Importance of Weight in the Treatment Outcomes of a Patient with TB

Essentials of Nurse Case Management

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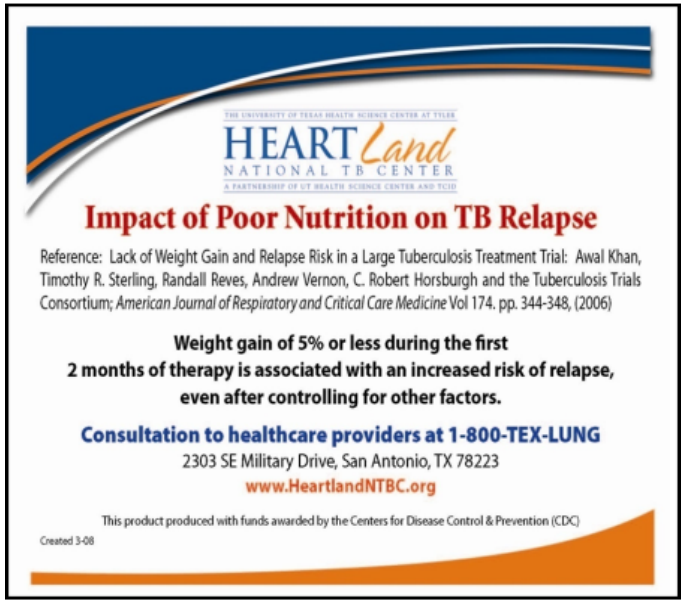
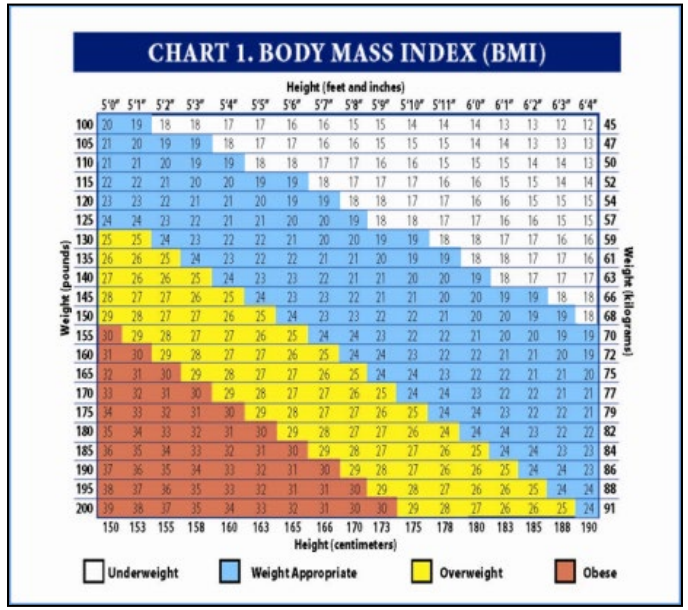
Objectives

- Discuss the Importance of weight gain on TB treatment outcomes

- Demonstrate the use of the BMI chart with case studies





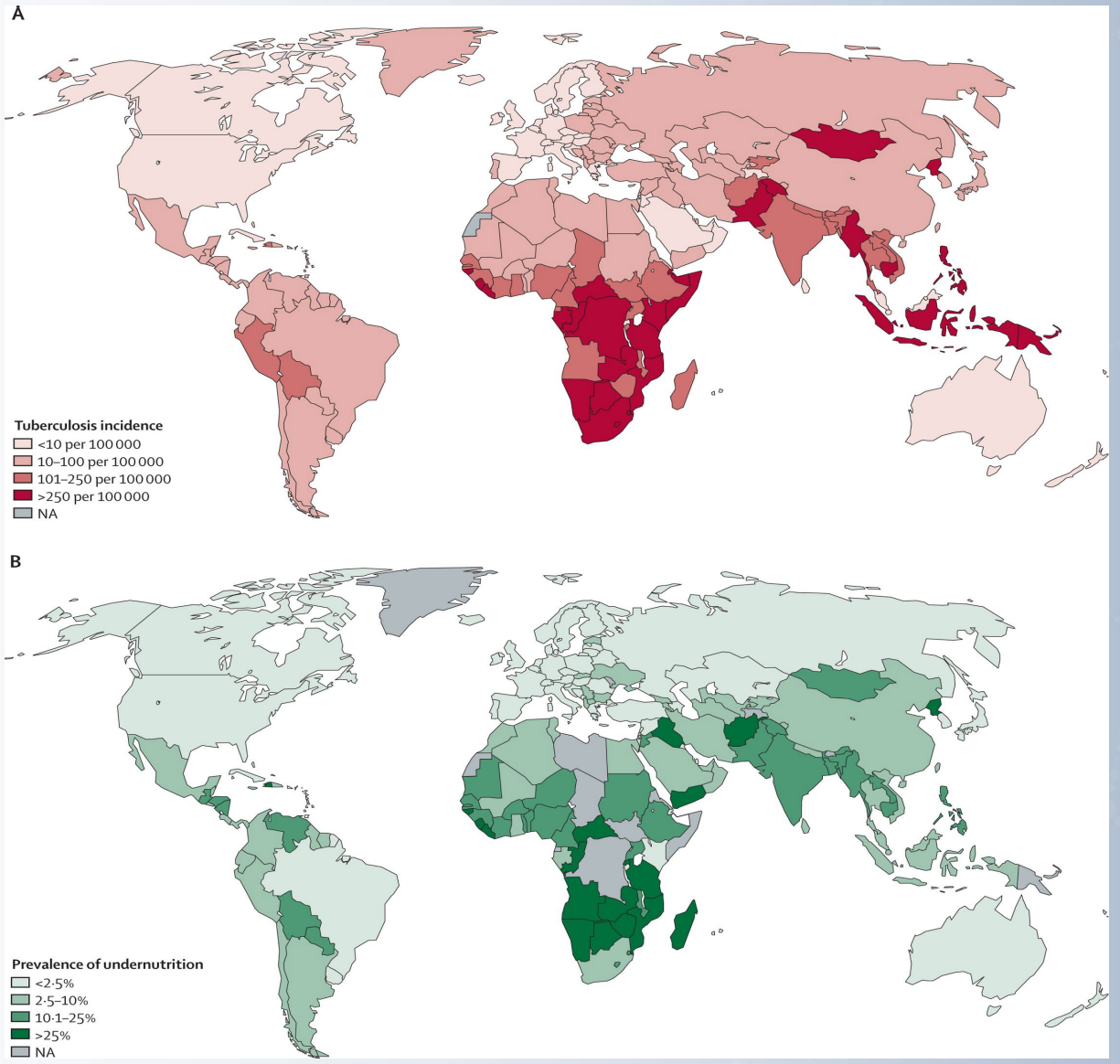
Malnutrition

Malnutrition refers to **deficiencies**, **excesses,** or **imbalances** in a person's intake of energy and/or nutrients.

