

IMPROVING NUTRITIONAL KNOWLEDGE OF CAREGIVERS IN HYDERABAD,
INDIA: A PILOT STUDY FOR THE MD WITH DISTINCTION

by

Sophia Tibe Tinger

DISSERTATION

Presented to the Faculty of the Medical School
The University of Texas Southwestern Medical Center
In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF MEDICINE WITH DISTINCTION IN
GLOBAL HEALTH

The University of Texas Southwestern Medical Center
Dallas, TX

© Copyright by Sophia Tibe Tinger 2019
All Rights Reserved

ACKNOWLEDGMENTS

I would like to acknowledge the Office of Global Health for their support, including the funding that made this study possible, as well as the Office for Quality, Safety, and Outcomes Education at UT Southwestern for their guidance and support. In particular, I would like to thank Rasha Babikir, Global Health Education and Research Coordinator, and Eleanor Phelps, Director of Nursing Quality Improvement.

I would also like to thank Dr. Joan Reisch for her help in analyzing the data for this study. Additionally, I would like to thank the National Institute of Nutrition and the staff of the Nutrition Department at Niloufer Hospital for facilitating the project.

I would like to express my gratitude to my mentor, Dr. Abigail Patterson, for her continuous guidance and strong support throughout these last four years.

Finally, I want to thank Swetha Kotamraju, my project partner, who has worked alongside me, and learned and grew with me throughout the course of this project.

TABLE OF CONTENTS

CHAPTER ONE: A GENERAL INTRODUCTION.....	2
CHAPTER TWO: BACKGROUND PROJECT: DEFINING THE LOCAL CONTEXT...	5
CHAPTER THREE: INTRODUCTION.....	12
CHAPTER FOUR: METHODS.....	14
CHAPTER FIVE: RESULTS	21
CHAPTER SIX: CONCLUSION.....	23
TABLES AND FIGURES.....	27
REFERENCES.....	38
VITAE.....	40

CHAPTER ONE: A General Introduction

Malnutrition accounts for almost half of all deaths of children under 5 worldwide.(1) Furthermore, half of these deaths come from only 5 countries,(2) with most occurring in India. Thus, malnutrition is a public health issue of particular concern in India, where the prevalence of underweight children under 5 is higher than any other country.(3) In a recent report, it was found that India is the country with the largest population of both wasted (25.5 million) and stunted (46.6 million) children under 5.(4) Here, wasting is defined as a low weight-for-height, and stunting is defined as a low height-for-age.(5) Some recent reports have shown that the percent of underweight and stunted children can be as high as 75% and 74%, respectively, in some parts of India.(3) While the numbers of children under 5 years old presenting with signs of undernutrition have almost halved in the last 25 years,(6) childhood malnutrition continues to be a huge burden on India.

One reason malnutrition in children under 5 is such a serious concern is because of the long-term consequences it can have when left untreated. Some of these consequences include decreased chances of childhood survival, increased susceptibility to frequent illnesses because of lowered immunity, decreased ability to learn, and decreased productivity later in life(7). Children who have moderate malnutrition, defined as a weight-for-height that is between 2 and 3 standard deviations (SDs) below the World Health Organization (WHO) standards, are much more likely to die from infections compared to well-nourished children.(8) For some illnesses, such as diarrheal illnesses, the risk of dying can be up to 5.4 times higher in undernourished children according to some studies.(9) Without proper management, a moderately undernourished child can quickly become severely malnourished (weight-for-height SD scores less than 3 below

WHO standards), which then has a fatality rate between 30-50% on average in children under 5.(5)

Treatment for malnutrition depends on the severity and presence of any comorbid illnesses. Generally, patients who have severe acute malnutrition require an intense 2-7 day inpatient stay for stabilization and to treat any additional medical illnesses. This stabilization phase is followed by a long rehabilitation phase which is focused on high calorie and protein intake to help patients gain weight.(10) Rehabilitation can start in hospitals, but there is a push, due to the number of patients requiring treatment, to move rehabilitation into the community once patients have increased appetite, especially with the availability of ready to use therapeutic foods.(5) Treatment for patients who are found to have moderate malnutrition includes food supplementation and more importantly, diet counselling for the caregivers.(11) These two management options are available in outpatient settings.

In India, in order to help combat this high prevalence of childhood malnutrition, the National Institute of Nutrition (NIN) was created. The NIN is a federally-funded research organization located in Hyderabad, where it primarily conducts public health research on nutrition. Over the last few decades, their research has focused on adapting the WHO severe acute malnutrition (SAM) management guidelines for the local setting of Hyderabad by emphasizing the use of local, cost-effective foods to achieve results comparable to the WHO recommended diet. This diet has been implemented and tested at the nutritional wards that the NIN oversees in several Telangana state government hospitals, including Niloufer Hospital. Niloufer Hospital, in addition to having this inpatient nutritional ward dedicated to rehabilitation for patients with SAM, also has an outpatient

(OP) nutritional room that is focused on providing the recommended management for patients with mild to moderate malnutrition, namely food supplementation and diet counselling for caregivers.

CHAPTER TWO: Background Project: Defining the Local Context

Background

Niloufer Hospital is a 60-year-old public hospital that provides free service to women and children of low socio-economic status in Hyderabad, India. The hospital has 500 inpatient beds and reports that they saw roughly 160,000 pediatric outpatients and 40,000 pediatric inpatients in 2008, the last year of published data available.(12) Most patients are from the city of Hyderabad located in the state of Telangana, although there are still many patients who travel from rural areas outside of the city. The majority of patients come from families that have little to no education and have low literacy levels. Although the Nutritional Department is funded by the NIN, the rest of the hospital is funded and run by the state of Telangana. Because of this difference in funding, there is little collaboration between the Nutrition Department and rest of Niloufer Hospital.

The Nutrition Department is physically spread out between two rooms located in separate buildings within walking distance of each other: the outpatient (OP) room and the inpatient ward. Outpatients are first seen in a general outpatient room between the hours of 9:00 AM – 12:00 PM. If the general pediatrician working that day clinically suspects a child is undernourished, they will refer the child and caregiver next door to the nutritional OP room.

Here, 1-2 nutritional nurses take anthropomorphic measurements including height, weight, and mid-upper arm circumference. They proceed to either give the patient supplemental food, or they give the caregivers diet counseling based on the age of the child and any other specific nutritional needs of the child.

The objective of this background study is to define the local context of the nutritional ward of Niloufer Hospital and to understand the needs of the population of

patients seen here. This will be achieved specifically by defining the average nutrition status of the children seen in the nutritional department, and by investigating the attitudes, practices, and knowledge regarding malnutrition of patients' caregivers. Children included in this study are up to 5 years old, and similarly caregivers included are those who are with patients up to 5 years old. This study will be useful in later designing interventions in the ward that align with the NIN's goals to 1) identify various dietary and nutrition problems prevalent among different segments of the population in the country and 2) to evolve effective methods of management and prevention of nutritional problems.

Methods

Defining the Average Patient

Every patient seen and evaluated in the outpatient room nutritional room has their information recorded in a logbook known as the Nutritional Outpatient Registration Book. This information includes the patient's age, gender, religion, height, weight, mid-upper arm circumference, primary diagnosis given by the general pediatrician referring the patient to the OP room, severity of malnutrition given in standard deviations (SD) below the WHO's weight-for-height standards, and treatment plan (given food in the outpatient room versus counseling to the caregivers). This data was collected directly from this logbook for all patients 5 years old and younger seen in the outpatient room from April 2016 to July 2016. Descriptive statistics were then done on this data.

