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

*Catalina B. Navarro, BSN, RN*

*May 7, 2025*

TB Nurse Case Management • May 6 – 8, 2025 • San Antonio, Texas

# Catalina B. Navarro, BSN, RN

Has the following disclosures to make:

- No conflict of interests
- No relevant financial relationships with any commercial companies pertaining to this activity

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***TB Nurse Case Management***

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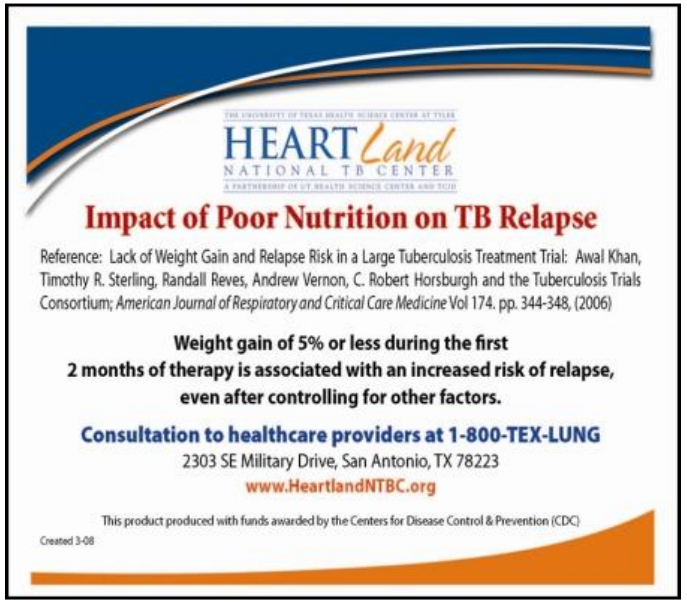
*Catalina B. Navarro BSN, RN*

