit programme.*

**Keywords:** Child development, early childhood, early nutrition, psychosocial intervention, Tropical Medicine Research Institute (TMRI), undernourished children

## **Construcción de la Capacidad Humana Mediante Intervención en la Primera Infancia: Programa de Investigación del Desarrollo Infantil en el Instituto de Investigación de Medicina Tropical, Universidad de West Indies, Kingston, Jamaica**

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### **RESUMEN**

*Una investigación dirigida por el Grupo de Investigación del Desarrollo Infantil en el Instituto de Investigación de Medicina Tropical, ha contribuido de manera significativa a comprender, por una parte, la importancia que tanto la nutrición temprana como el ambiente hogareño poseen para el desarrollo infantil de niños, y por otra parte, el impacto de la estimulación psicosocial para los niños desfavorecidos y/o desnutridos. La evidencia crítica ofrecida por este trabajo ha hecho que se le*

*conceda mayor atención al desarrollo de la primera infancia en el trabajo y las políticas de agencias como el Banco Mundial, la Organización Mundial de la Salud (OMS) y el Fondo de las Naciones Unidas para la Infancia (UNICEF). Este estudio trata de una investigación que documenta el impacto de la desnutrición en el desarrollo de niños, y por primera vez demuestra los beneficios y la necesidad de la estimulación psicosocial para favorecer el desarrollo. La investigación subsiguiente fue decisiva para establecer la importancia del retraso del crecimiento lineal (RCL) como un factor de riesgo para el desarrollo del niño pobre. Un estudio de veintidós años sobre niños con retraso en el crecimiento ha demostrado los beneficios hasta llegar a la adultez, en áreas como la educación, la salud mental y la reducción del comportamiento violento, a partir de un programa de visita a hogares de la primera infancia, que trabaja con las madres para promover el desarrollo de sus hijos.*

**Palabras claves:** desarrollo infantil, primera infancia, nutrición temprana, intervención psicológica, Instituto de Investigación de Medicina Tropical (IMT), niños malnutridos

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## INTRODUCTION

Child development research was introduced into the Tropical Metabolism Research Unit (TMRU), Jamaica, in 1972 by Professor Sally Grantham-McGregor. From small beginnings with just one academic staff member, a PhD student and a research nurse, the programme has developed into the Child Development Research Group now based in the Epidemiology Research Unit within the Tropical Medicine Research Institute, The University of the West Indies (UWI), Mona, Jamaica. The research began with studies on the development of severely malnourished children but the scope widened to include research on disadvantaged children in general, the impact of nutrition and health in school-aged children and interventions to promote social emotional competence and reduce aggression in young children<sup>1</sup>. This paper focusses on selected papers over the years which made important contributions to the understanding of the importance of early nutrition and the home environment for children's development and the impact of psychosocial stimulation for disadvantaged and/or undernourished children. The research is internationally recognized and has provided critical evidence that has contributed to the increasing attention given to early childhood development in the work and policies of agencies such as the World Bank, World Health Organization and United Nations Children Fund.

### Severely Malnourished Children

The first paper that will be reviewed described a prospective study of the mental development of severely malnourished children admitted to the TMRU ward. In the 1960s–1970s, there were studies showing that early childhood malnutrition was associated with poor cognitive development and school achievement (1, 2), however, there were few studies which evaluated interventions aimed at improving their development. The main aim of the first phase of the study was to compare the developmental levels of severely malnourished children admitted to the ward of the TMRU and Department of Child Health with that of adequately nourished children, matched for socio-economic background and age and ad-

mitted to the same hospital wards for reasons other than malnutrition. Other studies of severely malnourished children in hospital had found that they initially had low levels of development that improved with nutritional rehabilitation and the researchers attributed this to improved nutritional status (3). No prior study had included an adequately nourished group who were also hospitalised. Grantham-McGregor *et al* found that the adequately nourished children also had low initial developmental levels that improved with recovery. The difference between the groups was that the malnourished children had much lower developmental levels throughout, and showed no sign of reducing this deficit compared with the adequately nourished group following nutritional rehabilitation and recovery (4). This suggested that the pattern of improving scores in hospital in both groups was most likely attributable to the children feeling better and getting familiar with hospital, as well as test practice and probably not to improving nutritional status. It also suggested that nutritional rehabilitation alone was unlikely to be sufficient to reduce the malnourished children's developmental deficit.