Assessing the Pre-Existing Nutritional Knowledge, Attitudes, and Practices of Caregivers

In order to assess the pre-existing nutritional knowledge, attitudes, and practices

(KAP) of caregivers, surveys were given to caregivers at Niloufer. A Knowledge, Attitudes, and Practices survey created and standardized by the Food and Agriculture Organization of the United Nations was appropriately adapted for the study and used for this purpose. Information in the surveys included basic demographic information, KAP regarding breastfeeding and diet, KAP regarding undernutrition, and KAP regarding sanitation practices. Survey questions about breastfeeding and diet were asked depending on the caregiver's child's age. The surveys were orally given to caregivers with children under 5 years of age throughout the hospital, both in the nutritional ward and in other departments of the hospital. This broader scope of participants allowed for a more representative population that reflected the patients and caregivers that were overall seen at Niloufer Hospital and thus that had the potential to be referred to the outpatient nutritional room. Nurses who worked in the nutritional ward served as the primary translators for the surveys. Answers were summarized and analyzed with descriptive statistics.

Results

Characteristics of Nutritional Referral Patients

In order to understand the patient population that the Nutritional Ward evaluates, demographic and medical information about the patients referred to the outpatient room for nutritional evaluation was collected for June 2016. This data was gathered from the outpatient registration book of the nutritional ward. Data was collected for 124 patients 5 years of age and under. Characteristics of these patients are illustrated in Table 1. The average age of patients evaluated was 23.07 months, about 2 years. Roughly half the patients were male or female (male=53.22%; female= 46.78%). Similarly, there were

about equal numbers of both Muslim and Hindu patients being referred to the OP room (Muslim=49.19%; Hindu=50.81%). Patients 5 years and under evaluated in the OP room had an average weight-for-height of 2.13 SDs below the WHO standards. Table 4 illustrates the percentage of patients at each SD below the standard, the majority lying between -1 and -3 SDs. 60.48% of the caregivers were given diet counselling as the intervention of choice, as opposed to 39.52% of patients who were given food (Table 2). Table 3 lists the top 10 diagnoses assigned by the staff to the patients. Patients were given up to three primary diagnoses, and the most common one given was acute gastroenteritis (20.97%). Most patients were assigned either PEM (protein energy malnutrition) in general (9.68%) or a specific grade of PEM, such as grade III PEM (14.52%) or grade IV PEM (8.06%). Additional common diagnoses included fever (12.10%), lower or upper respiratory tract infections (12.10%), cold (8.06%), not gaining weight (7.26%), seizures (4.84%), and diarrhea (4.03%).

Knowledge, Attitudes, and Practices Scores

A total of 21 KAP surveys were administered to mothers (the primary caregivers) of children who were seen at Niloufer Hospital and were 5 years or younger. Table 5 details a selection of characteristics of the patients, the caregivers being surveyed, and their families. The average age of the patients was 26.2 months, and the average age of the mothers being surveyed was 23.9 years. Mothers on average had completed 7.2 years of education, and only 19% had a job (which included a seamstress, a daily wage laborer, and a farmer). The fathers of the families on average had a lower education level (5.4 years), but 100% of them were working. On average, each family had 1.9 children, and

5.2 family members living in the household. 57.1% of all patients were currently being breastfed, and Figure 1 breaks down the percentages being breastfed by age in months.

For some important questions regarding feeding knowledge and practices, such as determining how many of the 7 food groups patients were currently being fed and the age until breastfeeding is recommended to be continued, correct responses were low (Table 6). Only 10.5% of caregivers reported feeding their child foods from all 7 food groups the day before (on average 4.5 groups were reported), and only 15.8% of caregivers knew to introduce complimentary foods at 6 months (average response 8.8 months) or to continue breastfeeding until 24 months (average response 22.8 months). However, nearly all caregivers could recognize at least one symptom of undernutrition, with about half reporting lack of energy and half reporting loss of weight as symptoms (Figure 2). When asked what could be done to help prevent undernutrition in the community, 88.9% of caregivers recognized the need for more education and suggested having someone come to educate members in the community on how to prevent malnutrition.

Conclusion

In this study, the aim was to define the local context and understand the needs of this local community by defining the “average” patient seen in the OP nutritional clinic as well as by investigating the nutritional attitudes, practices, and knowledge of caregivers for patients seen at Niloufer Hospital.

Of patients seen in the OP nutritional clinic, there were slightly more male than female patients, but there were equivalent numbers of Hindu and Muslim patients,

implying one of these groups is not referred to the OP nutritional room more than the others. The patient's diagnoses were handwritten in the logbooks by the nurses, based on the diagnoses given to the patients from the preceding room by the general pediatrician. There was no standardization in the diagnoses given, and thus there were many overlaps. For example, some patients were given a diagnosis of "Acute GE" (gastroenteritis) or "GE," whereas other patients were more simply given "diarrhea" as a diagnosis. Similarly, some patients were diagnosed with a "cold" whereas others were diagnosed with upper or lower respiratory tract infections. Some patients were given a grade of severity when diagnosed with protein energy malnutrition, but a large portion of the patients were simply given a general diagnosis of "PEM". This lack of standardization in documenting diagnoses suggests this could be a future area for improvement.

The average weight-to-height SD-score for all patients 5 and under seen in the OP room was -2.13. According to the WHO, moderate wasting (weight-to-height) is between -2SDs and -3SDs(5), which implies that the majority of the patients seen in the outpatient room have mild-moderate malnutrition. Additionally, more patients were given counselling as opposed to feeding, reflecting the recommendations for patients who have mild-moderate malnutrition. It was noted, however, that the counselling was given by the nurses in the OP room, and was given verbally by memory based on each nurses' nutritional expertise. However, each nurse that works in the OP room has a different level of experience and education. Additionally, the responsibility of giving diet counselling primarily falls the OP nutritional nurses because the doctors working in the OP room must split their clinical time in the morning between the inpatient ward and the OP room, in two separate locations. They then must travel to the NIN campus in the afternoons to work on

nutritional research projects. Because of the inconsistencies observed in the information being given to the caregivers by the nurses, a future intervention could be geared towards improving nutritional counselling.

The KAP analysis revealed that there seems to overall be low knowledge of proper breastfeeding and nutritional practices among the caregivers. Further characterization of this knowledge gap is revealed in two specific questions: recognition of malnutrition and daily diets. While it wasn't surprising that a majority of mothers cited lack of energy or loss of weight as signs of malnutrition, it was interesting to note that a weakened immune system or delayed growth/development was rarely immediately associated with malnutrition. Similarly, it was striking the average number of food groups given was less than 5 per day. While there are a total of 7 food groups recommended by the WHO for a proper diet, vegetarianism is common in India and therefore may often limit these families to 5 or 6 food groups, depending on if the family eats eggs. It is especially important to stress in these families an alternative source of these nutrients, such as Vitamin B12 supplements.

Relatedly, many mothers expressed that a lack of exposure to correct nutritional information was a root cause of malnutrition and that their communities would benefit from more community outreach in this area. Thus, it may be worthwhile to pursue an intervention that aims to improve nutritional knowledge, potentially through patient educational programs, so that knowledge gaps found through the KAP scores, and eventually malnutrition itself, may be properly addressed.

CHAPTER THREE: Introduction

While one may assume that the simple reason a child may become malnourished is solely due to a lack of access to nutritious food, this is only one of a multitude of reasons. In truth, malnutrition is a complex and multifactorial problem. There are many factors that predict a child's nutrition status, including birth weight, age of the child, household wealth, maternal education, source of drinking water, place of residence, and frequency of illness.(3) (4)

One of the most important factors that can determine a child's nutrition status is their mother's nutritional knowledge, independent of her education(13). In fact, a mother's nutritional knowledge is oftentimes a greater determinant in a child's nutrition status than the availability of nutritious food.(14) In many cultures, such as those in India, mothers are the primary caregivers and are in charge of feeding and caring for children. Thus, educational interventions that target the mother's nutritional knowledge have the potential to have a positive lasting impact on her child's diet and nutrition status.(15) In fact, diet counselling, in addition to food supplementation, is currently one of the recommended management options for patients who have moderate malnutrition.(8, 11)

A previous study showed that nutritional counseling with the usage of visual guides, in this instance posters, was effective in increasing a mother's nutritional knowledge.(16) Likewise, many studies have shown that visual guides are effective educational tools that aid in the process of learning and that can improve comprehension.(17) In health care settings, this is especially true for patients of low literacy levels.(18) In order for a visual aid to be an effective tool and reinforce verbal education, it must be practical, simple, and relatable to the patients who are interacting with it.(19) Additionally, images used in visual guides should be culturally relevant to the patients, with pictures of objects and symbols

that are familiar and that can be easily recognized by the patients.(18) Effective visual guides should allow patients to effortlessly interpret their meaning along with guidance from health care workers(18) during an educational session.