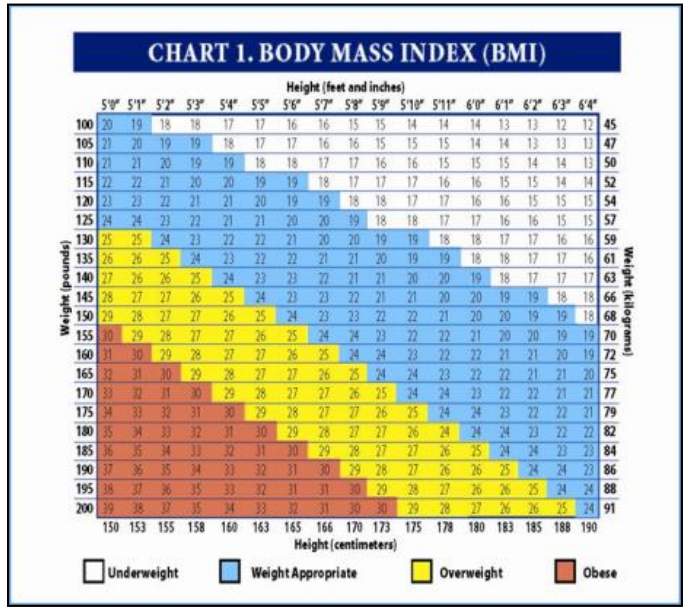
*Nurse Consultant/Educator*

# Objectives

- Discuss the Importance of weight gain on TB treatment outcomes

- Demonstrate the use of the BMI chart with case studies



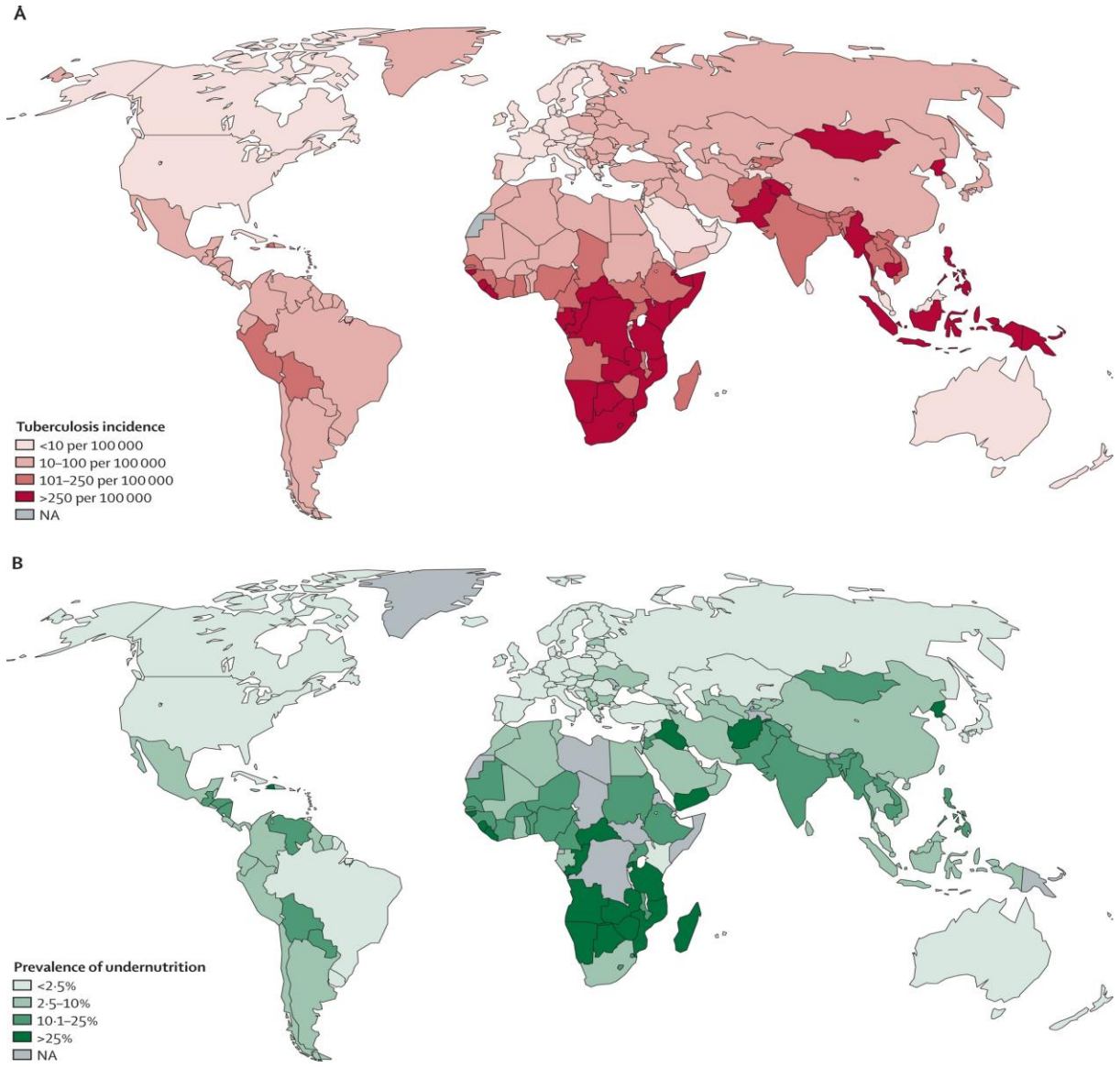
# Malnutrition

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

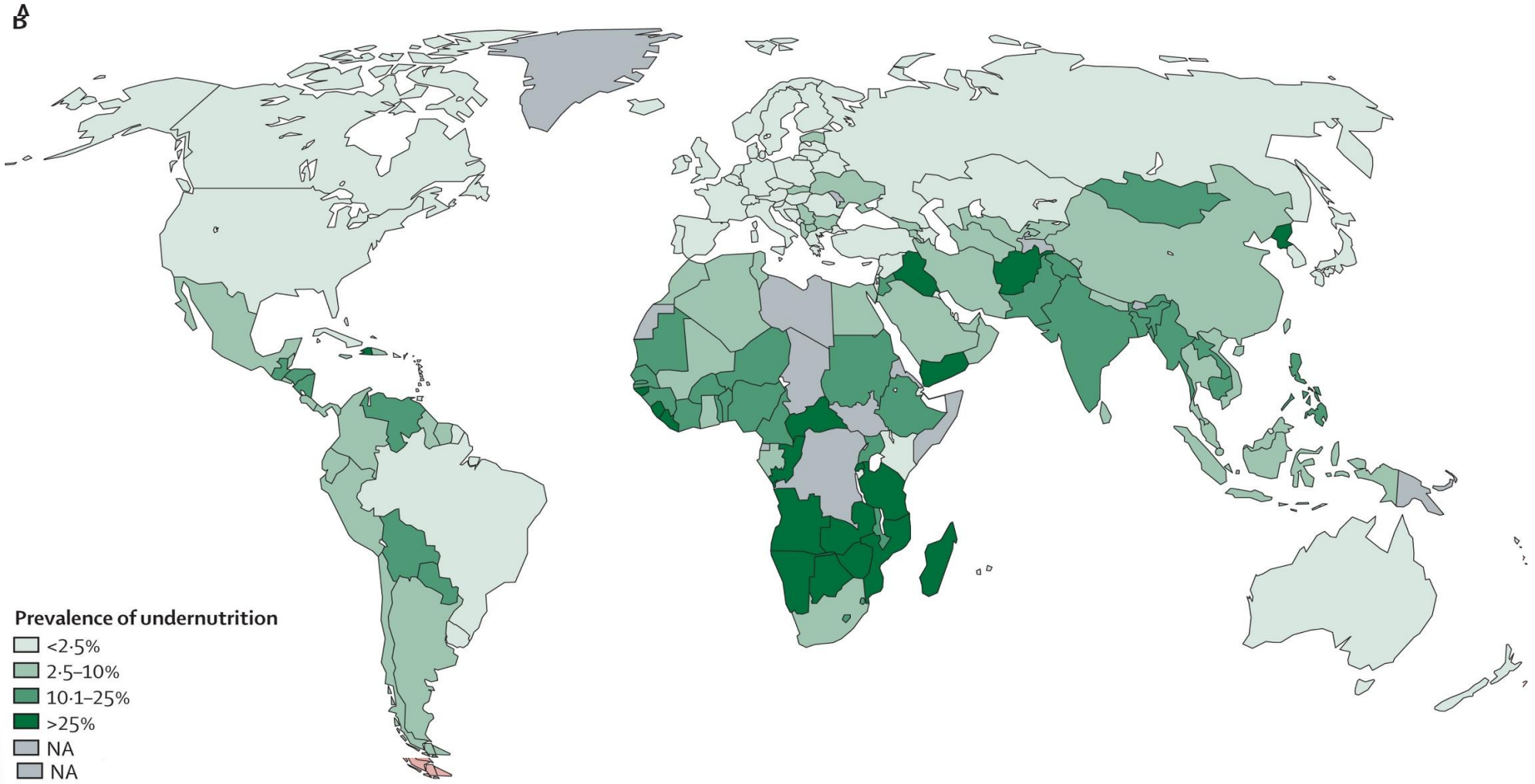
- **Undernutrition**
- Micronutrient-related malnutrition
- Overweight and obesity

