

THE LADDOO PROJECT

AN INDEPENDENT EXTERNAL EVALUATION

LOUIS POTTER

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MAIN SUPERVISOR: JOEL MONÁRREZ-ESPINO

CO-SUPERVISOR: ANNELI ERIKSSON

ABSTRACT

The Laddoo Project is a nutritional intervention targeting child undernutrition in the urban slums of Pune, India. Using established mixed methods of evaluation in development, the aim of this assessment was to identify the strengths and weaknesses of the project from design through to implementation using the OECD-DAC evaluation criteria. From a design aspect, the project was shown to be well thought out in terms of relevance and sustainability. However, insufficient forethought to the scientific method leads to inconclusive evidence of the effectiveness, efficiency and impact of the project. Statistical analysis of the available data shows a significant reduction in the prevalence of stunting, but not in wasting. In such a short followup period, this is a highly anomalous result and further investigation is required. It is hoped that this report will act as a learning process for the key stakeholders and accountability to beneficiaries. From this, practical recommendations will aim to improve the project in its current form and possible expansion.

Key words: evaluation, nutrition, supplementation, India

DECLARATION

I hereby certify that the research question, literature review, study design, data analysis and interpretation of this project are my own. I also confirm that this report is my own work and that I am the only person held responsible for its contents. All sources of information, printed or electronic, reported by others are indicated in the list of references in accordance with international guidelines.

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LIST OF ABBREVIATIONS

ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
DAC	Development Assistance Committee
DGS	The Deep Griha Society
DI	Design Impact
DOB	Date of birth
GDP	Gross Domestic Product
HAZ	Height-for-age z-score
ICDS	Integrated Child Development Service
IMCI	Integrated Management of Childhood Illness
LMIC	Low- and middle-income countries
MAM	Moderate acute malnutrition
MMS	Midday Meal Scheme
MUAC	Mid Upper Arm Circumference
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
PLW	Pregnant and lactating women
RDA	Recommended Daily Allowance
SATHI	Support for Advocacy and Training to Health Initiatives
SAM	Severe acute malnutrition
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
TSP	The Sphere Project
UNICEF	United Nations Children's Fund
WAZ	Weight-for-age z-score
WFP	World Food Programme
WHO	World Health Organization
WHZ	Weight-for-height z-score

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I hope this report proves an interesting read and a useful learning resource for future projects in the field.

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1. INTRODUCTION

Child malnutrition is an ongoing public health priority. In its various forms, malnutrition affects hundreds of millions of children worldwide – many of whom live in India. It is a complex issue with no single solution. Small-scale local interventions provide the opportunity for malnutrition to be addressed from within a community in a culturally sensitive manner. The use of evaluations as a learning and accountability tool in humanitarian work is well established and it is only through critical evaluation that humanitarian and development projects can truly help their intended beneficiaries in the most positive way possible.

In 2013, I worked in Pune, India as the coordinator of an HIV prevention project with a non-governmental organisation (NGO) called the Deep Griha Society (DGS). During this time, I became aware of the Laddoo Project – a nutritional supplementation program run by the US-based NGO, Design Impact (DI) in partnership with DGS. I was impressed by its design and sensitivity to the local context. Upon commencement of my studies at the Karolinska Institutet, I maintained contact with the personnel of the Laddoo Project. When, in November, it was time to plan my thesis, I contacted the directors of DI and DGS and was granted permission to use the project and its data as the basis for my thesis. Although a short internal assessment of the project had been performed, I wanted to discover the project's strengths and weaknesses by examining it in detail, with the hope of providing constructive feedback to both DI and DGS for the project's continuation and possible expansion.

2. BACKGROUND

To fully understand the aim of the Laddoo Project and this evaluation, it is important to first provide a brief outline of the main topics being considered. In this section the role, method and value of evaluations in the humanitarian field are examined, followed by a background study of malnutrition and interventions to treat or prevent it. Malnutrition in the Maharashtra and Pune context will then provide the background for a procedural report of the Laddoo Project itself.

2.1. EVALUATIONS

Since the early 1990s, the importance of evaluating aid and development projects in low- and middle-income (LMIC) settings as a means of providing accountability and quality has been acknowledged (1). Pushed by the failures of governments and humanitarian organisations during the 1995 Rwandan genocide, the Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP) and The Sphere Project (TSP) were established in 1997 to formalise this process (2, 3). The standards laid out in the subsequent resources released by ALNAP and TSP – along with the Organisation for Economic Co-operation and Development’s (OECD) Development Assistance Committee (DAC) existing framework – explain that evaluations of interventions are essential to ensure that they are of a high quality and accountable (1, 4, 5). Particularly within the humanitarian sector, the importance of learning to direct finite resources to achieve high quality outcomes is essential. Likewise, accountability is an essential tenant for any organisation to legitimately claim it is acting in the best interests of its beneficiaries.

Improving quality and accountability are seen by some as mutually exclusive aims that should be addressed in separate evaluations (4, 6). When tackling both aims, there are a number of significant hurdles as an internal or external investigator. These inevitably include: possible conflicts-of-interest; ensuring that the criticism is constructive in its nature; and seeing that recommendations are clear and actionable (4). Additionally, it is important to triangulate the process of evaluation where possible; using mixed qualitative and quantitative methods to enhance the reliability and understanding of results, whilst ensuring that the perspectives of all key stakeholders (including beneficiaries) are taken into account (7).

ALNAP suggests using the OECD-DAC criteria¹ (8) as a basis for evaluations (9) (see Table 1). These criteria offer a useful and logical means to structure an abundance of information of varying quality from different sources and will form the structure of the 'Findings' section of this document.

Table 1: OECD-DAC evaluation criteria as laid out on the DAC website	
Relevance	The extent to which the aid activity is suited to the priorities and policies of the target group, recipient and donor. In evaluating the relevance of a programme or a project, it is useful to consider the following questions: <ul style="list-style-type: none"> • To what extent are the objectives of the programme still valid? • Are the activities and outputs of the programme consistent with the overall goal and the attainment of its objectives? • Are the activities and outputs of the programme consistent with the intended impacts and effects?
Effectiveness	A measure of the extent to which an aid activity attains its objectives. In evaluating the effectiveness of a programme or a project, it is useful to consider the following questions: <ul style="list-style-type: none"> • To what extent were the objectives achieved / are likely to be achieved? • What were the major factors influencing the achievement or non-achievement of the objectives?
Efficiency	Efficiency measures the outputs – qualitative and quantitative – in relation to the inputs. It is an economic term which signifies that the aid uses the least costly resources possible in order to achieve the desired results. This generally requires comparing alternative approaches to achieving the same outputs, to see whether the most efficient process has been adopted. When evaluating the efficiency of a programme or a project, it is useful to consider the following questions: <ul style="list-style-type: none"> • Were activities cost-efficient? • Were objectives achieved on time? • Was the programme or project implemented in the most efficient way compared to alternatives?
Impact	The positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended. This involves the main impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators. The examination should be concerned with both intended and unintended results and must also include the positive and negative impact of external factors, such as changes in terms of trade and financial conditions. When evaluating the impact of a programme or a project, it is useful to consider the following questions: <ul style="list-style-type: none"> • What has happened as a result of the programme or project? • What real difference has the activity made to the beneficiaries? • How many people have been affected?
Sustainability	Sustainability is concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn. Projects need to be environmentally as well as financially sustainable. When evaluating the sustainability of a programme or a project, it is useful to consider the following questions: <ul style="list-style-type: none"> • To what extent did the benefits of a programme or project continue after donor funding ceased? • What were the major factors which influenced the achievement or non-achievement of sustainability of the programme or project?

¹ N.B. There are two sets of OECD-DAC criteria: five that are more general – efficiency, effectiveness, impact, sustainability, relevance – and a set of seven – relevance/appropriateness, connectedness, coherence, coverage, efficiency, effectiveness, impact – that are for complex emergencies. This evaluation will refer to the original five as these are more appropriate to the context.

Understanding the rational basis for evaluating development initiatives is crucial to initiating and performing them effectively. This paper aims to use this information to conduct an independent and high quality assessment of the Laddoo Project.

2.2. CHILD MALNUTRITION

Child malnutrition – which encompasses both undernutrition and overnutrition – remains a serious and complex global issue, particularly in LMIC settings (10). While overnutrition is of increasing importance in the global health field, this paper is targeting undernutrition and its most prevalent associated conditions (11). These are: stunting, wasting and underweight and micronutrient deficiencies; the symptoms and immediate causes of which are outlined below. A higher risk of mortality through developing disease is present for children with any of these four conditions, and this risk grows progressively with the severity of each (11, 12). Undernutrition is often the cause of death in cases of comorbidity with infectious diseases (11, 13). That is, cases where the disease alone would not have led to death, had undernutrition not been present. Mortality rates for diarrhoea, pneumonia and measles also rise when combined with all forms of undernutrition (11).