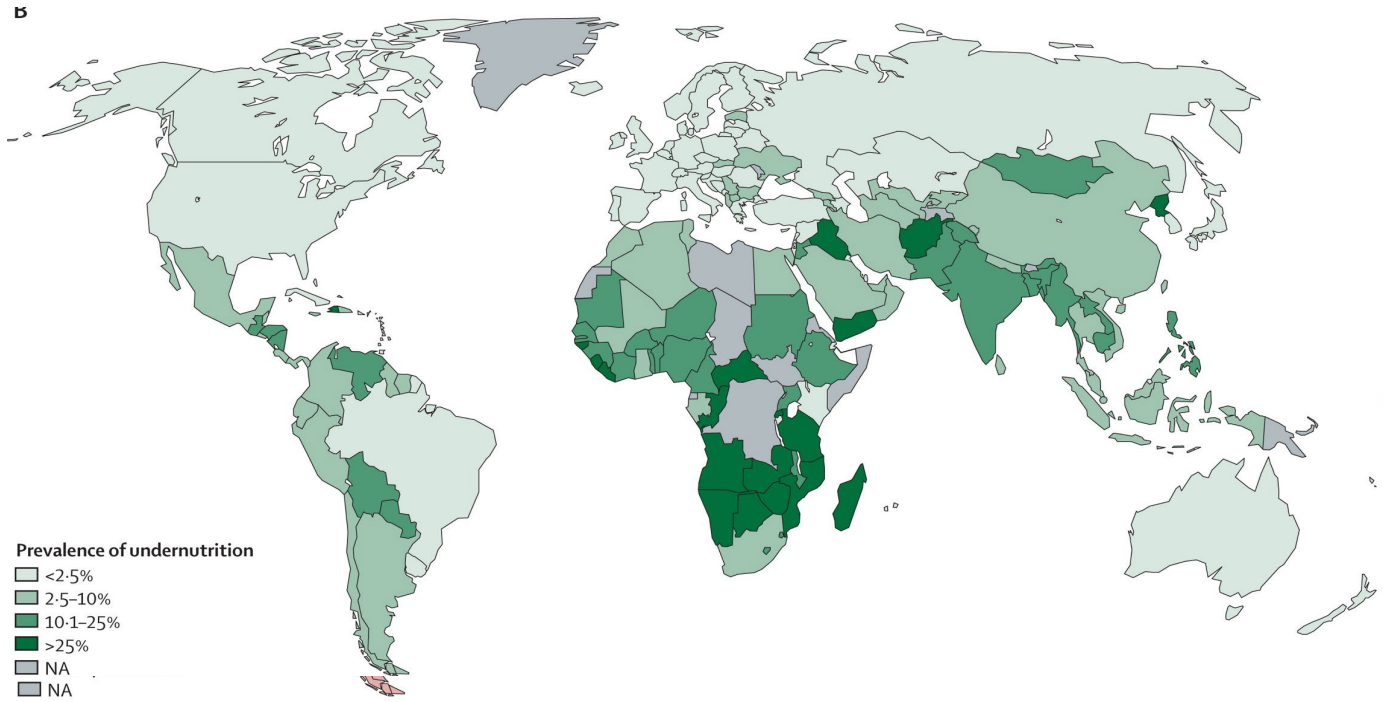
- **Undernutrition**
- Micronutrient-related malnutrition
- Overweight and obesity

World Health Organization

Geographic Overlap between TB and Undernutrition Worldwide 2018



Geographic Overlap between TB and Undernutrition Worldwide 2018



For a TB-free India, break the cycle of hunger and disease

Malnutrition and tuberculosis are India's major public health challenges. And the importance of nutritional intervention as a weapon against tuberculosis cannot be overemphasised

ANALYSIS Updated: Sep 08, 2017 17:48 IST

ht Rajan Sankar

People suffering from undernutrition are predisposed to contracting TB. In India, undernutrition contributes to a staggering 55% of the annual TB incidence.

Undernutrition and TB

"Rise in tuberculosis mortality was recorded in 1914-1916, and in those years the consumption of bread and flour rose, whereas that of meat decreased. ."--

"High TB mortality in Europe during and since WWII, coincided with great reduction of intake of protein food, such as, meat, fish and eggs"

Sandler MD (Diet Prevents Polio)