In the second phase of the study, all severely malnourished children admitted to the same wards the following year participated in a play programme while in hospital and a home-visiting programme for the following three years. A nurse conducted individual structured play sessions with the malnourished children on the ward every day. Community health aides (CHAs) were trained to do the home visiting which continued the play sessions, involving the mother and showing her how to continue the activities in between the visits. The children were visited for one-hour a week for two years then once every two weeks for a third year.

Initially, the intervened group had similar nutritional status and developmental levels as the non-intervened group studied in the previous year. They showed rapid improvement in development in hospital that continued at home (5) and caught up with the adequately nourished group 24 months after leaving hospital. Following cessation of the intervention, however, there was a decline in their develop-

mental levels but they remained above those of the control malnourished group. We reassessed all groups between 16 and 17 years of age (6) and found that the control malnourished group remained with much lower IQs (Fig. 1) and

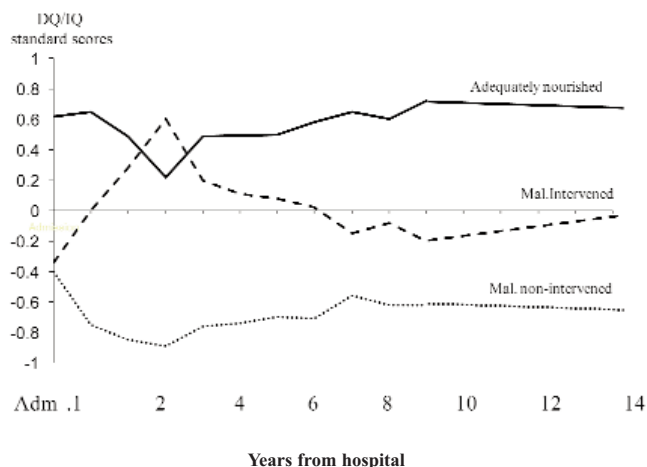


Fig. 1: Standard scores, adjusted for age, of three groups\* on enrolment (average age 2 years) and at each test session for 14 years following leaving hospital.

Grantham-McGregor *et al*, 1994 (6).

\*Adequately nourished, malnourished intervened, malnourished non-intervened

school achievement levels than the adequately nourished group and showed no sign of reducing their original deficit. On the other hand, the intervention group had IQ levels between the two other groups with significantly higher IQs than the control malnourished group.

The findings highlighted the continuing poor development of severely malnourished children if they were only given medical and nutritional care. Importantly, they demonstrated that the children's development could improve with intervention that provided stimulation. The sustained benefits from the stimulation were very encouraging.

### Linear Growth Retardation and Development and the Impact of Intervention

By 1980, describing child growth according to linear growth retardation (low height-for-age or stunting) and low weight-for-height (wasting) became the accepted way of classifying undernourished children (7). Re-analysis of the data from the study with severely malnourished children showed that the level of children's development was more closely related to degree of stunting on admission to hospital than to wasting or the presence of oedema (8). This brief but important paper suggested that stunting may have a role in the poor development of undernourished children and challenged the view that stunting was a harmless adaptation to inadequate dietary intakes, with few functional consequences, as was commonly thought at the time. In addition, linear growth retardation

affects many more children than severe acute malnutrition, approximately 30% of children less than five years of age in developing countries are stunted [height for age < -2 z-scores] (9). We, therefore, decided to look at the development of stunted children to determine whether stunted children had poorer development than non-stunted children and whether their development improved with nutritional supplementation with or without stimulation.

This landmark study comprised a two-year trial with 127 stunted children identified by survey of several poor neighbourhoods in Kingston as well as a group of adequately nourished non-stunted children from the same neighbourhoods (10). The stunted children were randomly assigned to one of four groups: nutritional supplementation, stimulation, both interventions or a control group which received health-care only. All children were visited weekly when morbidity was monitored. The supplement comprised one kilogram of milk powder delivered to the homes of the supplemented children every week as well as some additional food for the family.

The stimulated children had weekly play sessions similar to the approach used in previous studies. The objectives of the programme were to increase the mother's ability to promote her child's development through play, to improve mother-child interaction and to promote the self-esteem of both mother and child. At the weekly one hour home visit, the CHAs demonstrated play techniques and involved the mother in a play session with her child. Mothers were encouraged to continue play activities between the visits and to integrate them in their daily routines. They were encouraged to chat with their children and to label objects and actions. Emphasis was placed on the use of praise and positive reinforcement, and physical punishment was discouraged. Toys made from commonly discarded household materials and simple picture books were left in the home and exchanged each week.