Wasting – Wasting is the condition most universally recognised as being caused by undernutrition and is often characterised by affected individuals appearing very thin (14). Wasting is the product of acute undernutrition and is usually present in times when food security is not assured – such as a famine or other food shortage (15). It affects 52 million children under five years globally (11). Of these, 19 million are severely wasted – a condition leading to serious imminent health implications (11). Wasting occurs:

“...as a result of recent rapid weight loss, or a failure to gain weight within a relatively short period of time. Wasting occurs more commonly in infants and younger children, often during the stage when complementary foods are being introduced and children are more susceptible to infectious diseases. Recovery from wasting is relatively quick once optimal feeding, health and care are restored. Wasting occurs as a result of deficiencies in both macronutrients (fat, carbohydrate and protein) and some micronutrients (vitamins and minerals).” (16)

Wasting can be measured clinically or anthropometrically using the weight-for-height measurement system, whereby a child's weight (in kilograms) and height (in centimetres) are compared to the World Health Organization's (WHO) Child Growth Standards which follow a normal distribution curve (16). When a weight-for-height z-score (WHZ) – an expression of the number of standard deviations (SD) away from the median – is between -2 and -3, the child is said to be 'wasted' or Moderately Acutely Malnourished (MAM) (16). Cases that are below -3 SDs are categorised as Severe Acute Malnutrition (SAM) (16). The use of one international growth standard for under five years of age is applicable as it is only at school age that ethnic growth disparities are found to occur (16, 17). WHZ is especially useful for assessing nutrition in humanitarian emergencies, and classifications will often dictate the method of intervention used, depending on whether affected populations fall under MAM or SAM (16). MAM is associated with a three to four times higher mortality rate than normal, while a child suffering from SAM is nine times more likely to die than a well-nourished child (14).

Treatment for wasting is generally focused on restoring the nutrients lost through specialised foods (14). This can be achieved through in-patient care or the home-based use of Ready-to-Use Therapeutic Foods (RUTFs) (18). Several systematic reviews have shown RUTFs to be effective in the treatment of MAM (14, 19, 20), but in cases of SAM the evidence supporting their exclusive use is largely inconclusive (18, 21). However, RUTFs still form the basis of the responses to SAM, usually in addition to further health screening and preventative treatments (14, 16, 22).

Stunting – Stunting (or chronic malnutrition) is a failure to reach the optimal height for one's age group and is classified as a height-for-age z-score (HAZ) falling below -2 SDs away from the median of the WHO's Child Growth Standards (16). Stunting occurs:

“...as a result of inadequate nutrition over a longer time period, which is why it is also referred to as chronic malnutrition. It is a slow, cumulative process, the effects of which are not usually apparent until the age of two years, although to prevent stunting action is needed before a child reaches the age of two. Stunting is not a good indicator of growth failure in emergencies as it does not reflect recent changes and requires a long-term response. The effects of stunting are not completely reversible, and children who suffer from chronic malnutrition and become stunted will grow up to become small adults.” (16)

Child stunting has decreased an estimated 35% in the last 25 years, but remains widely endemic in many areas with an estimated prevalence of 165 million among under fives (11). In addition to the immediate health risks – especially for stunted women during pregnancy –, stunting poses a significant long-term problem due to its negative effect on cognitive development and human capital later in life (11, 14, 23). Stunting has also been shown to increase behavioural problems (11) and lead to poor health in later life (14).

Research investigating stunting has repeatedly shown the first 1,000 days from conception as the most important for effective treatment, which can target pregnant and lactating women (PLW) (11, 14, 23). Measures need to be long-term due to the chronic nature of the condition and can include: complementary feeding for breastfeeding children 6-23 months (14); improved nutrition education (22); and the rollout of the WHO's Integrated Management of Childhood Illness (IMCI) programme (22). Research into the use of supplementary feeding to treat stunting has not been conclusive and more research is needed on the topic (22, 24).

The prevention of stunting through policies targeting the underlying and basic causes of malnutrition (explained below) is essential (14) and the long-term nature of stunting makes HAZ a useful measure of a country's healthcare infrastructure and the progress of long-term development projects (16).

Underweight – Being underweight is classified as a weight-for-age z-score (WAZ) below -2 SDs from the median of the WHO Child Growth Standards. Unlike wasting and stunting, underweight is not a medical condition in itself. Instead it acts as a:

“...composite index, which reflects either wasting or stunting or a combination of the two. Rapidly changing weight-for-age can be assumed to be the result of changing weight-for-height” (16).

As a result interventions tend not to target WAZ specifically, but it can still be used to approximate the nutritional condition of a population.

Micronutrient deficiencies – Micronutrient deficiencies also pose a serious threat to child health. Some of the most significant of these are deficiencies in iron, iodine, vitamin A or zinc that all have adverse effects on growth and development (14). Iron-deficiency anaemia is estimated to present in roughly 18% of children worldwide (11). Conditions caused by micronutrient deficiencies can be effectively treated through micronutrient

supplementation or fortification (14, 22) which is often included with treatments for stunting or wasting (14). It is not clear if this also improves rates of growth (22).

A good understanding of the causes, symptoms, treatments and preventative measures of the conditions associated with undernutrition is essential to ensure that interventions are effectively targeted and efficient (16). The United Nations Children’s Fund (UNICEF) breaks down the causes of undernutrition into immediate, underlying and basic causes (15). The immediate causes are inadequate dietary intake and disease which are closely affected by one another (15). Underlying causes encompass household food insecurity, inadequate care and poor public health as a result of income poverty (15). Finally, basic causes consider the social, economic and political context from which these other causes arise (15).

The necessity to think beyond adequate food intake alone as a treatment and preventative measure of undernutrition is imperative if effective interventions are to be carried out. Projects that aim to prevent stunting must consider long-term goals in public health as key due to the chronic nature of the condition (14) and, likewise, interventions aimed at treating SAM need to consider the IMCI as an essential tenant of their programme. Many measures must also target PLW (22). Low birthweight and micronutrient deficiencies in the mother have been shown to correspond to an increase in undernutrition at later stages of childhood (22, 23). The intrinsic link between the health policies of governments and the nutrition of its people has been recognised and measures tackling the underlying and basic causes will ultimately be much more efficient in preventative utility than any treatment programme (25, 26).

2.3. MALNUTRITION IN MAHARASHTRA AND PUNE

The state of Maharashtra is located in the western region of India and is home to over 112 million people (the second most populous state in India) (27). The state capital is Mumbai – India’s largest city – and it is India’s richest state; contributing over 13% of the country’s Gross Domestic Product (GDP) (27). Like most of India, there is a tremendous disparity between the richest and poorest (28). Poverty in Maharashtra is slightly below the national average – 22% – at 17% and urban poverty is estimated to be around 9% (29). The city of Pune, is approximately five hours drive east from Mumbai and sits 560 metres above sea level (30). The city has a population of 6 million (making it the seventh

most populous city in India) and the most widely spoken language is Marathi, followed by Hindi and English (30). Around 40% of Pune's inhabitants live in its 560 plus slums in poor conditions (31, 32).

Child malnutrition, in all its forms, is endemic in Maharashtra. Statewide: 46% of children under five are stunted; 17% are wasted; 37% are underweight; and 63% of children are anaemic (33). A 2012 study of young children in Mumbai slums showed very similar numbers to the state average: 35% underweight; 17% wasting; and 47% stunting (34). In their 2009 report 'Nutritional Crisis in Maharashtra', the Pune-based Support for Advocacy and Training to Health Initiatives (SATHI), estimate that underlying undernutrition is responsible for 45,000 excess child deaths in Maharashtra each year (33). The report concludes that these staggeringly high numbers are largely due to poor food security:

"In Maharashtra only 31% of the children in the 1-3 years age group are able to consume the recommended daily allowance (RDA) of both calories and proteins. Further a large proportion of children (42%) get enough proteins but insufficient calories, while one in four children get both the calories and proteins in insufficient quantity. In the age group of four to six years, only 27% consume adequate calories and proteins." (33)

The report is also largely critical of the implementation of the Integrated Child Development Services (ICDS) scheme: the key government programme targeting under-five nutrition (33). The ICDS was established in 1975 and provides a range of free services aimed at improving maternal and child health including: pre-schooling; a daily food supplement of 300 calories to children under six years old; and ongoing growth monitoring (33). Access to the programme is theoretically universal, but in Maharashtra, there is a significant implementation gap – particularly in regards to the shortfall in the number of Anganwadis (ICDS care centres) for the size of the population in need (33). It is clear that there is an institutionalised awareness of malnutrition as a major issue in Maharashtra. However, as SATHI points out, an understanding of the true extent of the problem and how to effectively implement treatments is clearly lacking (33).