As described earlier, one-on-one nutritional counseling is a service that is offered to caregivers of children seen in the Nutrition Department at Niloufer Hospital. Children seen at Niloufer are mostly from families with low socio-economic status, and many of the parents have low education and literacy levels. Additionally, the previous data from the background study showed that there are knowledge gaps in mothers regarding basic nutritional concepts. These concepts include the current best practices for feeding infants and young children, as well as how poor sanitation practices and frequent illnesses are linked to malnutrition.

The counseling sessions offered to the caregivers of children clinically diagnosed with malnutrition are given verbally by the nursing staff of the Nutrition Department in the department's nutritional outpatient (OP) room. However, the nurses and other nutritional staff expressed concern that the counseling sessions were ineffective and they remained doubtful that caregivers were gaining as much knowledge as they aimed to provide during each session. Therefore, the staff voiced interest in doing a pilot quality improvement (QI) study in their nutritional OP room. Quality improvement studies are important in global health settings as they improve the quality of care, allow for flexibility in and customization of solutions that address any gaps when compared to a gold standard, and give structure to creating low-cost, sustainable interventions. Therefore, the aim of this study was to increase caregiver nutritional knowledge gained after receiving diet counseling at Niloufer Hospital by 25% by March 2017 through the use of quality improvement tools.

CHAPTER FOUR: Methods

Quality Improvement Tools

The two main QI tools chosen for use in this project were the plan, do, study, act (PDSA) model(20) and the define, measure, analyze, improve, and control (DMAIC) model.(21) In this study, small PDSA cycles were used within the overall framework of the DMAIC model. Both of these highly effective tools are standard for use in QI studies. They provide frameworks for organizing projects and creating interventions to ensure the results are both reliable and reproducible. The PDSA method is meant to be used on a small yet continuous level.(22) It allows for gradual small changes to be made, analyzed, and revised until a final product is perfected. DMAIC is used on a larger scale to plan out an entire project, starting at the beginning in the “define” phase where a team is created and the goals of the project are decided on, and ending in the final “control” phase where any interventions are perfected and made sustainable and the project is concluded by being handed off to a new team or the clients.

Interventions

This study implemented two sequential interventions, both designed through a series of PDSA cycles. The first logical step to an effective counseling session is to make sure the information being offered is complete, relevant, and consistent. Thus, the first intervention’s focus was to standardize the information that was being given to the patients during each counseling session. The chosen intervention to achieve this goal was a checklist that the nurses could refer to while giving counseling. A checklist was chosen as they are commonly used as memory aids in medicine.

Because there are different diet guidelines depending on a child's age, three separate checklists were made: one for children under 6 months, one for children 6 months to 35 months, and one for children 3 years to 5 years. The initial checklists were created using the internationally recognized counseling guidelines from the World Health Organization (WHO) and the United Nations International Emergency Children's Fund (UNICEF).(23) This list was then brought to the physicians in the Nutrition Department, who are nutritional experts, as well as to the nutritional nurses. Together, changes were discussed and made to the checklists to make them more culturally appropriate and practical for the local setting. For instance, the physicians requested that specific information from the Indian Ministry of Health and Family Welfare be added to the checklists.(24) Next, some of the 250ml 'cup' measurements used to calculate serving sizes were converted to 150ml 'katori' measurements. Katoris are the bowl of choice used to feed children in India since they are most affordable option. Additionally, some words and phrases in the checklists were changed to reflect words and phrases that patients would be more familiar with. For example, the word "breastmilk" was changed to "mother's milk" as this was the term that was better recognized by the caregivers. Finally, some Indian-specific foods were added to the checklists as examples of healthy food options that could be affordably found in local markets. The final checklist for each age group offered accurate yet practical information for the caregivers.

The second intervention was the introduction of visual guides. Originally, posters covering a variety of topics related to nutrition were going to be made and placed on the walls of the OP room in a location that patients could easily view and nurses could easily point to. However, both the nurses and physicians decided that the visual guides that

would best fit the need of the OP room would be flipcharts. Instead of relying on patients to passively view the posters and hope to gain knowledge from them, flipcharts would ensure that active and interactive learning was taking place during the counseling sessions. The nurses could more easily point to pictures in the flipcharts and ask caregivers questions about those pictures, further engaging them.

The flipcharts were designed using the same information found in the checklists. Images were placed on one side of the flipchart and the corresponding information from the age-specific checklist was placed on the opposite side of the flipchart. This design allowed the nurse and caregiver to sit face-to-face during counseling. The information from the checklist would face the nurse and a large image representing that information would face the caregivers. The images were taken from counseling cards specifically adapted for India by the Center for Human Services, originally from UNICEF.(25) It was important to use images that depicted Indian families and children so that the caregivers could more easily relate to them. Some of the information in the checklists did not have a corresponding picture from the UNICEF counseling cards, as the cards only featured infants and children under 2. Accordingly, images of children who were slightly older had to be found through additional sources for the 3-5 Years flipchart. Some of the images even had to be created, especially those images depicting healthy and unhealthy local Indian foods.

Study Design

The study design, within the DMAIC framework, consisted of a series of quasi-experimental uncontrolled before and after studies. The study was divided into three 2-

week phases. The first 2-week phase, the Baseline Phase, was used to collect the baseline data on caregiver nutritional knowledge gained after counseling sessions through the use of verbal pre- and post-counseling surveys. The second 2-week phase implemented the checklists, while also collecting the pre- and post-counseling surveys. Finally, the same metrics were collected in the third 2-week phase after the flipcharts were implemented.

Every caregiver with an undernourished child who was 5 years old or younger who was referred to the OP nutritional room for counseling was considered for the study. If a patient was over 5 years old, they were excluded. Caregivers were also excluded if their children were follow-up cases and they had already been counseled at a previous time. Similarly, caregivers of children who had already been admitted to the nutrition ward were excluded.

Verbal consent was obtained from all caregivers before proceeding with the surveys. No caregivers were forced to answer any questions they were uncomfortable with and instead could skip the question or say they did not know the answer. As soon as a caregiver walked into the OP room, and consented to doing the survey, they were asked some basic demographics and the pre-counseling survey was administered. The demographics included the mother's education, the father's education, the age of the patient, the number of children in the patient's family, the number of people in the household, and the caregiver's religion. This was immediately followed by a counseling session given by one or two of the nurses present in the OP room. Once the counseling had concluded, caregivers were asked the questions for the post-counseling survey.

The surveys were mainly translated by a medical student who knew one of the

local languages: Telugu. For caregivers who spoke Hindi, the nurses and doctors offered additional help in translating survey questions.

The surveys were developed through a series of PDSA cycles. The questions from these surveys were a combination of questions modified from the UNICEF adaptable knowledge, attitudes, and practices (KAP) surveys(26) and from questions suggested by the on-site physicians as important topics. The original survey consisted of 20 questions from four different categories: breastfeeding, complementary feeding, undernutrition, and sanitation. All these categories were covered during the counseling sessions and each question asked about material that the planned interventions would cover. Caregivers of children from all age groups received the same survey.

All the questions in each category were randomly assigned a number and then sorted in ascending order. For each survey, the first half of the questions in each category were asked before counselling, and the second half of the questions were asked after counselling. This way, each caregiver was eventually asked all the questions, even though some caregivers were given certain questions in the pre-counselling survey, whereas some were given the same question in the post-counselling survey. This same method of administering a set number of survey questions has been used in previous studies that also looked at same-day learning(27) The semi-randomization of assigned questions allowed for both the pre- and post-counselling surveys to cover roughly the same number of questions from each category. The questions were assigned this way so that the pre- and post-counselling questions were not repeated to the same caregiver, which could have potentially primed caregivers to listen for only certain things during counseling and not pay attention to the rest of the counseling session.(27)

The first time the 20-question survey was tested out, it was observed to be too long, and the caregivers were becoming impatient while the surveys were being administered. After several questions were cut out, the final survey consisted of only 12 questions, with half the questions asked in the pre-counselling survey and the other half asked in the post-counselling survey.