The children's development was measured on the Griffiths Mental Development Scales at intervals throughout the study. Initially, the stunted children had significantly poorer developmental levels than the non-stunted group, and the study was one of the first to demonstrate the relationship between stunting and poor child development. Stunting is now considered one of the key risk factors contributing to poor development among young children in low and middle income countries (11).

The deficit in the control stunted group compared with the non-stunted children increased over the study period. In contrast, both stimulation and nutritional supplementation improved the children's development and the effects were additive. The group receiving both treatments caught up in development to the non-stunted children by the end of the two years of the study [Fig. 2] (10). The supplemented children showed a small growth benefit (12).

The stunted cohort was reassessed in later childhood and adolescence and these studies are summarized in the

Table. At seven years, small benefits were found to cognition from each intervention but there were no longer any benefits to growth (13, 14). At ages 11 and 17 years, there were sustained benefits from stimulation to cognition, and to reading ability at age 17 years, whereas nutritional supplementation no longer had any benefit (15, 16). At 17 years, we also demonstrated for the first time that stimulation had benefits for psychological functioning (17).

The non-stimulated groups (control and nutritional supplementation only) had marked and significant deficits compared with the non-stunted group in all but one of 12 cognitive tests administered at age 17 years demonstrating the continuing negative effects of early childhood stunting. They also reported more problems with psychological functioning in areas such as depression and anxiety. In contrast, the stunted children who received stimulation had few significant deficits compared with the non-stunted group.

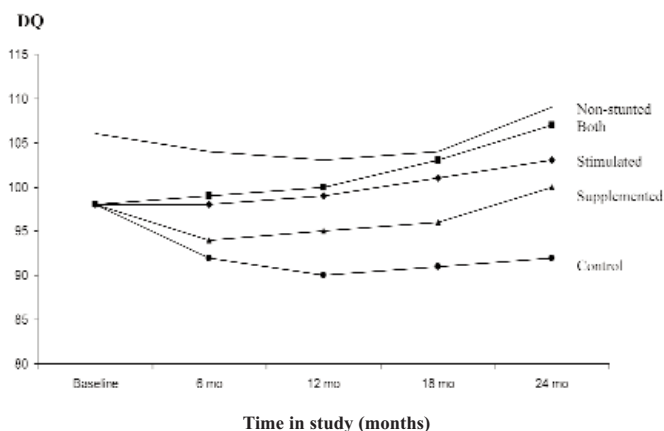


Fig. 2: Mean developmental quotients (DQ) of stunted groups adjusted for initial age and score, compared with non-stunted group.

Grantham-McGregor *et al*, 1991 (10).

Table: Long-term effects of psychosocial stimulation: follow-up of the Jamaica study from age 7 to 18 years

Age at follow-up (years)	Cognition	Outcome Education	Behaviour
7-8 Grantham-McGregor <i>et al</i> 1997 (13)	Simulation groups (and supplement only group) had better scores than control group on 13-14 of 15 tests (sign test $p = 0.01$ ). Significant benefits for perceptual motor function.	No significant benefits for school achievement	Not assessed
11-12 Chang <i>et al</i> 2002 (21) Walker <i>et al</i> 2000 (15)	Significant benefits from stimulation for IQ (effect size 0.52 SD), reasoning ability, and vocabulary compared with control group. No benefits for two other language tests and tests of memory and attention	Suggestive of benefits for reading, spelling, and comprehension (all $p < 0.1$ ) but not mathematics	No benefits for behaviour by teacher and parent reports
17-18 Walker <i>et al</i> 2005, 2006 (16, 17)	Significant benefits to IQ (effect size 0.51 SD) vocabulary and reasoning ability compared with no-stimulation groups (control and supplement only)	Significant benefits for reading and comprehension. No benefits for mathematics. Reduction in school dropout rate.	Significant reduction in symptoms of anxiety and depression, and higher self-esteem. No effect on antisocial behaviour. Fewer attention problems by parents' report and suggestive of reduced oppositional behaviour ( $p = 0.1$ ).