2.4. THE LADDOO PROJECT

The Laddoo Project is a food supplementation programme in Pune, instigated by Design Impact (DI): a US-based NGO with a mission to “...use design to address pressing social needs by partnering with community organizations already engaged in meeting local

Table 2: The Laddoo Project: key facts
<ul style="list-style-type: none"> Designed and instigated by DI in partnership with the DGS.
<ul style="list-style-type: none"> Laddoo is a traditional sweet Indian snack, which was reformulated to be high in protein and iron content with the hope of treating undernutrition.
<ul style="list-style-type: none"> The laddoo was given to roughly 300 slum children aged 6-59 months in the creches of the DGS three times per week for eight months.
<ul style="list-style-type: none"> Anthropomorphic measurements were taken before and after the project to track the nutritional progress of the children.

community needs” (35). The project is run in partnership with the Pune-based Deep Griha Society (DGS). DGS is an NGO working to “...better the lives of people living in slums in Pune. Through a range of family welfare programmes encompassing education, health, awareness building and self-help projects, DGS helps thousands of beneficiaries within Pune and several nearby villages” (36). As part of these services, DGS runs childcare creches in a number of the urban slum areas of Pune, catering to roughly 300 children (lunch is provided). These creches were the setting for the Laddoo Project.

The stated goal of the project was to “...reduce anaemia and malnutrition among children in India” (37). To do this, DI reformulated a traditional ball-shaped snack called ‘laddoo’ with locally available ingredients rich in iron and protein (see Table 3). These were then provided to 300 children aged 6-59 months from the DGS creches three times per week. To measure the effectiveness of the programme, anthropomorphic measurements of the

Table 3: Laddoo ingredients (to make 38-40 laddoo)			
Coconut and white millet laddoo		Peanut laddoo	
Ingredient	Amount	Ingredient	Amount
Wheat flour	187.5g	Wheat flour	375g
White millet flour	187.5g	Sesame seeds	125g
Desiccated coconut	125g	Peanuts	150g
Flax seed	125g	Ghee	50g
Ghee	50g	Jaggery	375g
Jaggery	350g	Cardamom	2.5g
Cardamom	2.5g	Milk	250ml
Milk	250ml		

enrolled children were taken periodically and compared to the WHO Child Growth Standards (38). The project lasted eight months from May 2012 to January 2013, and an internal analysis of the growth data showed a significant improvement in the height and weight indices of the children (39).

The project also included community engagement activities such as recipe distribution through free workshops and discussions with parents about the nutritional status of their children (39). Options for selling the laddoo as a means of self-sustaining the project were explored, but these failed due to restrictions on the commercial activities of NGOs (39). Additionally, possible partnerships to distribute laddoos to much larger groups of children did not come to fruition (39). At the time of writing, children at DGS are still receiving the laddoos three times a week, though the formal measurement process has stopped as has DI's direct involvement.

3. AIMS AND OBJECTIVES

To evaluate the strengths and weaknesses of the Laddoo Project from design through to implementation, with the aim of providing practical feedback to the organisations involved for improvement and possible further extension of the project. The three main steps taken to achieve this were to:

- Analyse the data available statistically to judge the effectiveness of the supplementation method used from a global health perspective.
- Conduct a review of the project's relevance, effectiveness, efficiency, impact and sustainability compared to good practice guidelines for nutritional intervention projects.
- Formulate practical recommendations that can be implemented on this and future projects by the organisations involved.

4. METHODOLOGY

This is a post-study evaluation and, as such, many of the findings are a result of assessing the methods already used in the design and implementation process of the project. As such, the ‘findings’ and ‘discussion’ section of this paper have been combined to ensure clarity for the reader by providing an explanation of a finding’s significance alongside its description. Unlike randomised control trials (RCTs), evaluations are predicated on the basis of providing feedback and accountability to the stakeholders of the project (4) and it is therefore essential that findings are explained and justified in a clear, logical and systematic manner. Previous evaluations of humanitarian projects have also followed this rationale (40) as a means to guarantee comprehension.²

An initial quantitative analysis of the anthropomorphic data collected by both NGOs will investigate the effectiveness of laddoo as a supplement (no control group available), as well as the quality of the internal analysis. A breaking down of the nutritional densities of the laddoo compared to suggested guidelines will then offer an assessment of their efficiency and relevance for treating undernutrition. With this quantitative analysis providing the foundation of the evaluation, a wider qualitative analysis of informal interviews with key stakeholders and DI’s literature will allow for all five criteria (relevance, effectiveness, efficiency, impact and sustainability) to be considered. Comparing findings with those of the original DI assessment and engaging with stakeholders during the research phase in an ongoing dialogue ensures that triangulation of results is taking place.

4.1. INFORMATION SOURCES

Due to the holistic nature of evaluations, a majority of the information on which this appraisal is based comes from the main stakeholders of the project. This information can be divided into three main categories: DI’s literature and data on the project; informal email and Skype interviews with project staff and stakeholders; and DGS’s post-project collected data.

² N.B. The author is aware that combining ‘results’ and ‘discussion’ is unconventional in regards to the thesis guidelines. However, after much consideration, it was decided (for the reasons stated above) that this would be the clearest way of providing quality feedback to stakeholders (the main aim of this project).

Design Impact's literature and data – once permission for this evaluation had been obtained, the first stage was to assess the information that already existed on the project through DI's own project outlines and evaluations. Two folders were received that contained all the known files on the Laddoo Project a DI Fellow who worked on the project. This consisted largely of materials created for presentations at workshops and two major reports on the project by both DI Fellows at the end of their work (38, 39). Reviewing the literature brought up a number of questions with the methods and the procedures used. Thus, the literature was substantially supplemented with responses to questions through email and informal Skype interviews.

Stakeholder interviews and emails – due to the long distance nature of this post-evaluation, much of the information had been obtained in an informal way through interviews and emails with the stakeholders of the project. In particular, the information came from the two DI Fellows that designed and instigated the project, as well as a key contact from DGS. In addition, correspondence and interviews have taken place with the directors of both NGOs. A list of those that have had input into the evaluation is below:

- DI Fellows – were responsible for the design and implementation of the Laddoo Project. This role was shared between the first Fellow who was in Pune from December 2011-June 2012, and the second, who was there from August 2012-June 2013. Both Fellows were the main port of call for questions that were brought up during the evaluation process. Contact mostly consisted of emails, but included informal interviews via Skype.
- DGS Project Coordinator – provided information on the ongoing implementation of the project and coordinated the collection of additional control group data. Contact took place via email.
- Volunteer with DGS – conducted the original DI data analysis, due to their research background. Helped by clarifying the methods used in this analysis. Contact took place using social media.
- Director of DI – provided permission to use the Laddoo Project as a basis for this thesis and additional information on the envisaged future direction of the project. Contacted through email and Skype.

- Director of DGS – provided written consent to use the data collected on DGS children. Contacted through email.

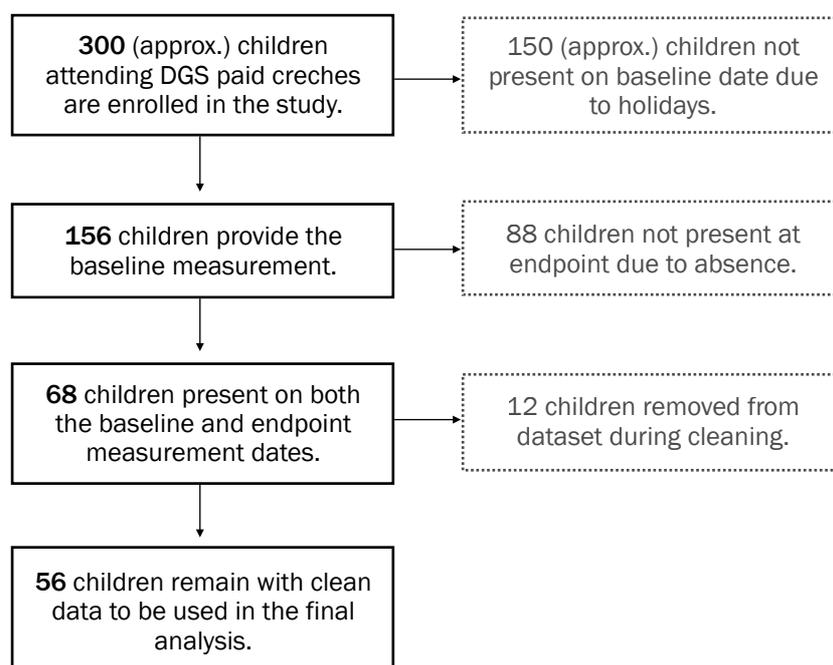
DGS's post data – this was organised as a response to a request from this investigation for a control group in order to offer a reference point for the data already obtained.