Outcomes and Analysis

Because all caregivers were given the same 12 survey questions regardless of their child's age, when analyzing the survey data, a set of questions from the original 12 was chosen for analysis for each age group. Ultimately, 8 questions were analyzed for caregivers with children under 6 months, 9 questions for caregivers with children 6 to 35 months, and 6 questions for caregivers with children 3 to 5 years. Although less than ideal, doing this allowed the surveys to be optimized for each age group by including all questions that would be appropriate for a caregiver to know based on her child's age and based on the counselling that would be given. For instance, it is not helpful to ask caregivers with a 4-year-old questions about best breastfeeding practices. Similarly, it is not helpful to ask a mother with a newborn baby details about the diet of a 3-year-old child. A list of the final survey questions used for each age group (in addition to the correct responses) is found in Table 15.

Caregivers' answers to the survey questions were then scored. They received 0 points for an incorrect answer or if they did not know the answer, 1 point for a partially correct answer, and 2 points for a completely correct answer. Using this point system, the total number of points earned was divided by the highest number of points they could

have obtained to calculate a “knowledge score.” This was done for each caregiver for their pre-counselling survey questions and post-counselling survey questions separately. A “change in knowledge score,” or “gain in knowledge score,” was then simply calculated by subtracting the pre-counselling knowledge score from the post-counselling knowledge score. Average change in knowledge scores were reported.

There were a total of 5 instances within the 6-35 month group where there was an unanswered question due to the fault of the interviewer and not of the caregiver. In these cases, where the answer to a question was not available, this question was not included in the denominator when calculating knowledge scores as to not artificially lower the percentages.

This data was stratified by both age groups and phases and then analyzed further using a one-way ANOVA. The purpose of the ANOVA was to compare the effect of counselling on the change in knowledge scores during each phase when a new intervention was introduced, for all the age groups. ANOVA is used to determine if a statistically significant difference exists between any two phases. Additionally, a post-hoc analysis with a student-Newman-Keuls (SNK) test was performed to confirm the findings of the ANOVA analysis. These results are displayed through letters. Phases that have the same letter are not statistically significant, whereas phases with different letters are statistically significantly different from each other.

CHAPTER FIVE: Results

Under 6 Months

Demographic characteristics of patients and caregivers in the under 6 month group is detailed in Table 8. In total, there were 26 caregivers surveyed for this age group, with 7, 5, and 14 surveyed during the Baseline, Checklist, And Flipchart Phases respectively. The average age for patients in this age group for the Baseline, Checklist, And Flipchart Phases was 2.5 months, 2.7 months, and 3.1 months respectively. For the Baseline Phase, the mean gain in knowledge score was 5.24. The mean gain in knowledge score was 10.17 in the Checklist Phase, and the highest gain in knowledge score was seen in the Flipchart Phase, with a mean of 12.20 (Table 11). From the Baseline Phase to the Flipchart Phase, there was an increase in the mean gain in knowledge of 6.96, or a 132.8% increase. However, ANOVA analysis shows that these results are not statistically significant ($p=0.87$)(Figure 3), and the SNK grouping from the post-hoc analysis confirms this finding.

6 Months to 35 Months

Table 9 displays the demographic characteristics for caregivers and patients from 6-35 months of age. Again, the sample size was small with 13 caregivers surveyed in the Baseline Phase, 13 caregivers surveyed in the Checklist Phase, and 19 caregivers surveyed in the Flipchart Phase. The mean change in knowledge scores were 9.25 in the Baseline Phase, 8.14 in the Checklist Phase, and finally 18.86 in the Flipchart Phase. The increase in gain in knowledge scores between the Baseline Phase to the final phase, the Flipchart Phase, was 9.61, or an increase of 103.9%. Similar to the Under 6 Months group, these findings were not found to be statistically significant ($p=0.52$).

3 Years to 5 Years

Demographic characteristics for this group are found in Table 10. Sample sizes during each phase of the study ranged from 7 (baseline) to 12 (checklist and flipchart). For this age group, the mean change in knowledge was 3.57 in the Baseline Phase, 6.25 in the Checklist Phase, and 29.17 in the Flipchart Phase. The difference in the mean change in knowledge scores between the Baseline and Flipchart Phases is 25.6, which is an increase of 717.1%. However, once again analysis of this data with ANOVA did not yield significant findings ($p=0.12$).

Mean change in knowledge scores is summarized for all age groups in Table 14. Although there were no statistically significant results, the Flipchart Phase for each age group did have the highest change in knowledge score compared to the other phases.

CHAPTER SIX: Conclusion

Summary and Interpretation

The aim of this pilot study was to increase caregiver knowledge gained after receiving diet counseling by 25%. Caregiver gain in knowledge was calculated by the difference in their post-counselling survey scores and pre-counselling survey scores. The aim was achieved for all of the groups when looking at the increase in caregiver gain in knowledge scores from the Baseline Phase to the final phase, the Flipchart Phase. The percent increase between the change in knowledge scores of the Baseline and Flipchart Phases was 132.8% for the under 6 months group, 103.9% for the 6 to 35 months group, and 717.1% for the 3 to 5 years group. Despite these seemingly large percent increases, none of the findings in the study were deemed to be statistically significant according to ANOVA analysis. This is not surprising for this pilot study given the very low sample sizes. In some instances, the sample sizes used to calculate averages were as small as 5 (under 6 months in the Checklist Phase). Nevertheless, the trends in the findings are still suggestive that flipcharts are overall an effective intervention and that by intervening in diet counselling and improving it, one can indeed improve a caregiver's nutritional knowledge.

The Checklist Phase had some inconsistent results, with some of the age groups actually having a lower gain in knowledge score in the Checklist Phase compared to the Baseline Phase. It is possible that when nurses were initially given the checklists to use during the counselling sessions, the information they were asked to provide was significantly more than they were previously used to. The organization of how the nurses presented the large amount of information may have been confusing for the caregivers,

which may have affected the results.

On the other hand, this was not the case with the flipcharts. The flipcharts deliberately divided all the information into smaller, more manageable chunks, so that the concepts illustrated on each page were easy to understand and not convoluted with information. This presentation of information may have been easier for the nurses to teach with and for the caregivers to understand and follow. Also, the information given was more standardized and consistent from counseling session to counseling session. Both of these factors, improved organization and consistency, may have worked together to allow the flipcharts to be an effective intervention for increasing caregiver knowledge. Another reason the flipcharts were effective was because the images added in the flipcharts increased how interactive the counseling sessions were for the caregivers. Caregivers began asking more questions, and they could easily follow along with the nurses by looking at the images. The images also addressed any potential language barriers present between the nurses and some caregivers. Because the caregivers spoke a wide variety of languages and dialects, it was sometimes difficult for the nurses to advise them on giving their children certain foods. For instance, there are many words for 'banana' or 'potato,' but no guarantee that the caregivers knew the same word that the nurse knew. But with the addition of pictures of these important foods, any confusion could be altogether avoided. Additionally, another reason why the flipcharts specifically may have been effective was because the images used in the flipcharts were relatable to the caregivers, depicting Indian families and common Indian foods. Overall, the flipcharts were a good intervention because they were visual, organized, relatable, interactive, and overcame language barriers.

Limitations

There was a limited time of only 6 weeks available to conduct this pilot study. As a result, the time available to make changes to the interventions as needed was decreased. In addition, sample sizes were very small and uneven, ranging from 5 to 19 cases in a given group. The OP building was only open for 3 hours in the morning, so there were a limited number of patients that could be seen on any given workday. There were especially low numbers of children under 6 months being referred to the OP room. This could be due to the fact that children under 6 months are largely protected from malnutrition if they are breastfed, and even if they are not receiving adequate nutrition, signs for undernutrition will not manifest immediately, but will become more apparent once the infant is older.