TB Incidence Related to BMI 1971-1992

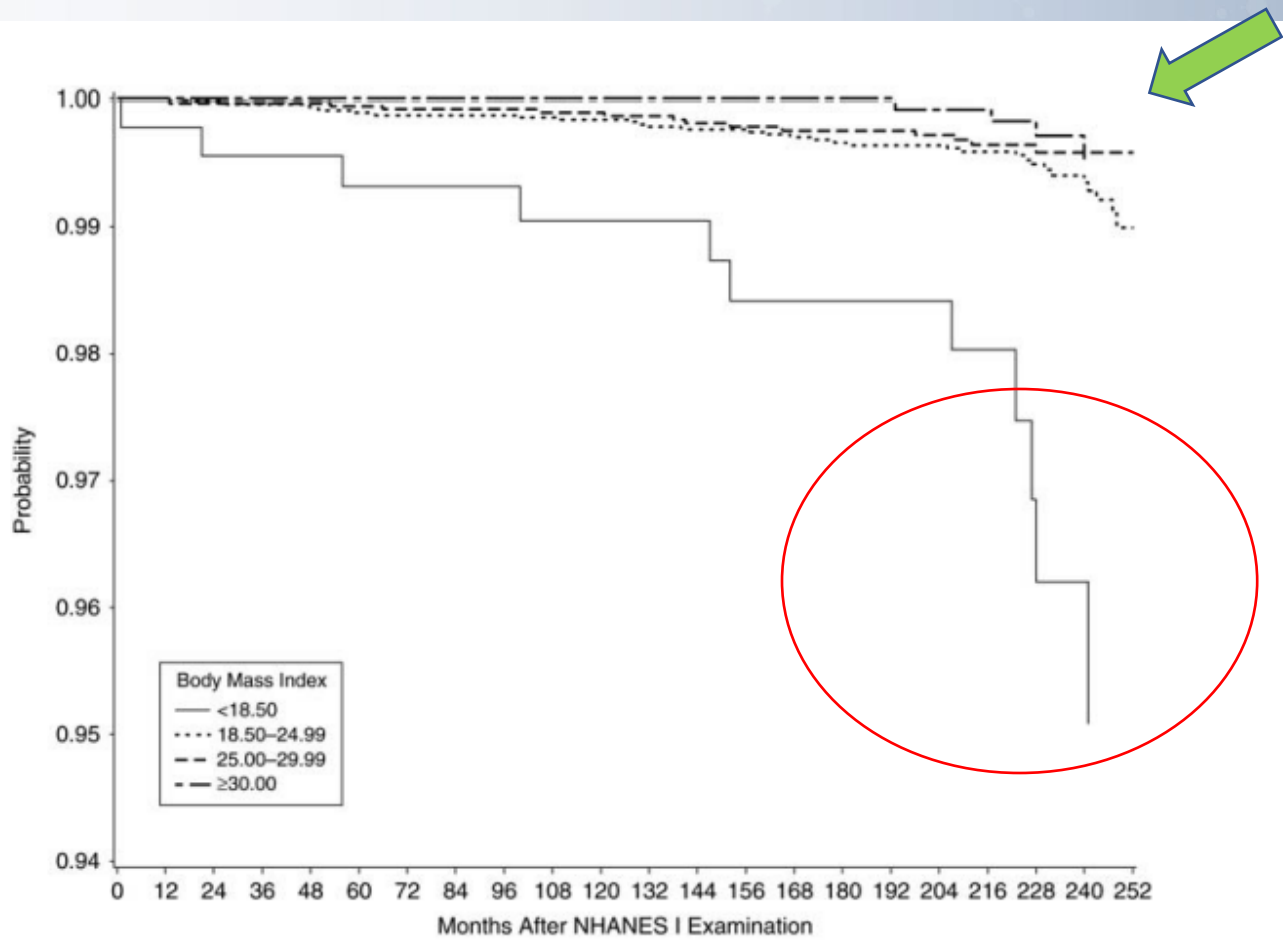
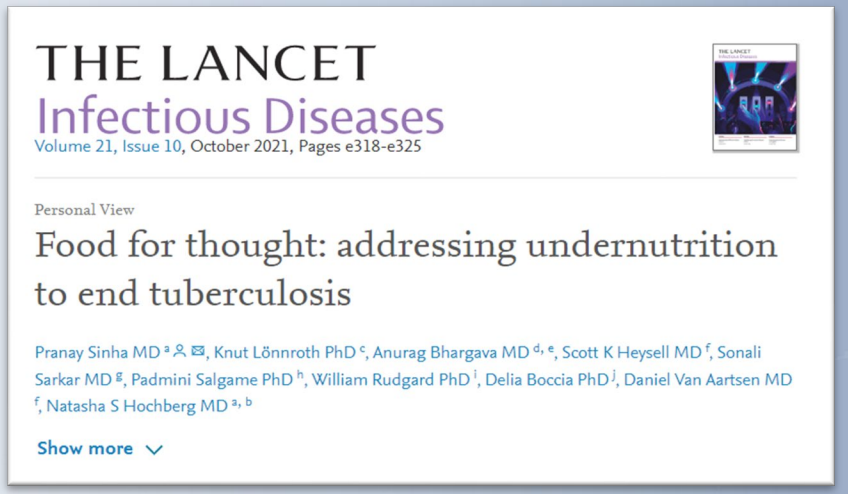


Figure 1. Kaplan-Meier plot of the probability of remaining free of tuberculosis according to body mass index (weight (kg)/height $(m)^2$), First National Health and Nutrition Examination Survey (NHANES I) Epidemiologic Follow-up Study, 1971–1992.

Recent Studies 2021



Undernutrition is the leading population-level risk factor for tuberculosis.

Studies have consistently found that undernutrition is associated

- ✓ Increased tuberculosis incidence
- ✓ Increased severity
- ✓ Worse treatment outcomes
- ✓ Increased mortality

Food for thought: addressing undernutrition to end tuberculosis - The Lancet Infectious Diseases

RESEARCH ARTICLE

Effect of malnutrition on radiographic findings and mycobacterial burden in pulmonary tuberculosis

Kacie J. Hoyt[1]*, Sonali Sarkar[2], Laura White[3], Noyal Mariya Joseph[4], Padmini Salgame[5], Subitha Lakshminarayanan[2], Muthuraj Muthaiah[6], Saka Vinod Kumar[7], Jerrold J. Ellner[8], Gautam Roy[2], C. Robert Horsburgh, Jr[1,3,8], Natasha S. Hochberg[1,8]*

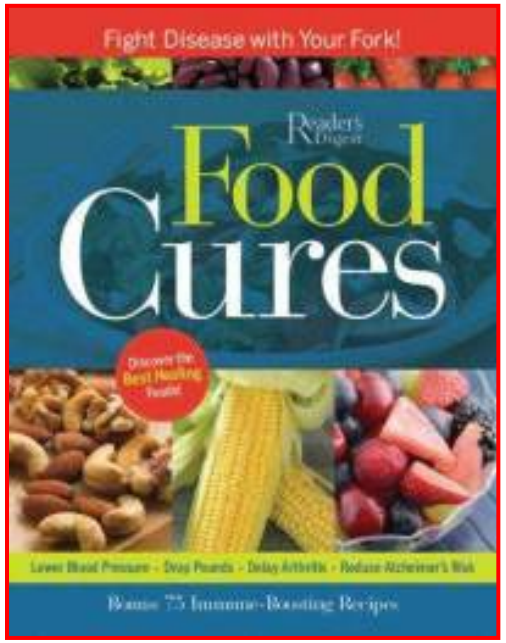
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0214011

Conclusion:

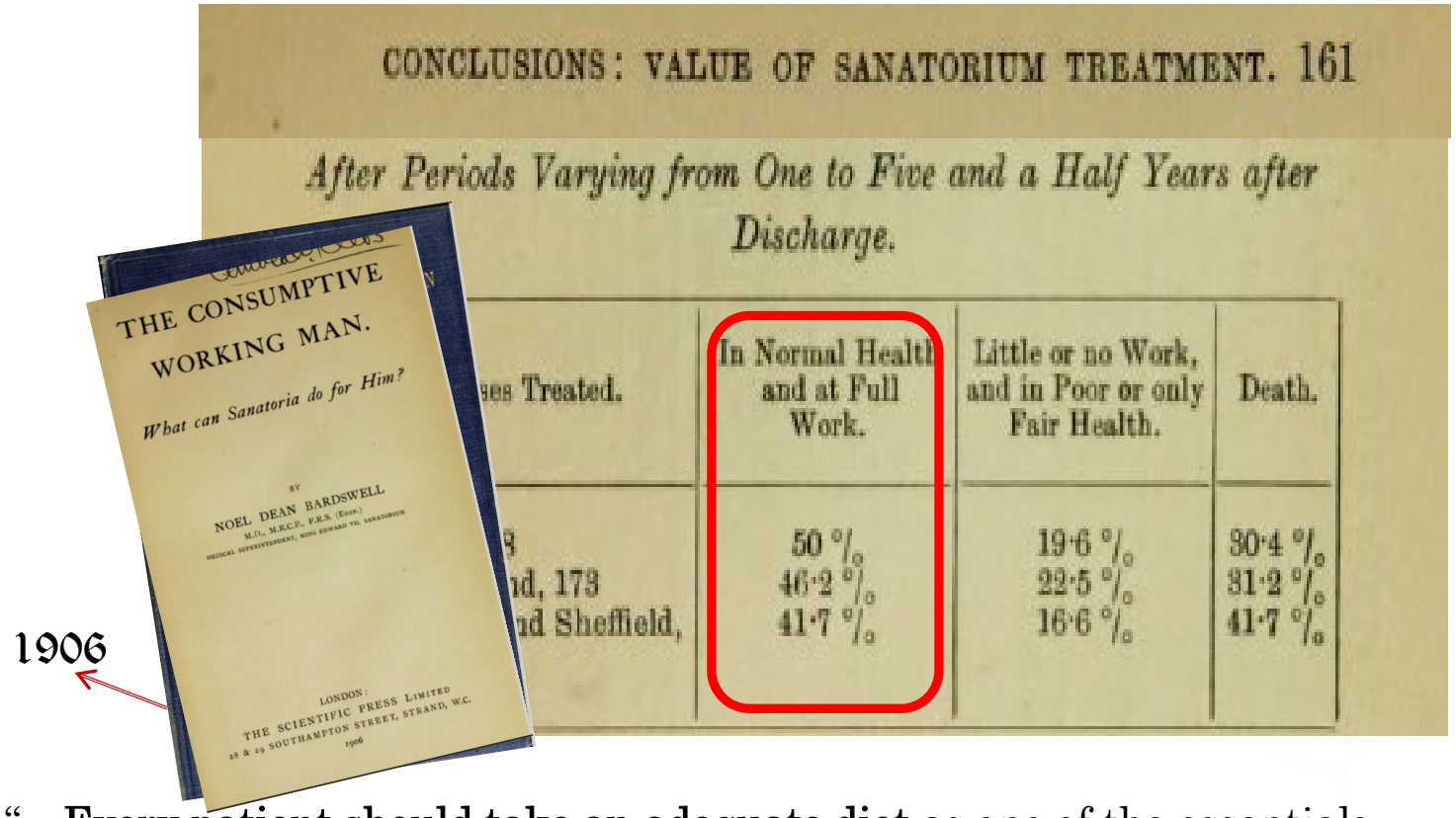
Malnutrition was associated with **increased extent of disease and cavitation on CXR**

How Was TB Treated Prior to 1950?

Nutritious Food
Rest
Sunshine
Fresh Air



"The Compsumptive Working Man"



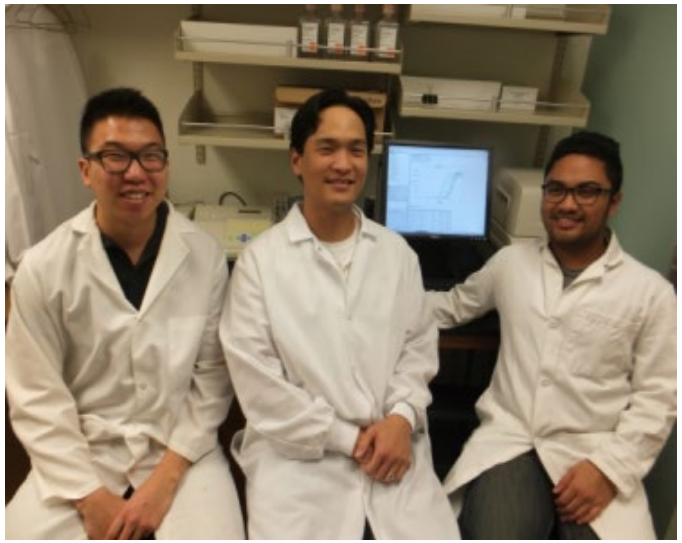
1906

"…**Every patient should take an adequate diet** as one of the essentials for the successful treatment of **consumption**"

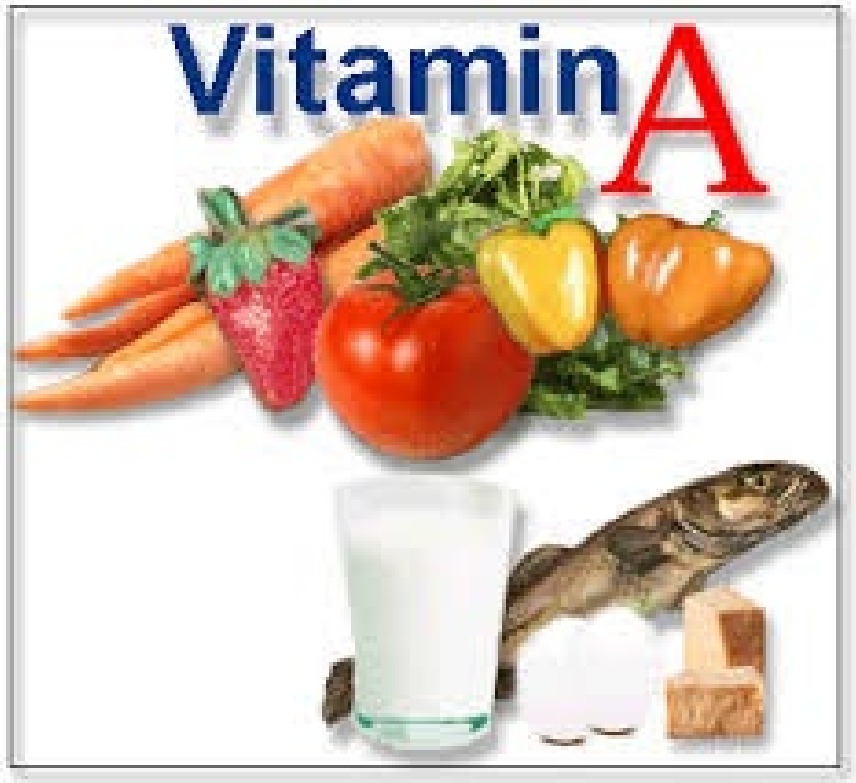
*The actual Nutritive value of the daily diet was, protein, 196.5 grammes, fat 126.4 grammes and carbo-hydrate 522.6 grammes with a caloric value of **4.040**"*

Vitamin A May Help Boost Immune System to Fight Tuberculosis

Nutrient lowers intracellular cholesterol used by TB to sustain infection



UCLA Researchers



UCLA's Elliott Kim, Philip Liu and Avelino De Leon

February 25, 2014

MTB is Sensitive to Killing by a vitamin C-induced Fenton Reaction

EINSTEIN
Albert Einstein College of Medicine

Department of Microbiology and Immunology, Howard Hughes Medical Institute NY, USA. 2013

Vitamin D Powerful Weapon Against TB

Researchers found that, in the presence of even minimally adequate levels of vitamin D, the body's own immune system will naturally trigger an immune response against the TB.