4.2. RELEVANCE

Study design – Information from project literature and stakeholders provided an understanding of the conception and design stages of the project. This was then compared against existing scientific literature to assess the suitability of the project to meet its stated aims.

Selection – All children at the DGS creches received laddoo three times a week when they were in attendance. Although approximately 300 children were involved in the study, only 68 of them were present at both the baseline and endpoint measuring point.

Figure 1: Selection process



Indicators – The choice of indicators were assessed on their aptness as tools for monitoring the effectiveness of the project.

Measurement protocol – The method of anthropomorphic measurement was considered against best practice protocol laid out by the WHO.

Cultural acceptability – Culturally acceptability was assessed through DI’s literature and informal emails with one of the DI Fellows. Data collected during the taste testing was provided.

Nutrient value – During the early stages of the project, a sample of laddoo was sent to a government-accredited laboratory for nutritional analysis (38, 39). The results were presented as ‘per 100g’ servings. This needed to be broken down to per 30g laddoo, which was done by multiplying the results by 0.3. In order to average out the daily nutritional intake from the laddoo, this result was multiplied by three (the number of laddoo given to each child per week), and then divided by seven (the number of days in a week). When considering the ingredients for the recipes of both the coconut and peanut laddoos, the recipes (which were in quantities to make 38-40 laddoos) were divided by 39, to get a per-laddoo estimate. This nutritional data was then compared with guidelines and recommendations for dietary supplements as suggested by the WHO, WFP and others (14, 41-43) in order to estimate the viability of laddoos as a means of nutrient delivery.

4.3. EFFECTIVENESS

Effectiveness was measured quantitatively using the dataset provided by DI.

Data management – The Excel data acquired from DI required cleaning. The various spreadsheets were collated into a single, usable dataset. Two follow-up measurement points that took place between the baseline and endpoint measures were omitted as they were not collected uniformly at all seven creches taking part in the study. Additionally, 12 further cases were excluded: eight due to the children being over five years old³ and four because their endpoint height measurements showed them to be more than 2cm shorter than when they started the project due to measurement error.

Using the WHO Child Growth Standards *Anthro* software each of the 56 completed entries was then manually inputted to obtain their baseline and endpoint WHZ, HAZ and WAZ. Using the *Statistical Package for the Social Sciences* (SPSS) software, the WHZ, HAZ and

³ N.B. The reason for excluding children who were over 5 years at any point during the intervention is twofold. Firstly, other aspects of this project have defined child malnutrition as malnutrition in children under 5 years. Secondly, if a child is inputted as being over 5 years in the *Anthro* program, the program will not provide a WHZ, HAZ or WAZ score for them. *AnthroPlus*, used for ages 5-19 years, does not calculate WHZ.

WAZ scores were transformed to nominal variables of 'wasted', 'stunted', 'underweight' or 'normal'. A Z-score of less than -2 was the cutoff point between each condition and a categorisation of 'normal'. Moderate or severe categories of stunting, wasting or underweight were not differentiated due to the small sample size and the small number of z-scores below -3 apparent.

Statistical analysis – Due to the lack of a control group, the options for the statistical analysis were limited to descriptive statistics and a difference in mean values of WHZ, HAZ and WAZ using a paired t-tests. Additionally ANOVA with Turkey tests were conducted to identify statistically significant differences across the means for variables with more than two categories. Non-parametric tests such as the Mann-Whitney and the Kruskal-Wallis tests were also used to identify differences between and across groups.

Controls – In an attempt to establish a control group, DGS sent a worker to the nearby government-run Anganwadi to take measurements of a group of children to give a snapshot of the nutritional status of those children who lived in the same area, but did not attend the DGS creches. During this process, the height of the children was not taken nor the exact date-of-births of the children. Thus, it was only possible to calculate an approximate WAZ for the 32 children. Further to this, two previous studies provided data on the prevalence of stunting, wasting and underweight in children in Maharashtra and a Mumbai slum. This allowed for a rough comparison to be drawn between the prevalence of malnutrition, but no data on significance or mean z-scores.

Compliance – When given laddoo, the children were supervised by their teachers in a closed environment. It is therefore unlikely that not eating them was an issue. However, if not present at the creche on a Monday, Wednesday or Friday, a child would not receive laddoo. Through the use of attendance registers it would be possible to track the attendance of each child and so investigate potential differences between those who had taken a full course and those that had not. Due to limited time and resources, this was not possible.

Anaemia – It was not possible to measure the effectiveness of laddoo on anaemia as blood samples were not taken consistently during the project.

4.4. EFFICIENCY

Efficiency was assessed using existing published literature to consider the quality of **targeting**, the overlap with **ICDS** and the **manufacturing process**.

4.5. IMPACT

The wider impact the project had on **awareness** and the effect of its **workshops** was assessed through informal interviews and DI's project literature.

4.6. SUSTAINABILITY

Project literature and interviews provided information on sustainability in regards to possible **extension** and **current status**.

5. ETHICAL CONSIDERATIONS

As an intervention study involving children, the Laddoo Project faces a number of ethical issues including: gaining parental permission for participation; ensuring the children's health was not endangered; and ensuring personnel are appropriately trained to deal with children. As the organiser of the creche, DGS deals with these issues and, as a formal partner of DGS, DI will have been required to conform to DGS's conditions. During the design stage of the project, it was decided by DI to not create a control group on the basis that it would be unethical to provide a supplement to some children, but not others.

Letters signed by the directors of DI and DGS granting permission for the use of the data in this evaluation explicitly state that "*Participants of the original study provided informed consent at the time that the original data was collected. Parental consent was provided where minors were involved.*" Additionally, all names were deleted during the data cleaning process to ensure the anonymity of participants.

6. FINDINGS & DISCUSSION

The findings of this evaluation are set out and discussed below. They are divided into the five OECD-DAC criteria of relevance, effectiveness, efficiency, impact and sustainability. ‘Relevance’ considers how well the Laddoo Project is suited to tackling malnutrition in the Pune context. ‘Effectiveness’ will focus on whether the Laddoo Project achieved its goals. ‘Efficiency’ considers whether the project’s method is efficient in its processes. ‘Impact’ will look at the wider effect the project has had on the community. Finally, ‘Sustainability’ covers the project’s longevity and potential expansion.

6.1. RELEVANCE

“The extent to which the aid activity is suited to the priorities and policies of the target group, recipient and donor.” – OECD-DAC

Study design – The Laddoo Project is predicated upon the assumption that supplementary feeding helps treat or prevent malnutrition. However, in the project literature, the scientific evidence to support this assumption is under-reported (38, 39). There is very little differentiation between the forms of malnutrition (SAM, MAM, stunting and micronutrient) in the project literature as a whole. Considering that the signs, symptoms, treatment and severity of each form of malnutrition vary significantly, this is a significant omission. MAM is the only form of undernutrition that has a strong evidence base to support supplementary feeding as an effective treatment method for children above two years of age (14, 20). SAM is undernutrition at its most severe and is treated as a medical emergency (14, 21), making it an unsuitable focus for a feeding supplementation programme. Evidence for interventions aimed at treating and reversing stunting in children 23-59 months is limited at best (24, 26, 41). Instead, interventions with significant effects on stunting have targeted PLW and infants in the first 1,000 days of life (14, 22). Finally, the evidence supporting iron supplementation in children has also focused on the under two age range (22).

A majority of the papers used for background to the project originate from the Pune-based Hirabai Cowasji Jehangir Medical Research Institute that collaborated with DI on the Laddoo Project and previously used DGS as a setting for a number of studies on

malnutrition. However, most of the papers consider just micronutrient deficiencies (iron, calcium, vitamin A and D) in adolescents (44-55) and two of these studies are interventions using fortified laddoo as a means of treating calcium deficiency (54, 55). This suggests that the project’s focus may have become blurred as a result of advice from the research institute. If the focus of the project was on micronutrient deficiencies, then the mode of intervention – from the laddoo recipe through to the measurement process – is largely unsuitable. Alternatively, if, as has been confirmed by DI staff, the project’s focus was on macro under-nutrition (wasting and stunting), these papers may well have led DI away from evidence of more appropriate approaches for the under-five age range.