Conclusions and Future Steps

Despite the fact that each caregiver surveyed only received one counseling session around 10 minutes long, there were some positive improvements in how much knowledge they gained after the interventions were introduced. The final intervention, the flipcharts, were simple to create and were a low-cost solution to improving nutritional counseling at Niloufer Hospital. Nurses found that it was easy to learn to use the flipcharts and incorporate them into counselling because of their ease of use. Because of their affordability and how easy they are to produce, these flipcharts can be easily adapted to other low-resource settings according to the local needs.

Both the checklists and flipcharts need to be further tested in a larger study to see if the findings can be duplicated but with statistical significance. This could either be

accomplished by testing the interventions in a new setting in Hyderabad or India, or by doing a comparative study here in the United States. Additionally, demographic characteristics, including the mother's age, education level, number of children in the house, and number of people in the household will need to be better controlled for in future studies.

Tables and Figures
Background Project: Defining the Average Patient

Characteristic	
Average Age (months)	23.07
Average (-)SD score	2.13
Female Patients	46.78%
Male Patients	53.22%
Hindu Patients	50.81%
Muslim Patients	49.19%

Table 1: Characteristics of patients (5 years of age and under) seen in the nutritional outpatient (OP) room at Niloufer Hospital.

Intervention	Patients	Percentage
Diet counselling	75	60.48%
Feeding	49	39.52%

Table 2: Interventions offered to patients seen in the OP Nutritional Room.

Diagnosis	Patients	Percentage
Acute Gastroenteritis	26	20.97
Grade III PEM	18	14.52
Fever	15	12.10
Lower/Upper Respiratory Tract Infection	15	12.10
PEM	12	9.68
Cold	10	8.06
Grade IV PEM	10	8.06
Not Gaining Weight	9	7.26
Seizures	6	4.84
Diarrhea	5	4.03

Table 3: Top 10 diagnoses assigned to patients by the staff in the OP Nutritional Room. Some patients were assigned up to 3 primary diagnoses. (PEM=protein energy malnutrition)

(-) SD score	Patients	Percentage
0	6	4.84
1	26	20.97
2	43	34.68
3	37	29.84
4	8	6.45
>4	1	0.81
No record	3	2.42

Table 4: Standard deviation below the WHO standards for weight-for-height for patients 5 years of age and under seen in the OP Nutritional Room.

Background Project: Assessing KAP in Caregivers

Characteristics	Averages
Mother's Age (years)	23.9
Mother's Education Level (years completed)	7.2
Mothers Reporting an Occupation	19%
Education Level of Mothers Who Work (years)	2.7
Father's Education Level (years completed)	5.4
Fathers Reporting an Occupation	100%
Age of Patient/Child (months)	26.2
Number of Children in the Household	1.9
Number of People Living in The Household	5.2
Children Currently Being Breastfed	57.1%

Table 5: Selection of characteristics of the caregivers and patients families that were surveyed

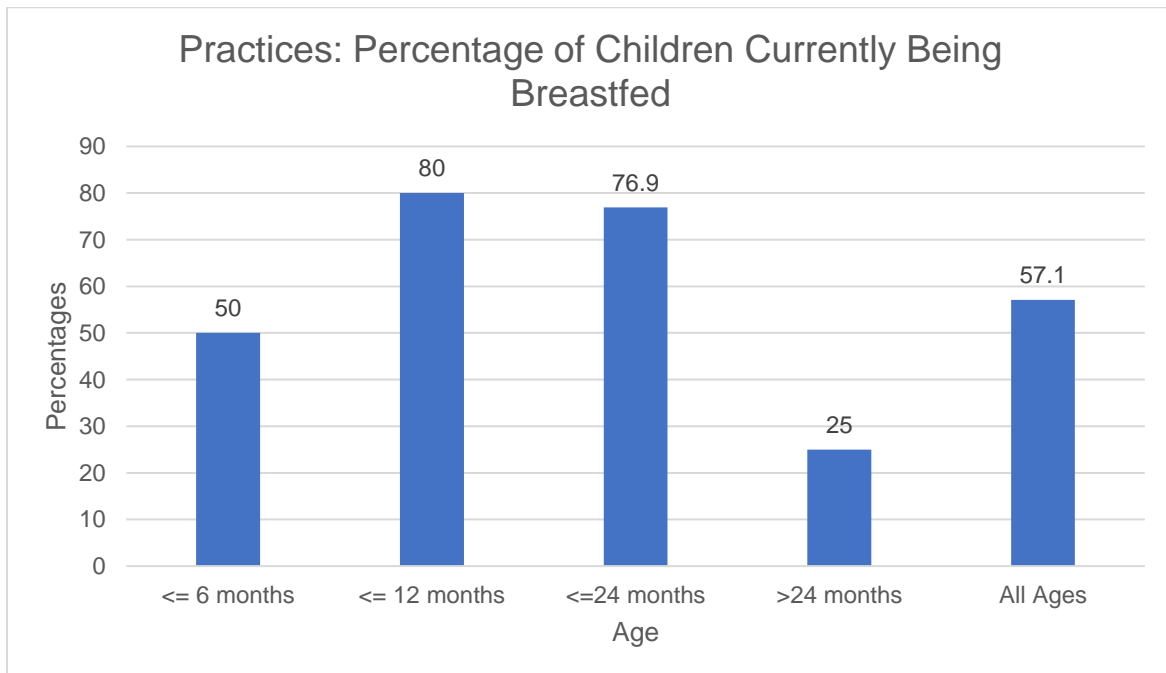


Figure 1: Percentage of children currently being breastfed in terms of age.

Question	Average Response	Percent correct response or correct practice	Percent unsure or did not give response
Practice: What foods did your child eat yesterday?	4.5 food groups listed	10.50% (correct: 7 food groups)	N/A
Knowledge: At what age should babies start eating foods in addition to breastmilk?	8.8 months	15.80% (correct: 6 months)	10.50%
Knowledge: How long is it recommended that a woman breastfeeds her child?	22.8 months	15.8% (correct: 24 months)	10.5%

Table 6: A selection of critically important questions regarding practice and knowledge of nutrition for children and the response of the caregivers.

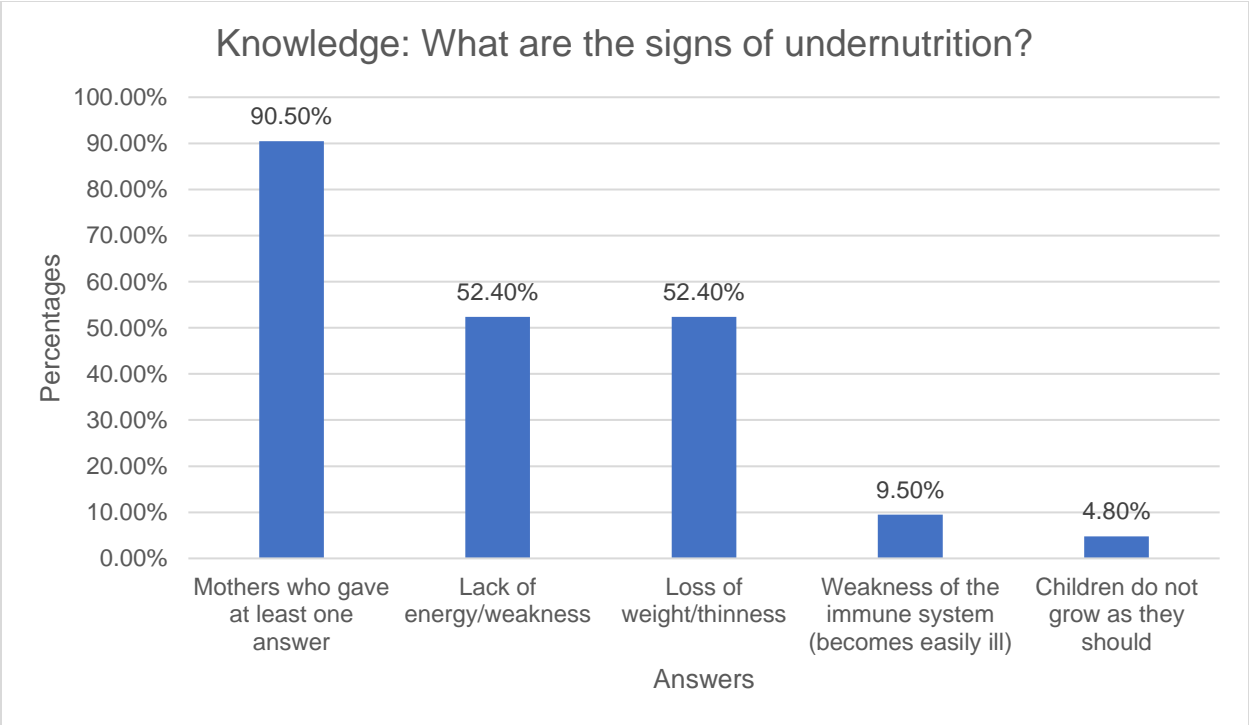


Figure 2: Responses to the knowledge question regarding signs of undernutrition.