World Health Organization

# Geographic Overlap between TB and Undernutrition Worldwide 2018



# Geographic Overlap between TB and Undernutrition Worldwide 2018



# Undernutrition and TB in India

People suffering from undernutrition are predisposed to contracting TB

Undernutrition contributes to a staggering 55% of the annual TB incidence in India

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

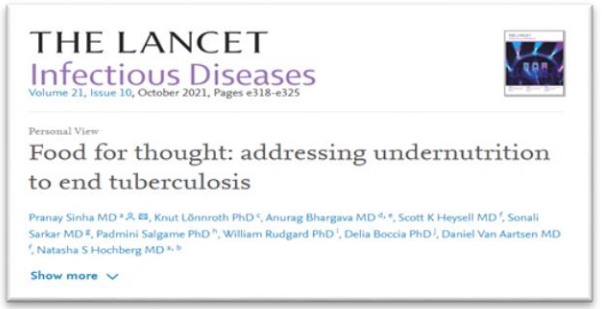
# Impact of Diet on Tuberculosis Mortality: Historical Insights

"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)

# 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]*

**Conclusion:**

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

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

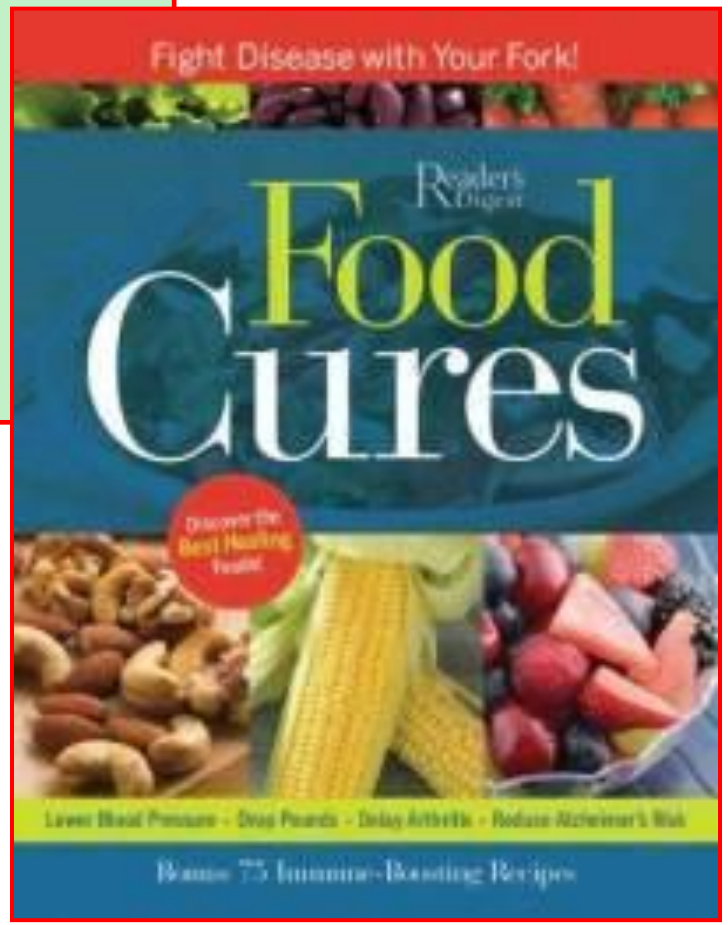
# How Was TB Treated Prior to 1950?