Journal Science Translational Medicine.

October 14, 2011

Most Recent Systematic Review

Effects of Vitamin D Supplementation on the Outcomes of Patients With Pulmonary Tuberculosis

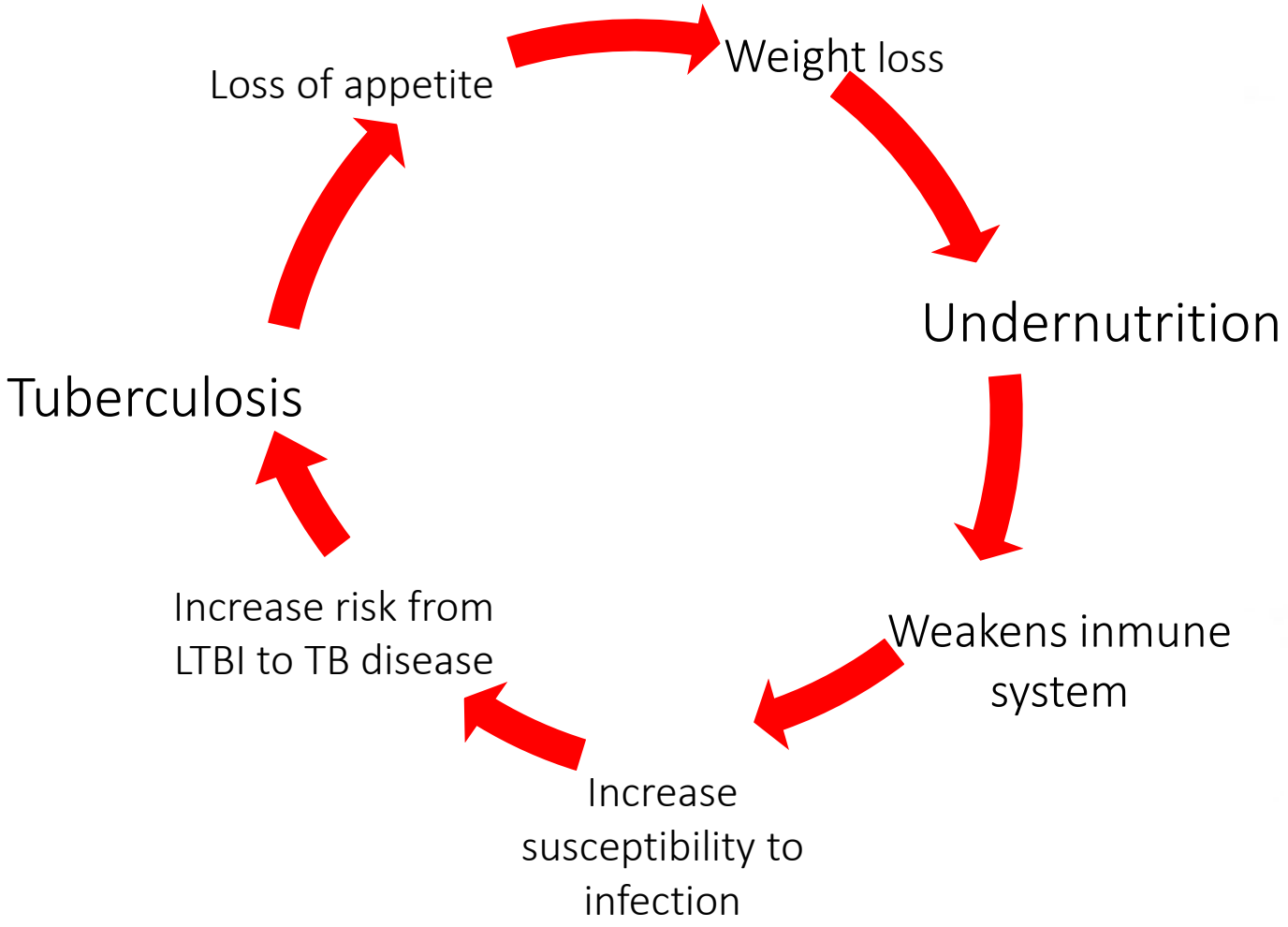
A Systematic Review and Meta-Analysis

Hong-xia Wu; Xiao-feng Xiong; Min Zhu; Jia Wei; Kai-quan Zhuo; De-yun Cheng Disclosures BMC Pulm Med. 2018;18(108)

CONCLUSIONS:

Vitamin D supplementation can be considered as a combination therapy in patients with PTB.

Undernutrition and TB



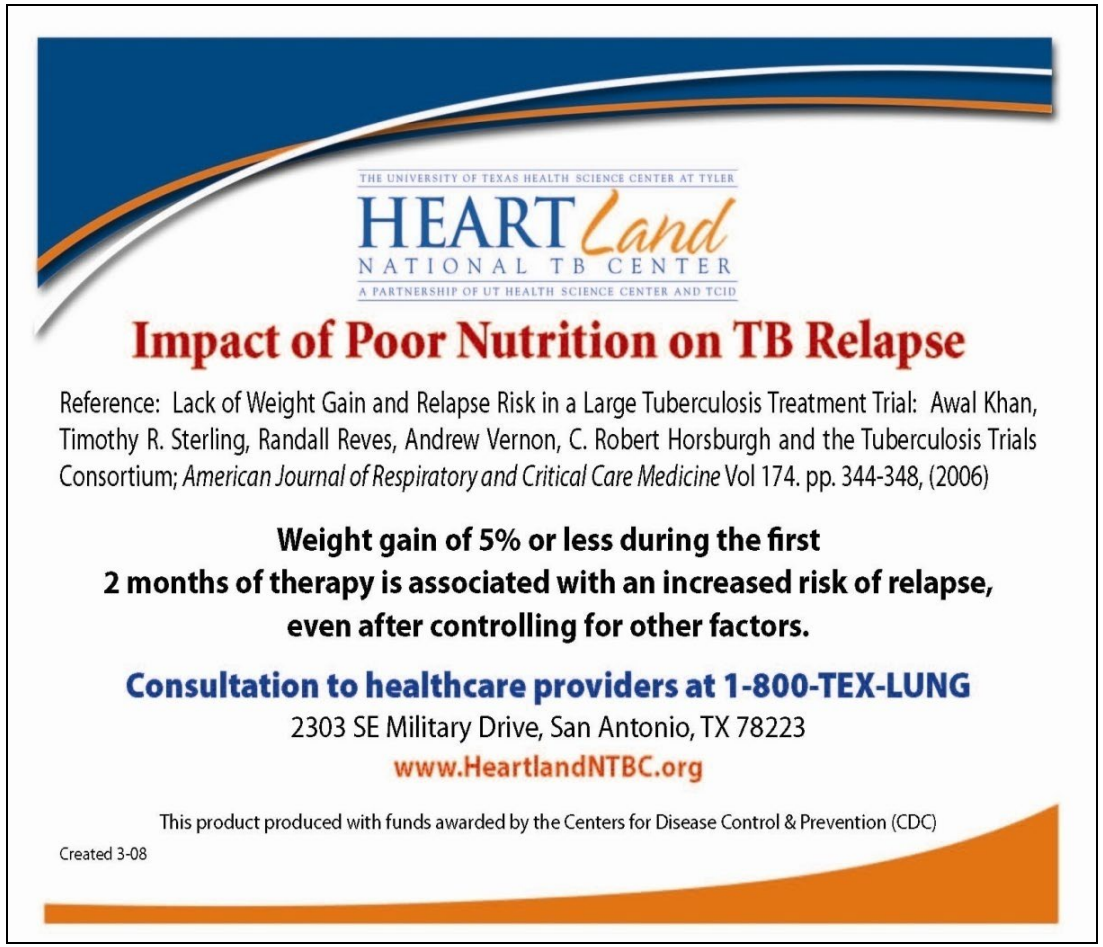
Why is Nutrition Important in a Person with TB?