Improving Nutritional Knowledge Gained

Demographic Characteristics of all patients	Mean	SD	Range
Age (Month)	23.0	20.0	0.3-60.0
Mother's Education (Years)	8.9	4.9	0.0-18.0
Father's Education (Years)	8.2	5.8	0.0-16.0
Number of children in the family	1.9	0.8	1.0-4.0
Number of people in the household	6.2	4.1	2.0-25.0

Table 7: Demographic characteristics of all patients throughout the study. N=102

Demographic Characteristics	Baseline (N=7)			Checklist (N=5)			Flipchart (N=14)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Age (Month)	2.5	1.6	0.3-5.0	2.7	2.2	0.8-5.0	3.1	1.3	1.0-5.0
Mother's Education (Years)	6.7	4.9	0.0-13.0	10.4	6.5	0.0-16.0	10.4	4.4	0.0-16.0
Father's Education (Years)	9.7	4.8	0.0-16.0	10.6	5.3	5.0-16.0	11.0	5.4	0.0-16.0
Number of children in the family	2.0	1.0	1.0-4.0	2.0	0.7	1.0-3.0	1.9	0.9	1.0-4.0
Number of people in the household	6.6	4.1	4.0-15.0	6.8	4.7	4.0-15.0	5.3	2.4	3.0-10.0

Table 8: Demographics for children <6 months throughout each phase.

Demographic Characteristics	Baseline (N=13)			Checklist (N=13)			Flipchart (N=19)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Age (Month)	13.6	5.8	7.0-24.0	14.5	6.1	6.0-24.0	18.0	7.4	8.0-30.0
Mother's Education (Years)	8.3	5.1	0.0-18.0	10.8	3.7	4.0-16.0	8.4	5.1	0.0-16.0
Father's Education (Years)	6.0	5.6	0.0-16.0	9.4	6.6	0.0-16.0	6.8	6.4	0.0-16.0
Number of children in the family	1.5	0.8	1.0-3.0	1.5	0.5	1.0-2.0	1.8	0.9	1.0-4.0
Number of people in the household	6.7	4.5	3.0-17.0	8.9	7.5	3.0-25.0	5.1	2.7	3.0-15.0

Table 9: Demographics for children 6-35 months throughout each phase.

Demographic Characteristics	Baseline (N=7)			Checklist (N=12)			Flipchart (N=12)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Age (Month)	53.1	6.4	48.0-60.0	51.5	8.3	36.0-60.0	48.0	8.5	36.0-60.0
Mother's Education (Years)	8.0	4.1	0.0-12.0	5.3	4.2	0.0-10.0	10.8	4.6	0.0-16.0
Father's Education (Years)	8.0	5.9	0.0-16.0	5.3	4.5	0.0-10.0	9.5	5.6	0.0-16.0
Number of children in the family	2.3	0.5	2.0-3.0	2.3	1.0	1.0-4.0	2.1	0.8	1.0-4.0
Number of people in the household	4.5	1.0	4.0-6.0	6.1	3.4	2.0-15.0	6.3	2.8	3.0-13.0

Table 10: Demographics of children 3-5 years throughout each phase.

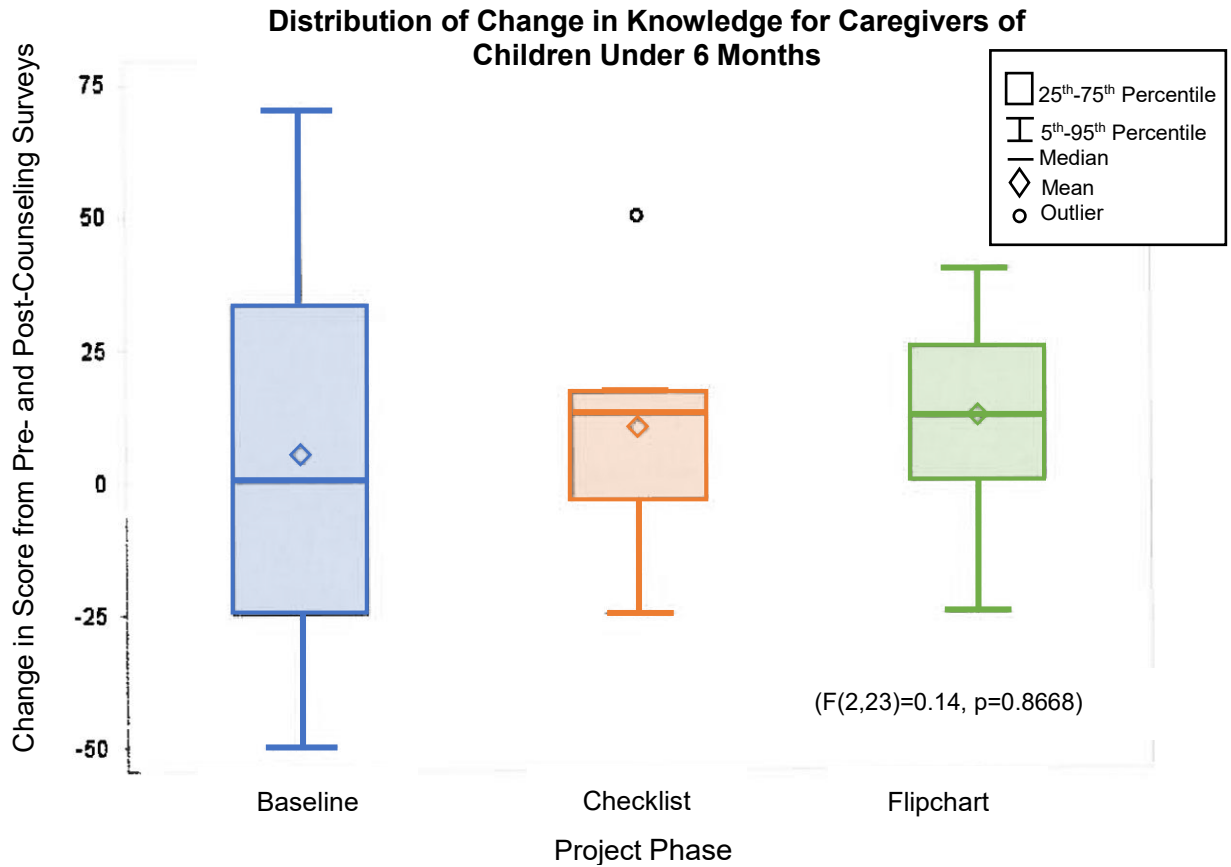


Figure 3: Box plot showing the distribution in the change of knowledge for caregivers of children under 6 months for each phase. The equation is derived from the ANOVA analysis, which shows $P > 0.05$.

Phase	Mean	SD	N	Student-Newman-Keuls Grouping
Baseline	5.24	40.5	7	A
Checklist	10.17	27.6	5	A
Flipchart	12.20	20.0	14	A

Table 11: Mean knowledge gained for caregivers of children under six months of age. Means with the same Student-Newman-Keuls (SNK) grouping letter are not statistically significantly different.