**Nutritious Food**

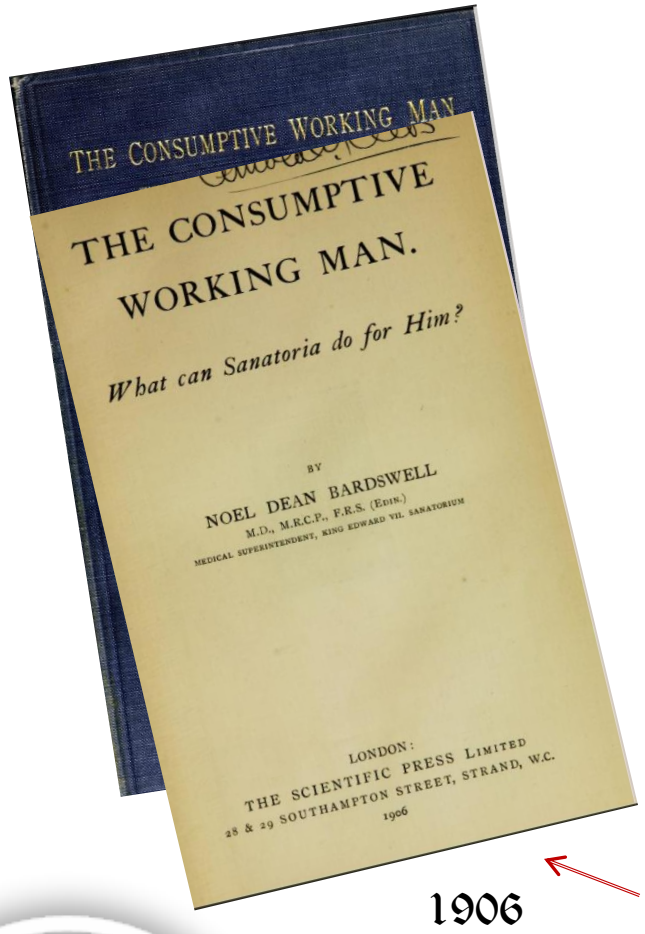
**Rest**

**Sunshine**

**Fresh Air**




# TB Outcomes in a Sanatorium: Insights from 'The Consumptive Working Man'"




1906

CONCLUSIONS: VALUE OF SANATORIUM TREATMENT. 161

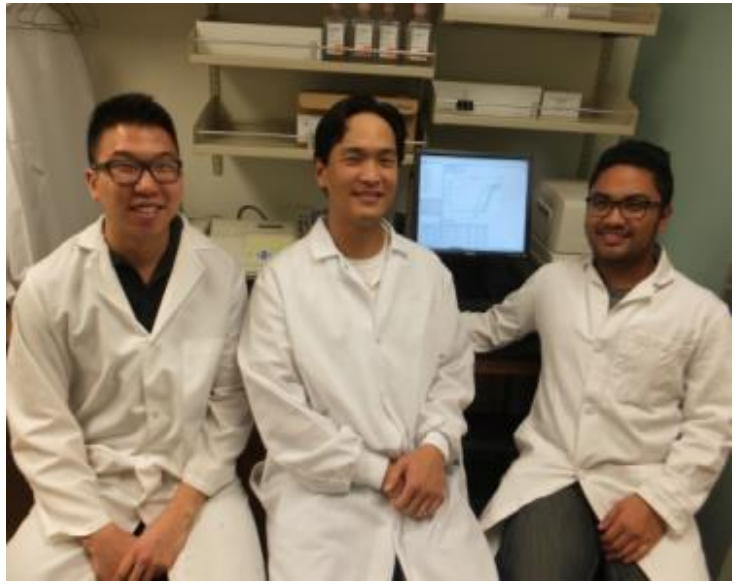
*After Periods Varying from One to Five and a Half Years after Discharge.*

| No. of Cases Treated. | In Normal Health and at Full Work. | Little or no Work, and in Poor or only Fair Health. | Death. |
|---|---|---|---|
| At Durham, 268 | 50 % | 19·6 % | 30·4 % |
| At Westmoreland, 173 | 46·2 % | 22·5 % | 31·2 % |
| At Mundesley and Sheffield, 24 | 41·7 % | 16·6 % | 41·7 % |

- "Every patient should take an adequate diet as one of the essentials for the successful treatment of consumption."
- Daily diet: 196.5g protein, 126.4g fat, 522.6g carbohydrates, totaling 4,040 kcal

# Vitamin A and Tuberculosis

**UCLA study (Journal of Immunology, March 1)** shows vitamin A may play a key role in helping the immune system fight tuberculosis