Importance of Nutrition in TB Treatment Response

Lack of Weight Gain & Relapse Risk in a Large Tuberculosis Treatment Trial

A. Khan, T. Sterling, R. Reeves, A. Vernon and the TB Trials consortium
American Journal of respiratory and Critical Care Medicine. Vol. 174

Importance of Nutrition in TB Treatment Response



Khan Am J Resp Crit Care Med 2006

Importance of Nutrition in TB Treatment Response

- ✓ The relationship between nutritional status and poor outcomes for patients with TB.
- ✓ The association of weight gain between diagnosis and the end of 2-month Initial Phase therapy and risk of relapse

Definition of TB Relapse

Patients remain **culture negative** during treatment , **but after** completion of therapy, they become **culture positive** again or show clinical or radiographic deterioration consistent with active TB.

Lack of Weight Gain and Relapse Risk

- **857** subjects were enrolled.
- Monitored for two (2) years.
- **Body weight (kg) was measured at:**
  - ✓Diagnosis
  - ✓Enrollment in study
  - ✓Monthly during treatment
  - ✓And every 3-6 months during follow-up
- **Height**
- **BMI** (Body Mass Index)
- **IBW** (Ideal Body Weight)

Lack of Weight gain & Relapse Risk in a Large Tuberculosis Treatment Trial : A. Khan, T. Sterling, R. Reeves, A. Vernon and the TB Trials consortium . *American Journal of respiratory and Critical Care Medicine.* Vol. 174

WEIGHT AS A RISK FACTOR FOR TB RELAPSE

Underweight at Diagnosis ≥ 10% Below Ideal Body Weight			
	Weight gain after 2 months Rx	**Relapse (%)**	**Cavitary AND Positive 2 months culture**
Yes	≤ 5%	20.3%*	50.5%**
	> 5%	11.9%	18.5%
No		4.2%	18.3%

*p=0.06 **p=0.02

BMI	RELAPSE (5)
< 18.5	19.5%
18.51-19.0	10.7%
>19.0	6.1%

Body Mass Index (BMI) is optimal weight for health. Adults with a BMI between 19 and 24 have less risk for illnesses such as heart disease and diabetes than individuals with a BMI between 25 and 29. A BMI greater than 30 indicates greatest risk for obesity-related diseases. (See Chart 1.)

Adapted from The National Institute of Health, NHLBI Clinical Guidelines on Overweight and Obesity June 1998. www.nhlbi.nih.gov/guidelines.

Lack of Weight Gain and Relapse Risk

Results

61 patients relapsed **(7.1%)**

BMI	RELAPSE (5)
< 18.5	19.5%
18.51-19.0	10.7%
>19.0	6.1%

Khan. 2006 Am J Resp & Crit Care Med;174:34

Lack of Weight Gain and Relapse Risk

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Remember....

Patients with 10% below ideal body weight at diagnosis that don't regain at least 5% weight by end of two months of Rx

+

+

At 2 months sputum culture (+)

50% chance of relapse


RELAPSE
PREVENTION

Assessing Nutritional Status in a Person with TB

Laboratories (Normal Values)

Albumin: **3.8 – 5.2 g/dl**
(Major protein. Low levels in poor diets, ↓ iron intake)

Total Protein: 6.0-8.5 g/dl (Low levels indicate poor nutrition)

Hemoglobin: 11.5 – 16 g/dl ♀ 13.2 – 17.1 g/dl ♂

Hematocrit: 36.0 – 45.0 % ♀ 38.5 – 50.5 % ♂

Glucose: 65 – 110 mg/dl

WBC: 3.8 – 10.8

Lymph: 18-48 % (decreases with progressive malnutrition)

Body Mass Index (BMI)