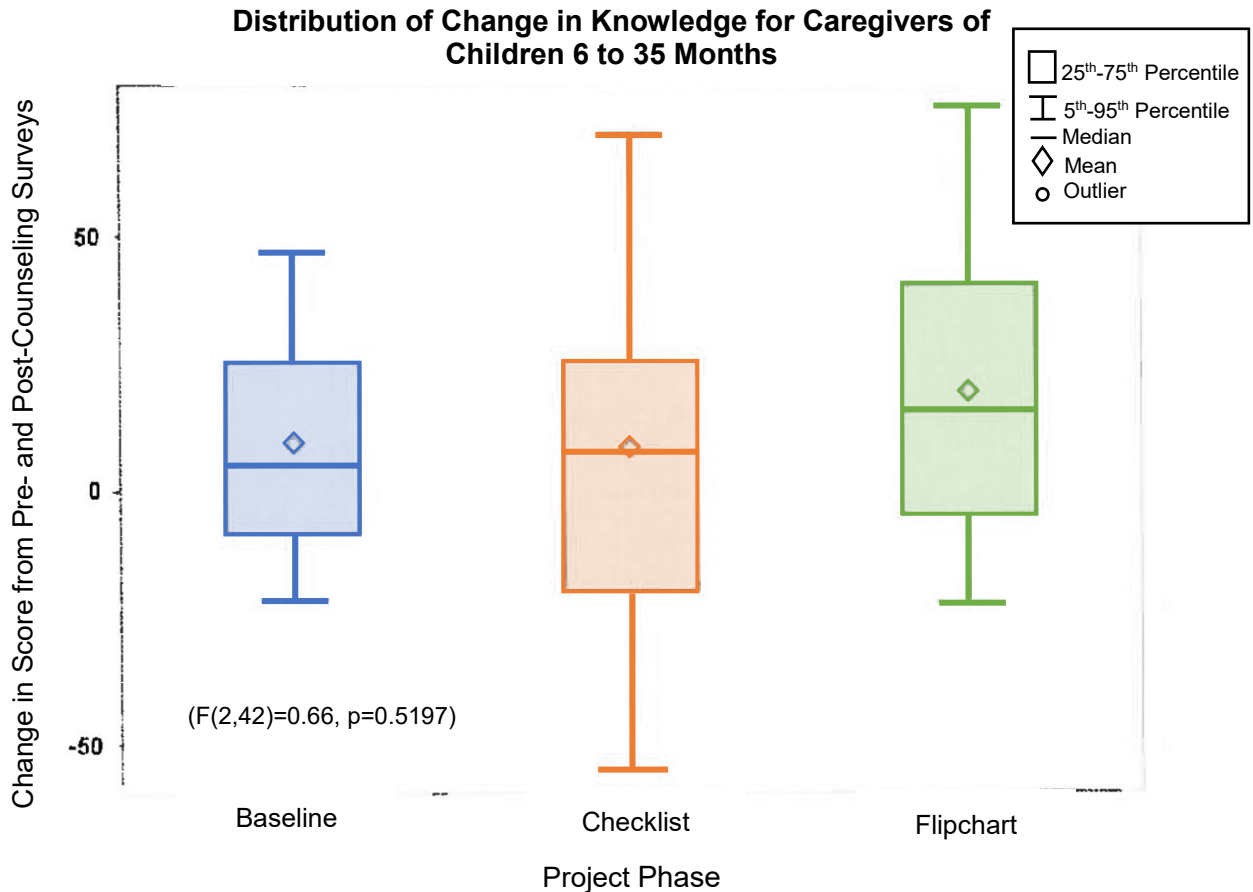


Figure 4: Box plot showing the distribution in the change of knowledge for caregivers of children 6 months to 35 months for each phase. The equation is derived from the ANOVA analysis, which shows $P > 0.05$.

Phase	Mean	SD	N	Student-Newman-Keuls Grouping
Baseline	9.25	21.3	13	A
Checklist	8.14	36.6	13	A
Flipchart	18.86	28.4	19	A

Table 12: Mean knowledge gained for caregivers of children 6 months to 35 months. Means with the same SNK grouping letter are not statistically significantly different.

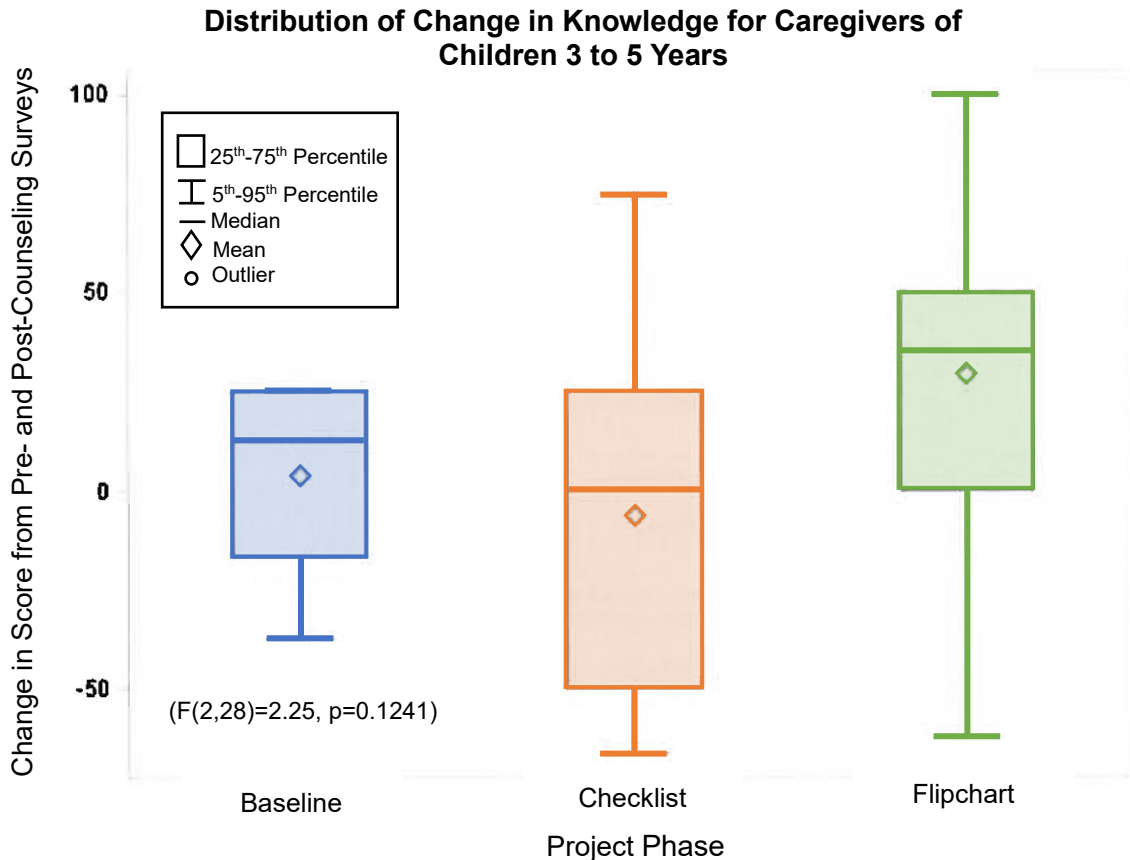


Figure 5: Box plot showing the distribution in the change of knowledge for caregivers of children 3 years to 5 years for each phase. The equation is derived from the ANOVA analysis, which shows $P > 0.05$.

Phase	Mean	SD	N	Student-Newman-Keuls Grouping
Baseline	3.57	23.4	7	A
Checklist	-6.25	49.4	12	A
Flipchart	29.17	41.3	12	A

Table 13: Mean knowledge gained for caregivers of children 3 years to 5 years. Means with the same SNK grouping letter are not statistically significantly different.