Taking this into account, the general terminology used by DI when describing the project’s goal to “...reduce anaemia and malnutrition among children in India” (37) seems poorly suited to the context. This is combined with a lack of a clear background problem statement. There is anecdotal evidence from the DGS doctor (38) that the children in the creches require iron and protein, but there appears to be no baseline cross-sectional data on the prevalence of wasting, stunting or underweight before the *method* of intervention was decided upon. This lack of clarity pervades throughout the early design process and appears to show a lack of medical awareness concerning the nuances of malnutrition. Irrespective of this uncertainty, the laddoo must be considered in relation to their theoretical ability to treat malnutrition that can be tracked through anthropomorphic

Table 4: Characteristics of study population		
Characteristics	n	%
Sex		
Male	32	57.1
Female	24	42.9
Age group (months)		
12-23.9	4	7.1
24-35.9	24	42.9
36-47.9	20	35.7
48-59.9	8	14.3
Slum distribution		
Tadiwala	34	60.7
Bibewadi	9	16.1
Ramtedki	13	23.2

measurements. As stunting prevention and treatment is largely unfeasible beyond two years of age (14, 22) and only 4 participants in the study are in this age group (see Table 4), one can only assume the focus must therefore be on MAM and underweight.

Selection — There is a significant differential between the size of the project, baseline and endpoint group. When the baseline measurements were taken, many of the children were away (possibly due to it being over a school holiday period). This meant that roughly only half of all children enrolled on the programme were actually measured. Due to further absences at endpoint, only 23% of children on the programme had completed data. This was reduced to 19% with data cleaning. Such a small sample makes it difficult to extrapolate conclusions about the effectiveness of any intervention because of sample bias: almost inevitably, the proportions of underweight children in the larger sample are different to those recorded in the smaller sample (around 40%, rather than 54%) (38). For the effectiveness or impact of a project to be assessed in an objective scientific manner, an end sample significantly larger than 56 will always be required.

Indicators — In keeping with its name, Design Impact has explicitly stated that it was interested in measuring the effectiveness and impact of the intervention from the start (38) and it is clear that there was a general awareness of some of the tools and methodology available to measure undernourishment:

“The weight-for-age measure provides an indication of nutritional status. Low weight-for-age indicates moderate to severe malnutrition. We plotted the final round of measurements using WHO’s AnthroPlus program which compares the population to the median. This plot appears on the following page. The red line curve shows that about 1/8th of the 156 children are severely malnourished, that is, more than three negative standard deviations from the median. Almost 1/4th (43 of 156) are moderately malnourished, i.e., between 2 and 3 negative standard deviations from the median.” (38)

The mention of *AnthroPlus*, is unexpected as this is usually used to assess malnourishment data in 5-19 year olds. Unlike *Anthro* — focused on 6-59 months — *AnthroPlus* does not offer WHZ as an index to be used — possibly the most relevant indicator in this scenario. Additional tools that are useful to assess the 6-59 month age group, such as head and arm circumference, are also not available in this version of the

software. Indeed, the use of Mid Upper Arm Circumference (MUAC) as an indicator offers a very quick and easy way of screening for undernourishment in children under five (16).

There was an attempt to measure haemoglobin as a test for iron-deficiency anaemia. However, this was not taken consistently (probably due to the difficult nature of the test and poor quality of the machine) so cannot be considered as a useful indicator.

Measurement protocol – There was initially some recorded issues with the protocol for measuring the heights and weights of the children (38). However, with the aid of a workshop on how to assess paediatric nutrition status, the protocol laid out was largely theoretically sound – instruments were calibrated and successive readings were taken by different staff – when compared with the WHO guidelines (56).

The good-practice approach is a positive step, but a number of questions are raised when looking at the final data set, which included cases of children shrinking in height by 20cm or more. Clearly, such anomalous results suggest that the protocol may not have been followed correctly at all measurement points. If more children had been measured at endpoint, this would have been less significant, but unfortunately every erroneous data point reduces the significance of the results as well as lending concern about the overall reliability of the already limited dataset.

Cultural acceptability – Ensuring that an intervention is culturally acceptable to the local population's palette is a very important, but often overlooked aspect of nutritional interventions (57). It can also be difficult to quantify. After initial research and development, two savoury and two sweet snacks were compared with each other through taste tests (38). Three different 'tasting sessions' – and questionnaires – were used to decide on which snack should be used (38). There was reported confusion over what the 'sad and happy faces' meant in the first session, the second used statements asking about different qualities of each snack (appearance, taste etc.) (38). However, this was still confusing and inconclusive due to low turnout. Finally, listing the snacks in order of preference was used.

Here, the difficulty in dealing with cultural differences is clearly apparent. Not only is the cultural acceptability of the laddoo at stake, but the questionnaire too was not translating well. The perseverance and redesign of the surveys is commendable, yet the process raises two possible issues: one, the use of staff as tasters (when children are the

intervention group) and two, the use of closed-questions in the survey (38). Though not hinted at, this leaves the option that: participants were simply marking the snack they disliked least instead of the one they liked the most; and, as raised by one of the stakeholders, that it was hard to elicit unambiguous responses from the 18 children that participated .

Nutritional value – The nutritional analysis conducted of both types of laddoo (Table 5) seems to show that the amounts of nutrients provided by the laddoos three times a week is small when compared to those used by the WFP to treat MAM and prevent stunting (14). The three supplements recommended to treat MAM in children 6-59 months: weigh between 92-100g; contain 500kcal, 13g protein, 29-31g fat; and are to be given daily (14). Those used to prevent stunting in 6-23 months: weigh 46-50g; contain 247-260kcal, 5.9-6.5g protein, 14.5-16g fat; and are to be given daily (14). In comparison, a 30g laddoo given three times a week provides a daily average intake of just: 51.9-52.1kcal, 1.1-1.2g protein, 2.1g fat and 0.4-0.7mg iron. Clearly, this is well short of the nutritional densities in other, mass-produced foods used to treat malnutrition.

Table 5: Nutritional analysis of laddoo					
Parameter	Unit	Peanut laddoo		Coconut laddoo	
		/100g	Per laddoo	/100g	Per laddoo
Energy Value	Kcal	405	121.5	404	121.2
Protein	g	9.4	2.82	8.9	2.67
Carbohydrate	g	54.2	16.26	55.9	16.77
Fat	g	16.7	5.01	16.1	4.83
Sugar as Sucrose	g	5.8	1.74	10.5	3.15
Iron	mg	3.03	0.91	5.8	1.74

In the Maharashtra context specifically, the estimated shortfalls in recommended daily intake (see Table 6 (33)), seem to suggest that laddoos might be marginally more valuable. Among children 1-3 years, there is an estimated shortfall of 1.1g protein, 12.4g fat, 549kcal and 6mg iron, whilst for 4-6 years, there is an excess of protein by 1.8g, and a shortfall of 8.8g fat, 624kcal, 7.7mg iron (33). With the exception of protein, there is still a significant shortfall, in the nutrient intake of the children after accounting for laddoo.

Table 6: Average intake of nutrients (per day) among children (age group one to six years) in Maharashtra				
Parameter	1-3 year (n=266)	% RDA	4-6 years (n=272)	% RDA
Protein (g)	20.9	95	31.8	106
Total Fat (g)	12.9	51	16.3	65
Energy (Kcal)	699	56	1062	63
Calcium (mg)	277	69	298	75
Iron (mg)	6	50	10.2	57
Vitamin A (µg)	113	28	131	33

In the WHO’s technical guidance on the use of supplementary foods to manage MAM in children under five, suggests that: “An energy intake of 25 kcal/kg/day in addition to the requirements of non-malnourished children is likely to support a weight gain of 5g/kg/day, based on average tissue composition” (43). Again, though moderate, the laddoos fail to make up this recommendation.

In regards to anaemia, simply put, there is very little chance that such an iron content of 0.4-0.7mg will have any significant effect (22, 46). As there is no complete data on anaemia, this is impossible to assess. Theoretically at least, there is very little evidence supporting the view that such a small amount of additional nutrients can have a significant effect on any form of under-nutrition.