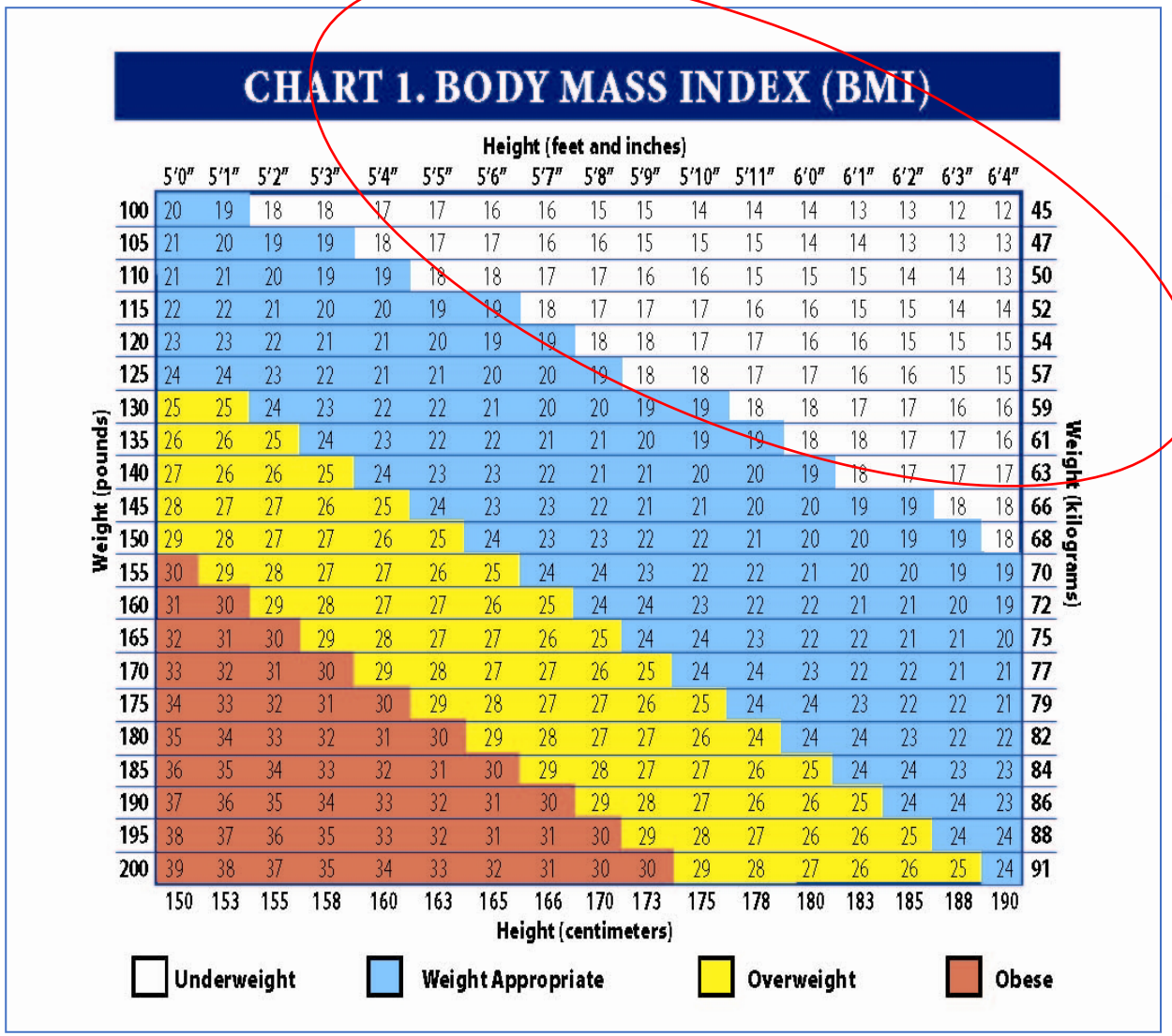


CHART 1. BODY MASS INDEX (BMI)

Height (feet and inches)

Weight (pounds)	5'0"	5'1"	5'2"	5'3"	5'4"	5'5"	5'6"	5'7"	5'8"	5'9"	5'10"	5'11"	6'0"	6'1"	6'2"	6'3"	6'4"	Weight (kilograms)
100	20	19	18	18	17	17	16	16	15	15	14	14	14	13	13	12	12	45
105	21	20	19	19	18	17	17	16	16	15	15	15	14	14	13	13	13	47
110	21	21	20	19	19	18	18	17	17	16	16	15	15	15	14	14	13	50
115	22	22	21	20	20	19	19	18	17	17	17	16	16	15	15	14	14	52
120	23	23	22	21	21	20	19	19	18	18	17	17	16	16	15	15	15	54
125	24	24	23	22	21	21	20	20	19	18	18	17	17	16	16	15	15	57
130	25	25	24	23	22	22	21	20	20	19	19	18	18	17	17	16	16	59
135	26	26	25	24	23	22	22	21	21	20	19	19	18	18	17	17	16	61
140	27	26	26	25	24	23	23	22	21	21	20	20	19	18	17	17	17	63
145	28	27	27	26	25	24	23	23	22	21	21	20	20	19	19	18	18	66
150	29	28	27	27	26	25	24	23	23	22	22	21	20	20	19	19	18	68
155	30	29	28	27	27	26	25	24	24	23	22	22	21	20	20	19	19	70
160	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	19	72
165	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	75
170	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	77
175	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	79
180	35	34	33	32	31	30	29	28	27	27	26	24	24	24	23	22	22	82
185	36	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	23	84
190	37	36	35	34	33	32	31	30	29	28	27	26	26	25	24	24	23	86
195	38	37	36	35	33	32	31	31	30	29	28	27	26	26	25	24	24	88
200	39	38	37	35	34	33	32	31	30	30	29	28	27	26	26	25	24	91
	150	153	155	158	160	163	165	166	170	173	175	178	180	183	185	188	190	

Height (centimeters)

Underweight | Weight Appropriate | Overweight | Obese

Ideal Body Weight Table

METROPOLITAN LIFE TABLE FOR MEDIUM FRAME ADULT

Ideal Weight For Women

Height in Shoes	Medium Frame
6′	148 to 162 lb
5′11″	145 to 159 lb
5′10″	142 to 156 lb
5′9″	139 to 153 lb
5′8″	136 to 150 lb
5′7″	133 to 147 lb
5′6″	130 to 144 lb
5′5″	127 to 141 lb
5′4″	124 to 138 lb
5′3″	121 to 135 lb
5′2″	118 to 132 lb
5′1″	115 to 129 lb
5′	113 to 126 lb
4′11″	111 to 123 lb
4′10″	109 to 121 lb

Ideal Weight For Men

Height in Shoes	Medium Frame
6′4″	171 to 187 lb
6′3″	167 to 182 lb
6′2″	164 to 178 lb
6′1″	160 to 174 lb
6′	157 to 170 lb
5′11″	154 to 166 lb
5′10″	151 to 163 lb
5′9″	148 to 160 lb
5′8″	145 to 157 lb
5′7″	142 to 154 lb
5′6″	139 to 151 lb
5′5″	137 to 148 lb
5′4″	135 to 145 lb
5′3″	133 to 143 lb
5′2″	131 to 141 lb

From height and weight tables of the Metropolitan Life Insurance Company, 1983. The ideal weights given in these tables are for ages 25 to 59. The weights assume you are wearing shoes with 1-inch heels and indoor clothing weighing 3 pounds.

Nutritional Teaching TIPS!

- ✓Considerer Prolonging therapy for patients >10% underweight.
- ✓Calculate BMI and IBW %
- ✓Monitor weight weekly in underweight patients.
- ✓Once stable, monitor monthly
- ✓ Ideally patients should gain1lb/week
- ✓Provide food resources
- ✓Recommend iron-rich food intake if client is anemic
- ✓Recommend intake of food sources of vit A, C, Vit D (fish, butter, milk etc)
- ✓Encourage the patient to monitor his/her weight.

More Studies!

Int J Tuberc. Lung Dis. 2014 May;18(5):564-70. doi: 10.5588/ijtld.13.0602.

Body mass index predictive of sputum culture conversion among MDR-TB patients in Indonesia.

Compared to patients with normal weight (BMI ≥18.5), severely underweight patients (BMI <16) had longer time to initial conversion and a lower probability of sputum culture conversion within 4 months.

Conclusion:

Severe underweight was associated with **longer time to initial sputum culture conversion** among MDR-TB patients.