Phase	<6 Months	6-35 Months	3-5 Years
Baseline	5.24	9.25	3.57
Checklist	10.17	8.14	-6.25
Flipchart	12.20	18.86	29.17
Difference between Baseline and Flipchart Phases	6.96	9.61	25.6
Percent Increase between Baseline and Flipchart Phases	132.8%	103.9%	717.1%

Table 14: Mean change in knowledge scores for all ages in each phase.

Code	Question	Correct Answer
B1 ^a	What is the first food a baby should receive?	Breastmilk
B2 ^a	Until what age should a baby receive nothing more than breastmilk?	6 months
B3 ^{ab}	Until what age should a mother continue to breastfeed her child?	24 months and beyond
B4 ^{ab}	Which is better for babies, breastmilk or infant formula?	Breastmilk
CF1 ^{bc}	What are 3 types of healthy food that you should feed a child after 6 months of age?	3 or more of the following: <ol style="list-style-type: none"> 1. Grains, roots, tubers 2. Legumes and nuts 3. Dairy 4. Flesh foods 5. Eggs 6. Vitamin A fruits and vegetables 7. Other fruits and vegetables
CF2 ^a	How many times a day should an infant under 6 months receive water?	0 times
CF3 ^{bc}	If you are giving milk to a 3 year old child, how much water should be added to the milk?	No water should be added
CF4 ^{bc}	Name 2 types of food that are not healthy to give a 3 year old.	2 or more of the following: <ol style="list-style-type: none"> 1. Junk food 2. Sweets 3. Deep fried foods 4. "Outside food" 5. Street food 6. Cold drinks (sodas) 7. Any other foods that are not considered healthy (i.e., in the list of 7 healthy foods above)
U1 ^{abc}	Name 2 signs you know a child is undernourished.	2 or more of the following:

		<ol style="list-style-type: none"> 1. Less energy, less activity, or any similar answer 2. Low weight, not gaining weight 3. Not growing, short stature 4. Frequent illnesses
U2 ^{abc}	How many times a day should a child be fed if they are sick?	Multiple times a day (more than 1 time a day)
U3 ^{bc}	What foods should you not give a sick child?	All foods can be given to a sick child; or, any of the “unhealthy” foods listed above
S1 ^{ab}	Should you use a bottle or a cup/spoon to feed an infant milk?	Cup and spoon

Table 15: This table lists the twelve questions and their corresponding correct answers which were used for the pre- and post-counselling surveys. The “B” questions were questions about breastfeeding. Questions on complementary feeding were designated with the label “CF.” The “U” questions were general questions about undernutrition and the “S” question was a sanitation question.

^aQuestions asked to caregivers with children under 6 months

^bQuestions asked to caregivers with children 6 months to 35 months

^cQuestions asked to caregivers with children 3 years to 5 years

References

1. Fund UNICsE. Malnutrition: Current Status and Progress 2017 [updated Feb 2017]. Available from: <https://data.unicef.org/topic/nutrition/malnutrition/>.
2. Organization WH. Causes of child mortality, by country, 2000-2010 2017 [Available from: http://www.who.int/gho/child_health/mortality/mortality_causes_text/en/].
3. Sahu SK, Kumar SG, Bhat BV, Premarajan KC, Sarkar S, Roy G, et al. Malnutrition among under-five children in India and strategies for control. *J Nat Sci Biol Med*. 2015;6(1):18-23.
4. Fanzo J, Hawkes C. 2018 Global Nutrition Report: Shining a light to spur action on nutrition. Bristol, UK: Development Initiatives; 2018.
5. Organization WH. Nutrition 2019 [Available from: <https://www.who.int/nutrition/en/>].
6. Fund UNICsE, Organization WH, Group WB. Joint Malnutrition Dataset: Child Malnutrition Estimates. 2016.
7. Bank TW. Helping India Combat Persistently High Rates of Malnutrition 2013 [updated 13 May 2013]. Available from: <http://www.worldbank.org/en/news/feature/2013/05/13/helping-india-combat-persistently-high-rates-of-malnutrition>.
8. Ashworth A, Ferguson E. Dietary counseling in the management of moderate malnourishment in children. *Food Nutr Bull*. 2009;30(3 Suppl):S405-33.
9. Caulfield LE, de Onis M, Blossner M, Black RE. Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles. *Am J Clin Nutr*. 2004;80(1):193-8.
10. Ashworth A. Efficacy and effectiveness of community-based treatment of severe malnutrition. Technical Background Paper. Geneva: World Health Organization; 2005 21-23 November 2005.
11. WHO, UNICEF, WFP and UNHCR Consultation on the Programmatic Aspects of the Management of Moderate Acute Malnutrition in Children under five years of age Geneva, Switzerland: World Health Organization; 2010 02/23/2010.
12. Hospital N. Welcome to Niloufer Hospitals - Patients 2009 [
13. Gupta MC, Mehrotra M, Arora S, Saran M. Relation of childhood malnutrition to parental education and mothers' nutrition related KAP. *The Indian Journal of Pediatrics*. 1991;58(2):269-74.
14. Organization WH. Combined course on growth assessment and IYCF counseling: Participant's Manual. Geneva2012.
15. Guldan GS, Fan HC, Ma X, Ni ZZ, Xiang X, Tang MZ. Culturally appropriate nutrition education improves infant feeding and growth in rural Sichuan, China. *J Nutr*. 2000;130(5):1204-11.
16. A. N, A. Z, Awaluddin. The Effectiveness of Counseling and Posters in Improving Maternal Nutrition Knowledge and Nutritional Status of Children Aged 24-35 Months in District Buloa Tallo Makassar. *International Proceedings of Chemical, Biological and Environmental Engineering*. 2015;86(11):65-70.
17. Delp C, Jones J. Communicating information to patients: the use of cartoon illustrations to improve comprehension of instructions. *Acad Emerg Med*. 1996;3(3):264-70.
18. Houts PS, Doak CC, Doak LG, Loscalzo MJ. The role of pictures in improving health communication: a review of research on attention, comprehension, recall, and adherence. *Patient Educ Couns*. 2006;61(2):173-90.
19. Ngoh LN, Shepherd MD. Design, development, and evaluation of visual aids for communicating prescription drug instructions to nonliterate patients in rural Cameroon. *Patient Educ Couns*. 1997;31(3):245-61.

20. Langley GJ, Moen RD, Nolan KM, Nolan TW, Norman CL, Provost LP. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*: Wiley; 2009.
21. Kassardjian CD, Williamson ML, van Buskirk DJ, Ernste FC, Hunderfund AN. Residency Training: Quality improvement projects in neurology residency and fellowship: applying DMAIC methodology. *Neurology*. 2015;85(2):e7-e10.
22. G. R, R. H, W. B, P. B, P. G, O. G, et al. *Quality Improvement Basics*. G. R, R. H, editors: UTSouthwestern Medical Center; 2016. 116 p.
23. World Health Organization U. *Infant young child feeding counselling: An integrated course*. Geneva, Switzerland2006. 262 p.
24. Welfare MoHaF. *Guidelines for Enhancing Optimal Infant and Young Child Feeding Practices*: Government of India; 2013.
25. Fund UNCs, Services CfH, University Research Co. L. *Maternal, Infant and Young Child Nutrition: Counselling Cards for Health Care Workers*. 2010.
26. Mariás YF, Glasauer P. *Guidelines for assessing nutrition-related knowledge, attitudes and practices*. Rome: Food and Agriculture Organization of the United Nations (FAO); 2014. vi + 180 pp. p.
27. Colt HG, Davoudi M, Murgu S, Zamanian Rohani N. Measuring learning gain during a one-day introductory bronchoscopy course. *Surg Endosc*. 2011;25(1):207-16.

Vitae

Sophia Tibe Tinger (February 7th 1992-present) is an M.D. candidate from UT Southwestern Medical Center. She will be training to become a Family Medicine physician at John Peter Smith Family Medicine Residency Program starting in July 2019. She hopes to continue pursuing her passion for global health and working with underserved patients in her future. Outside of medicine, she enjoys photography and French horn performance.

Permanent Address: 903 Murphy Lane
Friendswood, Texas, USA 77546