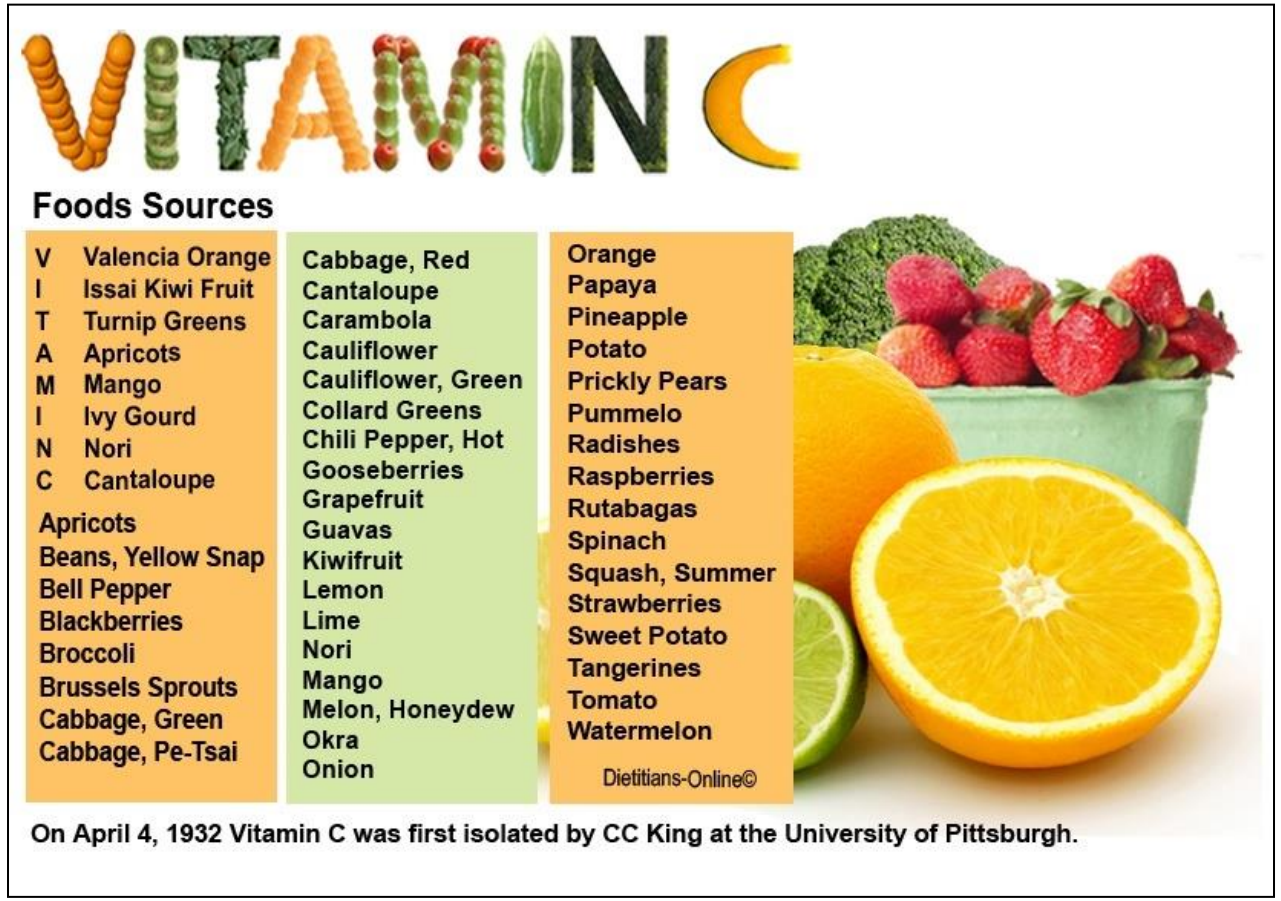


**UCLA Researchers**

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





https://pmc.ncbi.nlm.nih.gov/articles/PMC3698613/pdf/nihms468905.pdf

# Vitamin D Powerful Weapon Against TB

**Research** shows that **adequate levels of vitamin D** can trigger the body's immune system to naturally respond to tuberculosis


UCLA Health

*Journal Science Translational Medicine October 2011*

# Most Recent Systematic Review

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

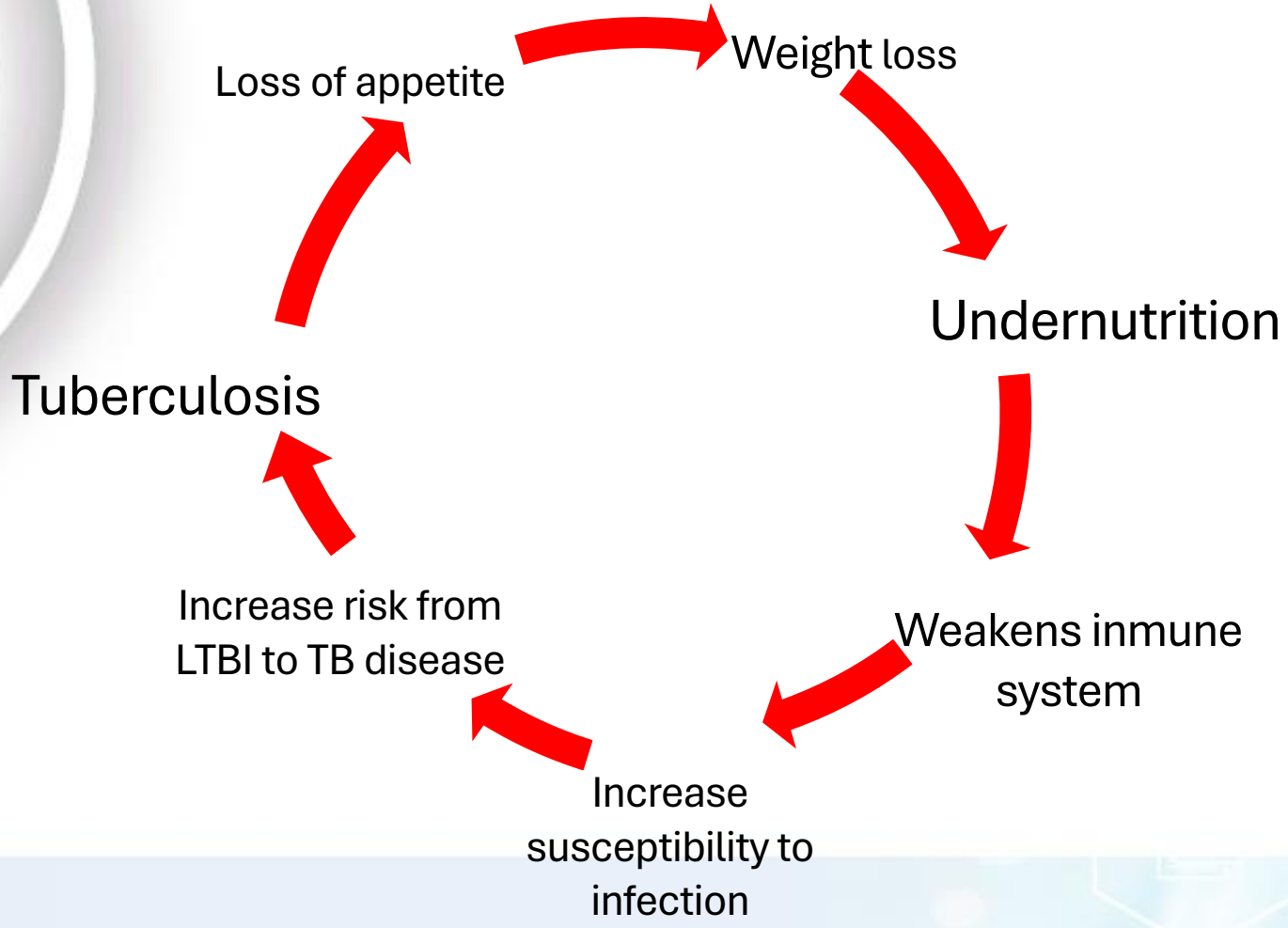
**A Systematic Review and Meta-Analysis**