6.2. EFFECTIVENESS

*“A measure of the extent to which an aid activity attains its objectives.” –
OECD-DAC*

Statistical analysis – Using SPSS, the first stage of the statistical analysis is focused on comparing the same children at baseline and endpoint. A comparison between baseline and endpoint proportions show a reduction in wasting, stunting and underweight in a majority of characteristics (see Table 9). In the total study cohort, rates of wasting reduced by 12% and stunting by a surprising 46%. Underweight which, as a composite indicator should sit between the two, reduced by 30%. From a policy-making point of view, this would appear to show that the project was very effective (Table 9). The use of a paired t-test to find significant changes in the mean of such a small sample is less

Table 7: Baseline anthropomorphic characteristics of study population						
Characteristics	Mean±SD			Proportion (%)		
	WHZ	HAZ	WAZ	Wasting	Stunting	Underweight
Sex						
Male	-1.4±1.6	-1.9±1.1	-2.0±1.1	40.6	53.1	53.1
Female	-0.6±1.5	-2.7±1.5	-1.8±1.2	16.7	70.8	54.2
Age group						
12-23.9	-1.2±2.6	-3.1±2.4	-1.6±2.4	50.0	75.0	75.0
24-35.9	-1.1±1.7	-2.3±1.1	-2.0±1.1	25.0	66.7	54.2
36-47.9	-1.1±1.4	-2.0±1.4	-2.0±1.0	40.0	50.0	50.0
48-59.9	-0.8±1.3	-2.2±1.2	-1.9±0.8	12.5	62.5	50.0
Slum						
Tadiwala	-1.7±1.2	-1.8±1.0	-2.2±0.9	44.1	50.0	58.8
Bibewadi	-1.1±1.0	-2.2±1.1	-2.1±1.0	22.2	66.7	55.6
Ramtedki	0.6±1.6	-3.4±1.5	-1.3±1.5	0.0	84.6	38.5
Totals	-1.1±1.6	-2.2±1.3	-1.9±1.1	30.4	60.7	53.6

¹ Proportion of wasting, stunting and underweight is equal to the proportion of children that have z-scores below -2.

Table 8: Endpoint anthropomorphic characteristics of study population						
Characteristics	Mean±SD			Proportion (%)		
	WHZ	HAZ	WAZ	Wasting	Stunting	Underweight
Sex						
Male	-1.5±1.5	-1.1±1.4	-1.6±1.0	40.6	21.9	34.4
Female	-0.8±1.2	-2.2±1.3	-1.9±0.9	8.3	50.0	41.7
Age group						
12-23.9	-2.7±2.3	-1.2±2.5	-2.7±0.8	50.0	50.0	75.0
24-35.9	-1.3±1.4	-1.5±1.3	-1.7±0.9	33.3	29.2	41.7
36-47.9	-1.1±1.2	-1.6±1.6	-1.7±1.0	20.0	30.0	35.0
48-59.9	-0.5±1.3	-1.9±1.3	-1.4±0.9	12.5	50.0	12.5
Slum						
Tadiwala	-1.7±1.3	-1.1±1.2	-1.7±1.0	38.2	17.6	38.2
Bibewadi	-1.1±0.6	-2.5±1.5	-2.3±0.9	11.1	66.7	55.6
Ramtedki	0.0±1.6	-2.3±1.6	-1.4±0.8	7.7	53.8	23.1
Totals	-1.2±1.4	-1.6±1.5	-1.7±0.9	26.8	33.9	37.5

¹ Proportion of wasting, stunting and underweight is equal to the proportion of children that have z-scores below -2.

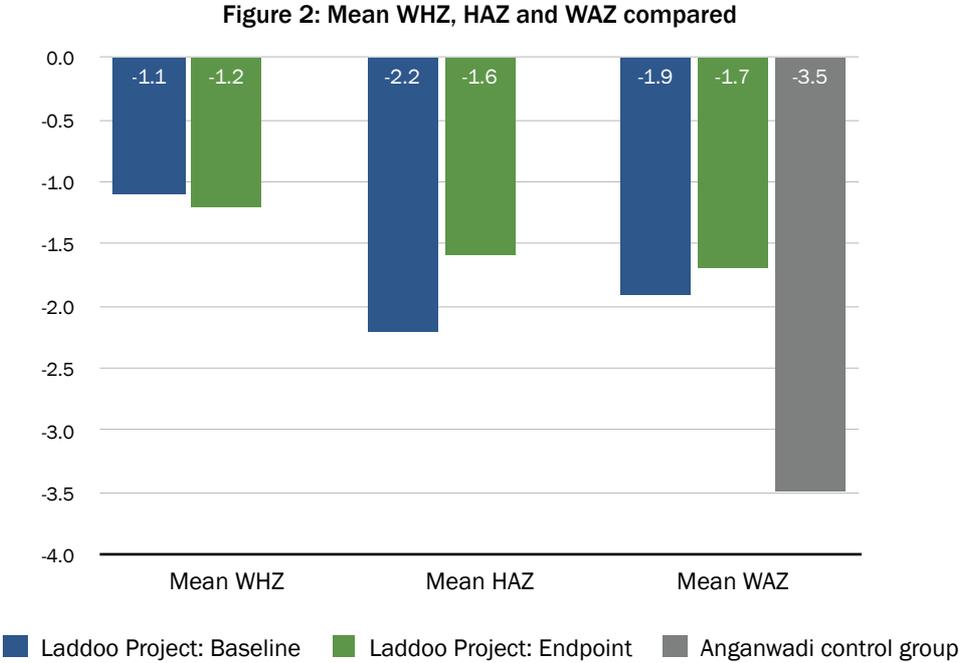
Characteristics	Baseline proportion (%)			Endpoint proportion (%)		
	Wasting	Stunting	Underweight	Wasting	Stunting	Underweight
Sex						
Male	40.6	53.1	53.1	40.6	21.9	34.4
Female	16.7	70.8	54.2	8.3	50.0	41.7
Age group						
12-23.9	50.0	75.0	75.0	50.0	50.0	75.0
24-35.9	25.0	66.7	54.2	33.3	29.2	41.7
36-47.9	40.0	50.0	50.0	20.0	30.0	35.0
48-59.9	12.5	62.5	50.0	12.5	50.0	12.5
Slum						
Tadiwala	44.1	50.0	58.8	38.2	17.6	38.2
Bibewadi	22.2	66.7	55.6	11.1	66.7	55.6
Ramtedki	0.0	84.6	38.5	7.7	53.8	23.1
Totals	30.4	60.7	53.6	26.8	33.9	37.5

¹ Proportion of wasting, stunting and underweight is equal to the proportion of children that have z-scores below -2.

Characteristics	WHZ			HAZ			WAZ		
	means±SD	95% C.I.		means±SD	95% C.I.		means±SD	95% C.I.	
		lower	upper		lower	upper		lower	upper
Sex									
Male	0.1±1.3	-0.4	0.6	-0.8±1.1*	-1.2	-0.4	-0.4±0.7*	-0.6	-0.2
Female	0.2±1.2	-0.3	0.7	-0.5±1.2	-0.1	0.1	0.0±1.1	-0.4	0.5
Age group									
12-23.9	1.5±1.13	-0.3	3.3	-1.9±2.6	-6.0	2.2	1.0±1.9	-2.0	4.0
24-35.9	0.2±1.1	-0.3	0.7	-0.8±0.9*	-1.2	-0.4	-0.3±0.8	-0.6	0.0
36-47.9	0.0±1.4	-0.7	0.6	-0.4±1.0	-0.9	0.1	-0.3±0.7	-0.6	0.1
48-59.9	-0.3±0.8	-1.0	0.4	-0.4±1.0	-1.2	0.5	-0.4±0.4**	-0.7	-0.1
Slum									
Tadiwala	-0.0±1.1	-0.4	0.4	-0.7±1.1*	-1.1	-0.3	-0.4±0.7*	-0.7	-0.2
Bibewadi	0.1±0.7	-0.5	0.6	0.3±0.5*	-0.1	0.7	0.3±0.6*	-0.2	0.7
Ramtedki	0.6±1.6	-0.3	1.6	-1.1±1.3**	-1.9	-0.3	0.1±1.2	-0.6	0.8
Totals	0.1±1.2	-0.2	0.5	-0.7±1.2*	-1.0	-0.4	-0.2±0.9	-0.4	0.0

* Significance is between 0.000-0.005
** Significance is between 0.006-0.020
No significant results between groups when running ANOVA with Turkey tests.

flattering, only showing a significant result of just -0.7 HAZ as a whole (see Figure 2). Non-parametric tests show the differences between baseline and endpoint HAZ and WAZ to be significant. Additionally, the difference in means of underweight in males only and two slums produced small significant results.