Case Study # 1

Case Study

42 year old Hispanic male admitted to TCID

- Chronic diarrhea, severe undernutrition, difficulty walking, generalized weakness
- 60Lb weight loss
- Disseminated TB involving lungs and bowel

Nutritional Status:

Weight at admission: **77.8 Lb**

Height: **5’7’**

IBW (Ideal Body Weight): **142 Lb**

BMI : 12.2 **Severely underweight**

How to calculate the % IBW?

$$\% \text{ IBW} = \frac{\text{Current Body Weight}}{\text{Ideal Body Weight}} \times 100$$

$$\% \text{ IBW} = \frac{77.8}{142 \text{ lb.}} \times 100 = 54.7\ \%$$

45.3 % ↓

Below of the IBW

Nutritional Update

Diet advance slowly
Patient refuses to eat meals on regular basis
After 1 year of treatment

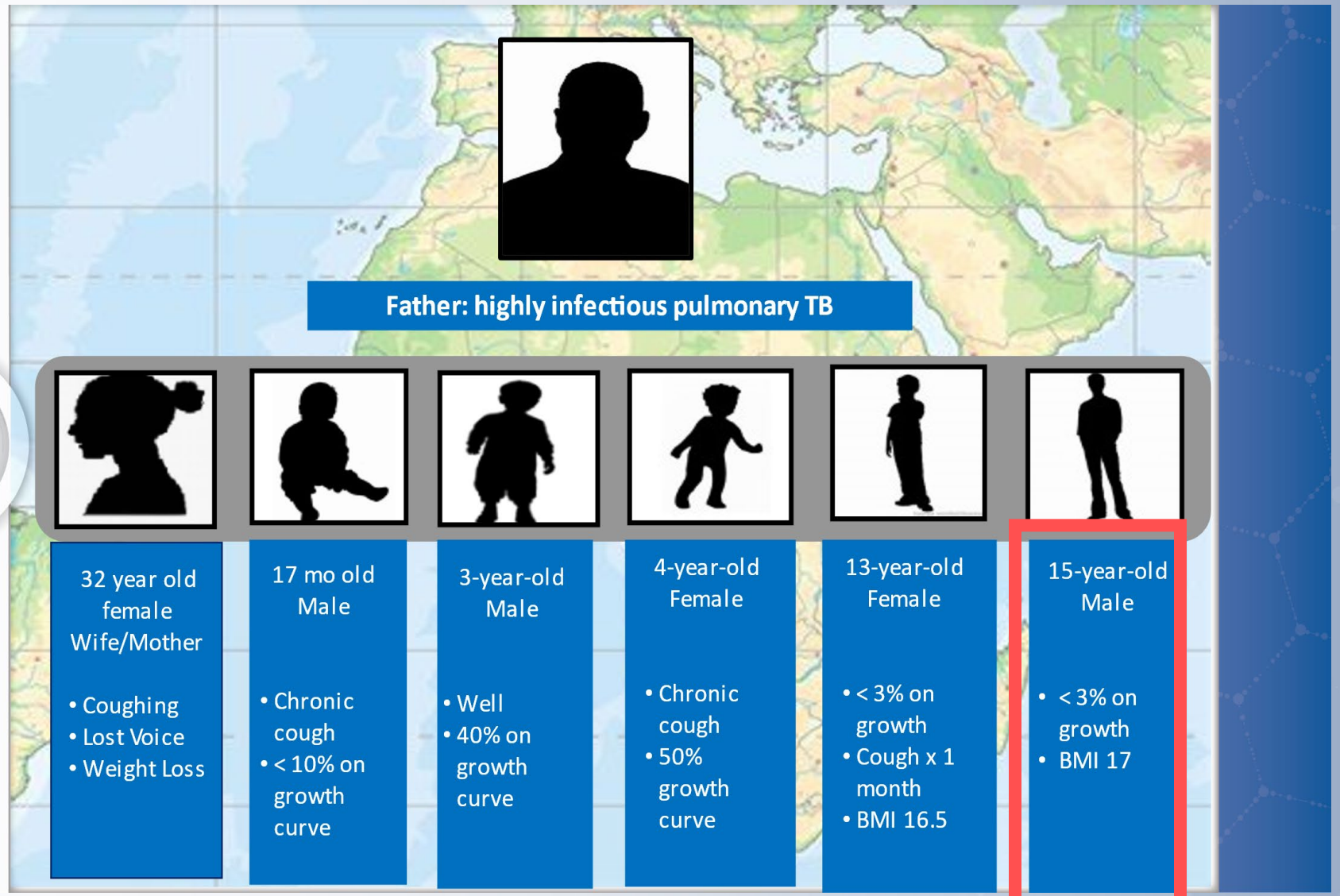
Weight at d/c: **114 Lb**

Height: **5’7’**

IBW (Ideal Body Weight): **142 Lb**

BMI : 18 **Underweight**

$$\% \text{ IBW} = \frac{114 \text{ lb}}{142 \text{ lb.}} \times 100 = 80\%$$


Father: highly infectious pulmonary TB
32 year old female Wife/Mother
• Coughing
• Lost Voice
• Weight Loss
17 mo old Male
• Chronic cough
• < 10% on growth curve
3-year-old Male
• Well
• 40% on growth curve
4-year-old Female
• Chronic cough
• 50% growth curve
13-year-old Female
• < 3% on growth
• Cough x 1 month
• BMI 16.5
15-year-old Male
• < 3% on growth
• BMI 17

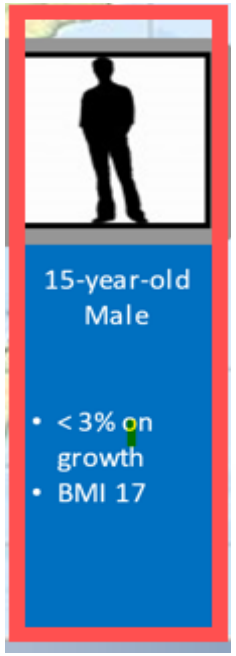
Nutritional Status:

Weight at diagnosis**: 91 Lb**

Height: 5’2”

IBW (Ideal Body Weight): **123 Lb**

BMI : 17 - Underweight



How to calculate the % IBW?

$$\% \text{ IBW} = \frac{\text{Current Body Weight}}{\text{Ideal Body Weight}} \times 100$$

$$\% \text{ IBW} = \frac{91\text{lb}}{123\text{ lb.}} \times 100 = 73.9\%$$

26.2% ↓

Below of the IBW

Nutritional Update

- Patient was treated for PTB for 6 months (non-cavitary)
- Episode of neutropenia
- Clinical improvement Increase energy, appetite and
- Gained 15 lb.

Weight at en of Rx: **106 Lb**

Height: **5’2’**

IBW (Ideal Body Weight): **123 Lb**

BMI : **19.2** **Normal weight**

$$\% \text{ IBW} = \frac{105}{123 \text{ lb.}} \times 100 = 85\%$$

"Giving people medicine for TB and not giving them food is like washing your hands and drying them in the dirt"

Quote by a Haitian public health worker

Book: Mountains Beyond Mountains

THANK YOU!