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



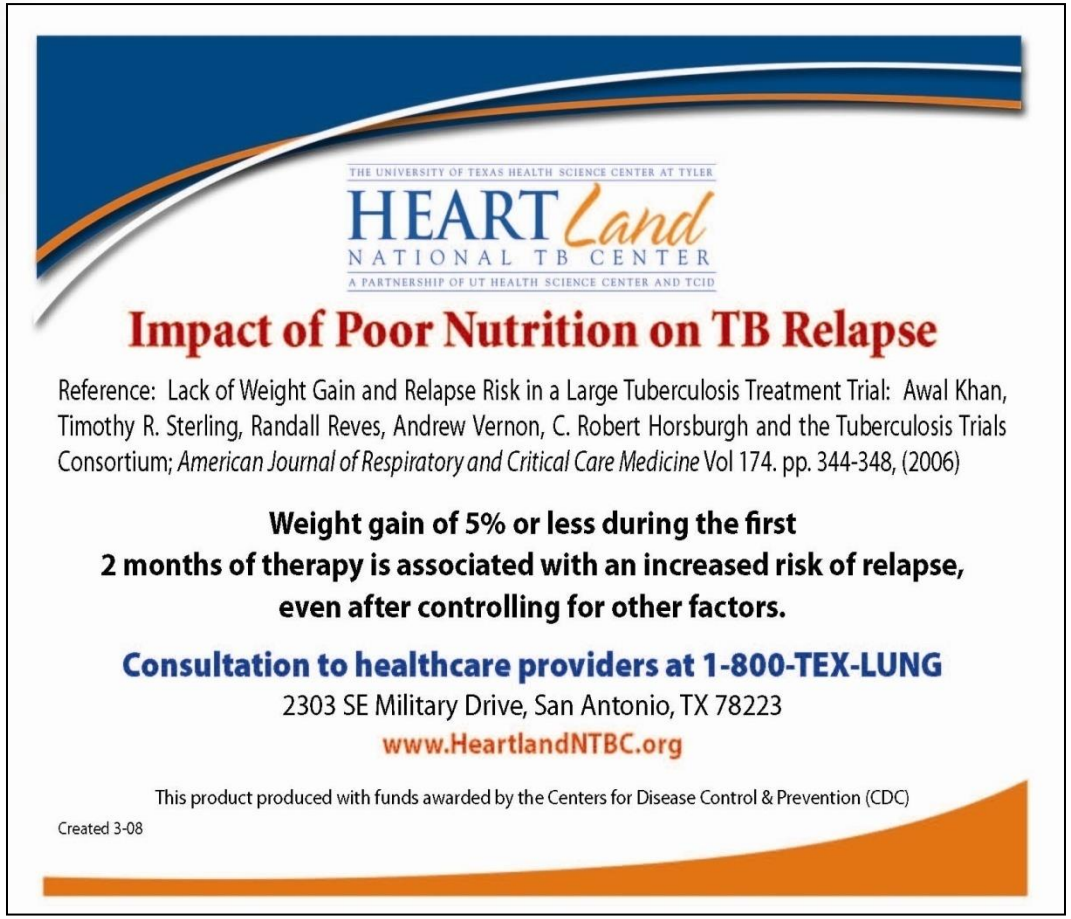
# Why is Nutrition Important in a Person with TB?