There is a great difficulty in interpreting these results as, although they show a positive effect, established scientific and medical thought seems to be largely incompatible with them. As mentioned, stunting is considered to be largely irreversible once a child reaches the age of two (14, 16). Meanwhile, the indicator that would have been most likely affected by the intervention – wasting – shows very little change.

Another issue to come to light in this investigation is the inability to recreate the results that appear in the final project reports. It is likely that this is because the datasets analysed were not cleansed of errors (they were still working with 68 instead of 56 entries). The final report claims that 53.7% of children have “*shifted up to the safe zone*” of moderate stunting from severe stunting, and 42% from severely underweight to moderately underweight (39). This does not really make sense as a rapid change in the WAZ will almost always be as a result of a change in WHZ (16). Though this is a basic error, easily corrected, it is another example of how a more rigour and understanding would have helped the project whilst the trial was ongoing.

Controls – Probably the largest oversight of the entire project from – a scientific perspective – is the omission of a control group. For any study or project that aims to test

a new creation, having a group who have not been exposed to the item is the most important factor to determine if the variable had any effect. Though not included on reasonable ethical grounds – DI stated that they felt it would be unethical to withhold laddoos from some children, whilst giving them to others – this is an almost insurmountable issue in the relevance of the design when making any claims about the project’s efficacy.

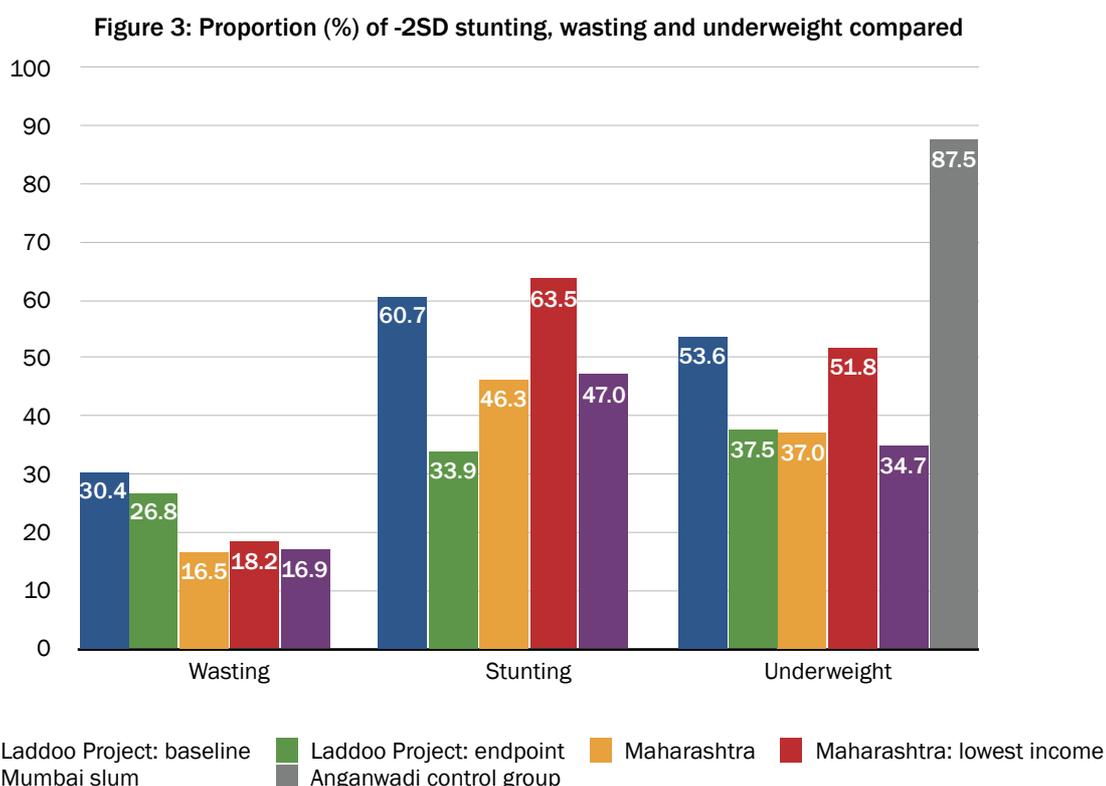
Table 11: Nutritional status of children between one to five years in Maharashtra (collated from the SATHI Report on Nutritional Crisis in Maharashtra)			
Characteristics	Wasting (%)	Stunting (%)	Underweight (%)
Sex			
Male	17.5	47.3	36.7
Female	15.4	45.1	37.3
Age group			
12-23.9	16.2	49.7	32.5
24-35.9	11.8	54.3	38.3
36-47.9	14.5	51.4	43.2
48-59.9	16.5	47.3	42.8
Wealth index			
Lowest	18.2	63.5	51.8
Second	21.8	55.1	46.4
Middle	19.4	53.6	48.2
Fourth	16.1	45.1	32.4
Highest	10.8	28.9	20.9
Place of residence			
Rural	18.2	49.1	41.6
Urban	14.1	42.3	30.7
Totals	16.5	46.3	37.0

In an attempt to contextualise the results, data on the prevalence of under-nutrition in Maharashtra is provided by two reports. The baseline prevalence of malnutrition in the children in the project are very similar to those rated as ‘lowest’ in the wealth index of the SATHI report on nutrition in Maharashtra (see Table 11) (33). A follow-up study of children in Mumbai slums however, shows rates at much closer the state-wide average (34). Unfortunately, without a control group from Pune, conclusions about the exact baseline prevalence in the child population of the Pune slums is not possible.

Characteristics	n	Mean WAZ±SD	Underweight
Sex			
Male	19	-3.7±1.2	94.7
Female	13	-3.3±1.9	76.9
Age group			
12-23.9	6	-3.3±2.7	66.7
24-35.9	0	-	-
36-47.9	17	-4.0±1.0	100.0
48-59.9	9	-2.9±1.3	77.8
Totals	32	-3.5±1.5	87.5

¹ Proportion of wasting, stunting and underweight is equal to the proportion of children that have z-scores in each category that are two standard deviations or below.
² Approximate age as the data collected was in nominal values only.

Thanks to DGS, there was also a small amount of data available from the government-run Anganwadi in the same slum as one the intervention creches. Unfortunately, height data was not collected, so WHZ and HAZ could not be calculated. Additionally, the lack of a specified date of birth meant that WAZ are approximate. There is however, a significantly lower mean WAZ and prevalence in this group than the study cohort at any point (Table 12).



As Figure 3 shows, there is a clear difference between all these groups, suggesting unknown variables at play. The danger of drawing conclusions from such apparently self-evident results when they are based on limited data is plain.

It is understandable why both NGOs chose to not withhold laddoos from some children. However, the decision to not use a control group greatly undermines any results that can be derived from the project. Indeed, this could well damage any funding applications to extend the project.

Compliance – Poor compliance in nutritional interventions will result in participants not receiving the full expected dose of nutrients and so making post-conclusions about the effectiveness of the intervention difficult (58). Compliance issues in this case mainly focused on school attendance, rather than problems with the children eating what they were given (children were supervised at all times by teachers). There were clear cases (shown during the measurement sessions) where children were not present at the creches, and so could not receive the laddoo. Many of the issues with the data collection also stem from child absence and this is difficult to address. Even in cases where a child has been measured at baseline and endpoint, it is difficult to definitively say whether their attendance was consistent for the full length of the intervention. For this reason, the registers used by DGS in it's creche would provide an ideal log of compliance – providing it is accepted that the children received laddoo three times a week when they attended school.

Anaemia – As the ongoing measurement of haemoglobin levels did not take place, it is impossible to measure the effectiveness of laddoos on levels of anaemia.

6.3. EFFICIENCY

“Efficiency measures the outputs – qualitative and quantitative – in relation to the inputs.” – OECD-DAC

Targeting – Using specially formulated supplementation as a means to treat MAM can be effective (20). However, as described earlier, the nutritional densities of the laddoo do not seem high enough to efficiently treat MAM. If the laddoos were specifically targeting complementary feeding to preventing stunting in infants 6-23 months, however, the densities would be better suited – provided that their dosage was increased to two

laddoo every day. If this occurred, the laddoos would be similar in content to the supplements recommended by the WFP (14). Additionally, they would make up a significant amount of the RDA shortfall in Maharashtra children (33). Additionally, if micronutrients were to be more central to the project, using fortified ingredients would be a more certain way of ensuring that the laddoo were effective. It is not clear if this would improve efficiency from a cost perspective.