Adapted from Walker, 2011 (22).

These findings have serious implications both for stunted children and for the development of countries where stunting is prevalent. They indicate that stunted children have

wide ranging cognitive and educational deficits and that improving nutrition only is unlikely to lead to long-term improvements. However, the benefits from stimulation demon-

strate that long term outcomes including cognition, education and mental health can be improved with intervention in early childhood.

We re-examined the participants at age 22 years to determine whether benefits to IQ and psychological functioning were sustained to adulthood and to examine possible effects on educational attainment, general knowledge and behaviour. In this round of follow-up, we were able to include participants who emigrated. One hundred and five participants were assessed (82.7% of 127 who completed the initial study).

Compared with the non-stimulated groups (control and supplementation only) the participants who received stimulation had higher adult IQ, higher educational attainment (achievement in mathematics and reading, grade level attained and secondary exams), better general knowledge and fewer symptoms of depression and social inhibition (18). Participants who received stimulation were also less likely to have been expelled from school, usually a result of behaviour problems (4% of participants in the stimulation group compared with 17% of those who did not receive stimulation). They reported less involvement in physical fights and were less likely to be involved in serious violent behaviour such as gun use, fights with weapons and gang membership (Fig. 3).

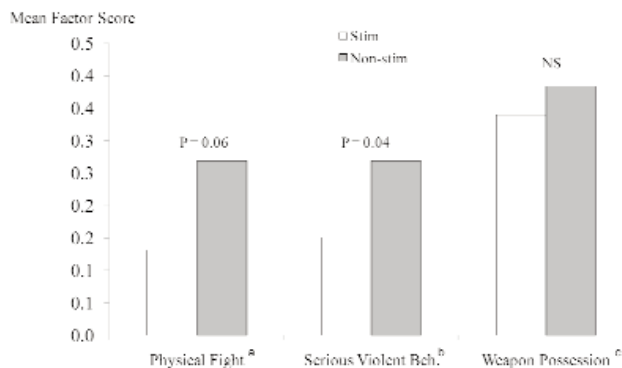


Fig. 3: Effect of early childhood stimulation on violent behaviour at age 22 years

- a Involved in physical fight or started fight
- b Involved in: fight with weapon, hurt someone with weapon, carry gun in past month, threatened someone with gun, shot someone with gun, or gang member
- c Carried weapon in past month or ever threatened someone with a weapon

There were no differences in weapon possession. These findings reinforce the importance of starting interventions in the early childhood years in order to prevent aggressive behaviour in young adults.

This study provides the most comprehensive data on the adult benefits of early psychosocial stimulation for disadvantaged children from a developing country. The findings suggest that early childhood development (ECD) programmes can reduce the large number of children who do not

attain their developmental potential. Benefits to educational attainment, general knowledge and psychological functioning are likely to improve everyday functioning. The reductions in violent behaviour are particularly important, given the substantial problems with societal conflicts in many developing countries.

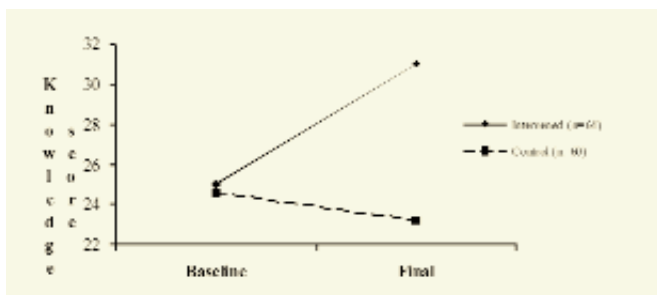
The benefits of early psychosocial intervention for adult educational attainment and behaviour have important policy implications. The challenge now is to develop effective strategies for scaling-up of interventions to reach the millions of children worldwide at risk of poor development. This will require identifying opportunities for integrating child development activities within existing services.