# 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.

# TB Incidence Related to BMI 1971-1992

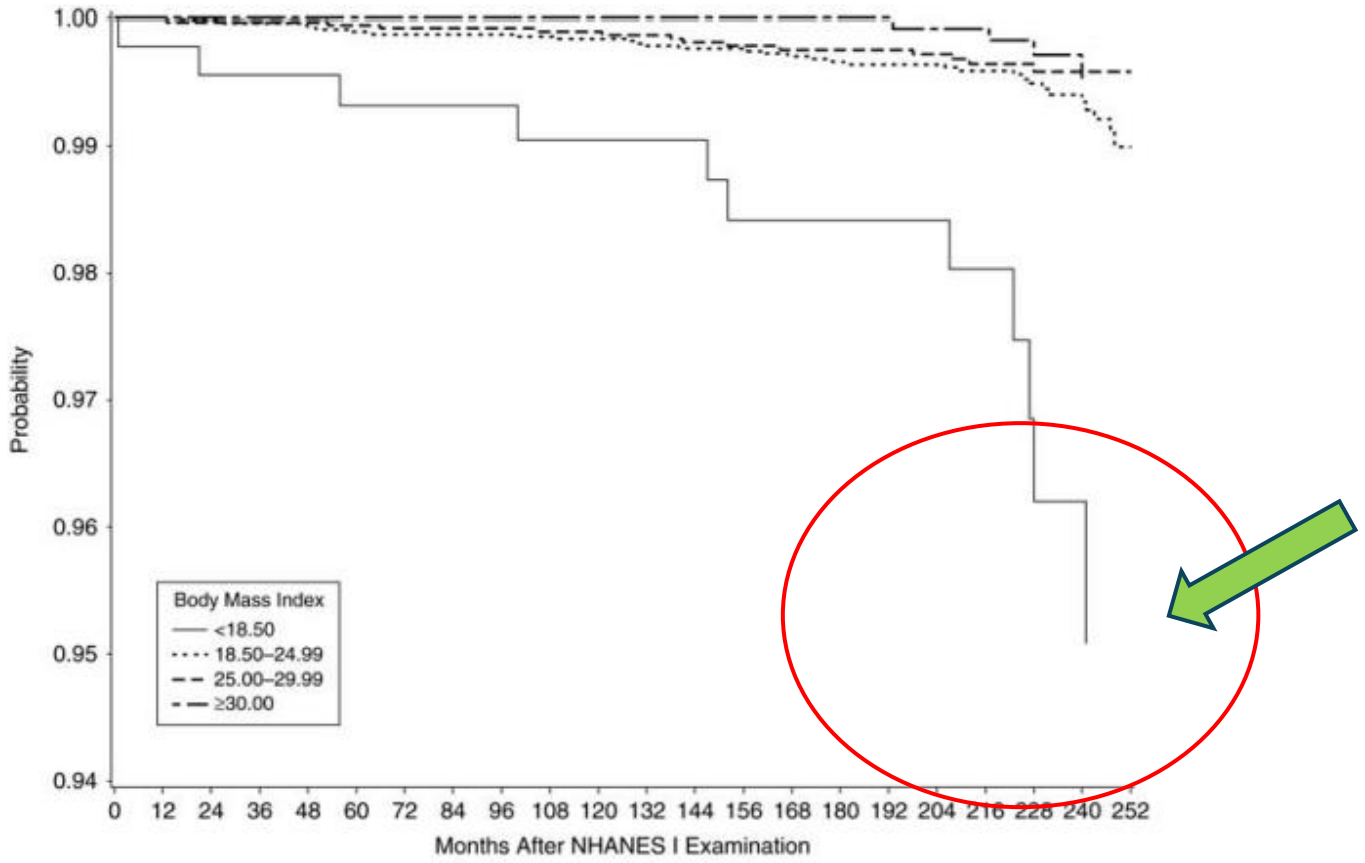



**Figure 1.** Kaplan-Meier plot of the probability of remaining free of tuberculosis according to body mass index (weight (kg)/height $(m)^2$), First National Health and Nutrition Examination Survey (NHANES I) Epidemiologic Follow-up Study, 1971–1992.

# 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;174:344-48*

# Lack of Weight Gain and Relapse Risk

| Underweight at Diagnosis ≥ 10% Below Ideal Body Weight | | | |
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| Yes | ≤ 5% | 20.3%* | 50.5%** |
| | > 5% | 11.9% | 18.5% |
| No | | 4.2% | 18.3% |