Integrated Child Development Service — The government-run Anganwadi creches are meant to provide a daily food supplement of 300 calories to children under six and it is estimated that this at a cost to the of 1.5 Indian Rupees (Rs.) that is paid by the government (33). Children attending DGS creches do not receive this supplementation. This means that the the Laddoo Project is theoretically making up a shortfall in the child's nutrition intake that is the result of not attending the Anganwadi.

The manufacturing process — The production of the laddoo is a relatively efficient process, with each laddoo costing roughly Rs. 3, or 0.05 USD. Also, the focus on easily accessible ingredients makes them a viable option for even remote settings. The flour in the recipes does require roasting for around 25 minutes. If it were possible to reduce or remove this stage altogether, the manufacturing process would be very efficient. Once prepared, the laddoo can be stored in an airtight container for a number of days. Not having to the cook or heat the laddoo before serving is a big advantage.

6.4. IMPACT

“The positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended.” — OECD-DAC

Awareness — The project increased awareness among parents of the children in the study by providing sessions where they would be asked to measure the height and weight of their children and put the results into *Anthro*.

“Most of the parents were shocked to know that even though their child ‘looked’ fine, he/she was moderately malnourished.” (39)

Through the creation of brochures and these sessions, the project informed the parents about their children's nutritional status. This is definitely a positive step as moderate

forms of under-nourishment – particularly stunting – can be hard to identify in endemic areas.

Workshops – Through DGS, DI ran workshops for other small NGOs presenting the Laddoo Project as a sustainable model for improving nutrition. Ideally, such a move would be post-study and evaluation, so the true effectiveness of the laddoos could be confirmed (and improved upon). Regardless of this, increasing partnerships between NGOs and sharing an innovative method of intervention has an intrinsic value.

6.5. SUSTAINABILITY

“Sustainability is concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn.” –
OECD-DAC

Extension – Towards the end of the project’s trial, a significant effort was made to commercialise laddoo as a means of making the project self-sustaining. Packaging was designed by a local design company pro bono and it was calculated that each pack could make Rs. 38 profit – a not insignificant amount when considering the low costs of production (39). However, as DGS is an NGO, it is not legally allowed to enter into commercial business so this idea was not pursued.

A number of partnerships with other organisations were explored as a possible means of extending the project. One of them was the possibility of joining with Naandi, a large NGO catering for over 100,000 children through the government-funded ICDS and Midday Meal Scheme (39). Negotiations seemed positive with the following statement:

“Naandi can accommodate the Laddoo Project if an organization would be interested in funding this initiative. Naandi has identified a village of 10,000 people in Oddisha, wherein along with awareness campaign against malnutrition it would like to introduce the Laddoo Project.” (39)

The proposal of such a large expansion is surprising given the relatively small evidence base for the effectiveness of the laddoo. This collaboration however, could not secure the required funding.

Further to this, there was an attempt to tie a popular children’s television show to the project for the publicity:

“Now that Naandi was interested in partnering in the Laddoo Project, I had to look for a suitable funder. My search, led me to a logical conclusion of getting in touch with the creators of a popular Indian animated cartoon character, Chotha Bheem who, like Popey , gets his super human energy by eating Laddoos. To me the collaboration of all four organization seemed like the perfect marriage to take the project further.” (39)

Unfortunately, this collaboration could not be fully negotiated, but it is an excellent example of the lateral thinking that staff with a broad set of skills such as marketing and design can bring to a global health project.

Current status – At the time of writing, the Laddoo Project is still ongoing, with children receiving laddoo thrice a week, though the ongoing measurements have stopped. This is funded through individual and group sponsorships and project fundraising. DI did plan to apply to extend the project, but this has been put on hold.

6.6. QUALITY OF EVALUATION

This evaluation has a wide-ranging focus that has inevitably meant that some aspects have been more deeply explored than others. Given more time, this assessment would be more detailed. In particular, given the resources, the introduction of a control group, further data collection, and an investigation of attendance registers could make the statistical analysis more robust. Though there has been great cooperation from the staff at both DI and DGS, there is a clear difficulty in investigating a project without being on location. Had this been possible, extended interviews with key stakeholders and beneficiaries would be have added greatly to the process. Indeed, the minimal input from the beneficiaries to this report is a significant omission.

7. CONCLUSION

The Laddoo Project is a well-intentioned attempt at improving the health of children living in poor conditions. The approach is innovative – though there have been similar projects – and locally focused. The entrenching of the DI Fellows at DGS provided a chance for the context to be understood fully and the enlisting of outside help for various parts of the project is admirable. Additionally, the project design – once the method had been decided upon – is largely solid and well thought out.

From an external viewpoint, the project suffered from a lack of scientific rigour. Although tracking progress through anthropometry is used, the basic background and exact focus are lacking – at least in the literature. Had this project identified, for example, stunting as a particular issue first and *then* researched the evidence and nutritional requirement to prevent it, the project might have been significantly improved. Undoubtedly, the results do show an improvement – particularly in stunting – but it is hard not to view them skeptically when considering nutritional knowledge, the size of the cohort, and existence of anomalous measurements. Using WHZ as an index – and thus *Anthro*, not *AnthroPlus* – would be a very simple improvement to the study. Using attendance registers of DGS as a measure of compliance would be useful also.

The laddoos themselves, though perhaps not containing the full nutritional requirements, are a well-chosen and thought-out supplement. Their simple recipe (requiring minimal cooking time) and long-lasting nature make them very well suited to storage and large scale production. Additionally, the use of readily-available, cheap ingredients is excellent.

As an outsider not currently in Pune, it is quite difficult to understand exactly what impact the Laddoo Project has had on its external environment. For some of the parents of the children involved it seems to have had an effect through the workshops. The lateral thinking to seek to join forces with a kids cartoon also has to be applauded, even though the attempt ultimately failed. It would be very interesting to investigate how exactly the Laddoo Project could interact and compares with the supplementary feeding programme of the ICDS, as this service should already, in theory, be providing a similar service to the same children. If the laddoo were given as a supplement on top of this, then the cumulative impact might be greater.

8. RECOMMENDATIONS

1. **Increase scientific rigour** – Ensure that any intervention is more scientifically and medically grounded. This will ensure that a project is credible and can stand up to scrutiny. This will should funding for future projects more easy to secure.
2. **Improve preliminary research** – Conduct cross-sectional studies of existing epidemiology, dietary assessment and risk factors first to identify the exact medical issue, and then design the intervention accordingly.
3. **Improved targeting** – Improve the efficiency and credibility of the project by specifically targeting stunting prevention in 6-23 months or MAM in 6-59 months.
4. **Increase dosage** – Increase dosage and frequency of laddoos in the targeted population to increase nutritional intake to an acceptable level in relation to RDA.
5. **Increase sample size** – Increasing the final sample size by setting aside more time to measure children whilst they are at the creches. Additionally, increase length of study and frequency of follow-ups.
6. **Create a control group** – For any future project where effectiveness or impact is to be measured, a control group should be used.
7. **Full micronutrient analysis** – The project would benefit from a more detailed analysis of the laddoo, incorporating Vitamin A, zinc and iodine.

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ANNEXES



November 4th, 2013

To whom it may concern,

This letter is to confirm that Louis Potter has been given permission to use the data collected on the 'Laddoo Project' by Design Impact and the Deep Griha Society as a basis for his master's thesis at the Karolinska Institutet, Stockholm. He will be supervised by Joel Monárrez-Espino.

The data will be used to conduct an evaluation of the project. The evaluation is likely to consider: the process of design; the suitability of assessment methods used i.e. measurements taken; program compliance; cultural acceptability; and the effectiveness of the impact indicators used.

The raw data will not be passed on to third parties without prior permission from Design Impact or Deep Griha Society.

If required, and where convenient for all parties, additional data may be collected with the consent of the participants.

Participants of the original study provided informed consent at the time that the original data was collected. Parental consent was provided where minors were involved.

The resulting thesis document will credit and be distributed to Design Impact and the Deep Griha Society, but will remain the property of Louis Potter to distribute as appropriate.

Signed,

A handwritten signature in black ink, appearing to read 'RF', with a long, wavy horizontal line extending to the right.

Ramsey Ford,
Design Impact
Design Director

205 West Fourth St., Suite 1140
Cincinnati, OH 45202 USA



Deep Griha Society

Family Welfare Centre, 13 Tadiwala Road, Pune 411 001, Maharashtra, INDIA
① www.deepgriha.org ② deepgriha@gmail.com ③ +91 20 26124382 / 26051773

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Dr. Neela B Onawale
Director

Deep Griha Society

30th Oct. 2013.

DIRECTOR
Deep Griha Society,
13, Tadiwala Road,
Pune - 411 001.