### Integrating Stimulation into Services

Powell and colleagues (19) conducted a study to demonstrate the feasibility of integrating the stimulation intervention described previously into the Jamaican primary care services and the impact of the intervention when delivered by primary healthcare staff rather than CHAs specially hired to our research programme. The study was a cluster randomized trial conducted in 18 health centres in Kingston, St Andrew and St Catherine, Jamaica. Community health aides assigned to intervention health centres were trained in the stimulation programme and asked to visit the homes of moderately underweight children weekly for one year. The study demonstrated that the health aides could add home visits to their usual activities and managed to visit children approximately once every 10 days. Children in the intervention clinics showed substantial benefits to their development compared with children in the control clinics. The study also showed that mothers' knowledge of child rearing improved, and they provided better stimulation in the home for their children (Fig. 4). This is an important finding as it suggests that intervention benefits may be sustained through maternal gains in child rearing knowledge and practice. Mothers who participated in the intervention showed a reduction in depressive symptoms compared with those in the control group (20). This suggests that parenting interventions have the potential to improve maternal mental health which would be an additional pathway through which benefits to child development could occur.

In collaboration with the Inter-American Development Bank and the Ministries of Health in Jamaica, Antigua and Barbuda, and St Lucia, we are implementing a project to evaluate two approaches to early intervention which can be delivered at scale. A new approach "The health centre intervention" is being implemented at child health clinics and includes showing videoed child development messages, and CHA led discussions and demonstrations of the messages. The intervention takes place at the routine child health clinics from age three to 18 months. "The home visiting intervention" will be similar to one used previously in Jamaica modified from weekly to fortnightly visits to increase the feasibility of scaling-up. As before, CHAs conduct play ses-

## Change in maternal knowledge



## Change in maternal practices

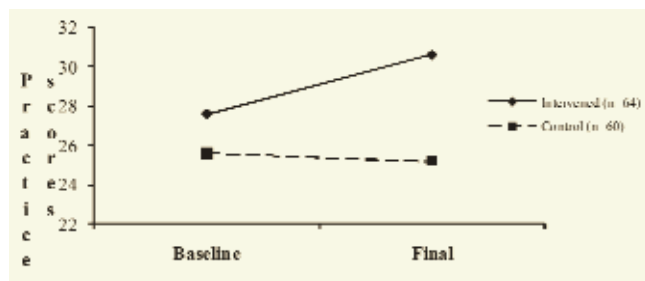


Fig. 4: Maternal knowledge of child care and stimulation practices in intervention and control groups.

sions with the mother and child to demonstrate activities to promote development. All CHAs were trained in the appropriate interventions (health centre or home visiting) before the start of the study. Both approaches are being evaluated in Kingston and St Andrew (KSA), Jamaica, and the health centre intervention is also being evaluated in Antigua and Barbuda, and St Lucia. Health centres have been randomized to intervention (health centre, home visit or both interventions) or control. When the children are aged 18 months their development will be measured and the mothers' knowledge and practices related to child development will be assessed.

## CONCLUSION

We showed that the development of disadvantaged children is at serious risk both from lack of stimulation and poor nutrition. Both severely malnourished children and stunted children are particularly vulnerable to poor mental development. The study of stunted children provides some of the most comprehensive evidence on long term consequences of early childhood stunting to cognition and educational achievement. It also provided the first evidence showing long term problems in psychological functioning. Deficits continue to adulthood and are likely to contribute to the continuation of the poverty cycle.

The follow-up to adulthood of participants in an early childhood psychosocial intervention showed benefits to cognitive ability and psychological well-being through to age 22 years. The benefits came from a relatively low cost intervention that focussed on working through mothers to promote their children's development. The findings provide evidence to international agencies and governments of the importance of integrating stimulation programmes into nutrition and health services for young children.

We have also demonstrated that it is feasible to integrate the stimulation intervention into primary care services. Early child development has become an increasingly important priority for several international agencies including the World Bank, Inter-American Development Bank, WHO and UNICEF. However, implementation of strategies for children 0–3 years has been constrained by lack of consensus on effective interventions which are feasible to be implemented at scale. The study we are now conducting in health centres in KSA should reduce this knowledge gap by providing important information for scaling-up of the home visiting programme as well as an evaluation of a new approach to improving parenting practices which could reach larger numbers of families.

## Footnote

- 1 Information on other aspects of the Group's work can be found in "The House that John Built: The Tropical Metabolism Research Unit, The University of the West Indies, 1956–2006. Kingston: Ian Randle Publishers; 2007"; "Nutrition, health and child development: research advances and policy recommendations. Washington DC: Pan American Health Organization; 1998; Baker-Henningham *et al.* Reducing child conduct problems and promoting social skills in a middle-income country: cluster randomized controlled trial. *Br J Psychiatry* 2012.

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