# 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)

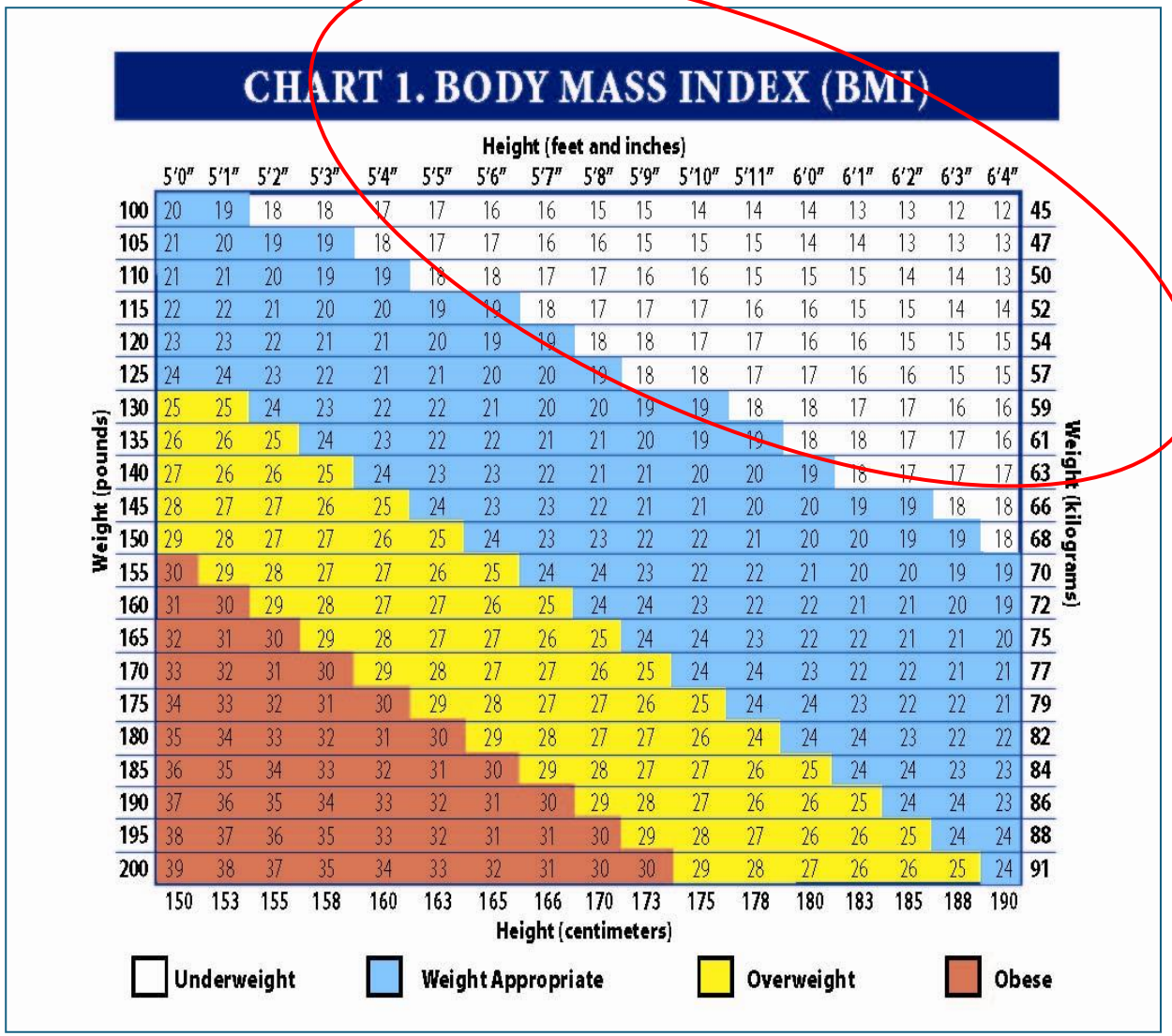
**Albumin:** **3.8 – 5.2 g/dl**
(Major protein. Low levels in poor diets, ↓ iron intake)

**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 |

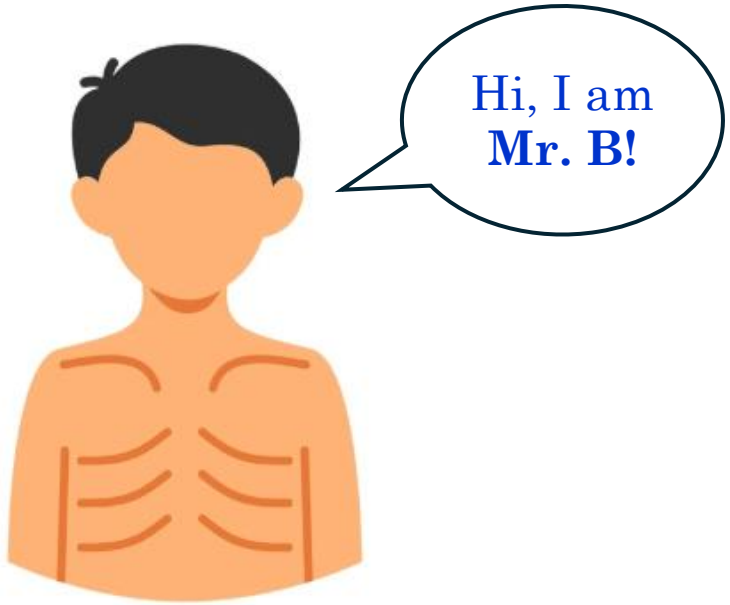
From height and weight tables of the Metropolitan Life Insurance Company, 1983. The ideal weights given in these tables are for ages 25 to 59. The weights assume you are wearing shoes with 1-inch heels and indoor clothing weighing 3 pounds.

# 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.

# How to calculate the % IBW?

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




**Mr. B** Height: 5’4” Weight: 109lb

IBW: (see chart) 140lb

$$\% \text{ IBW} = \frac{109\text{lb}}{140\text{ lb.}} \times 100 = \textbf{77.8\%} = (100\% - 77.8\%) = 22.2\%$$

**Below of the IBW**

# Weight Classification Based on IBW Percentage

| Weight Classification | Percentage of IBW |
|---|---|
| **Minimal Survival** | **48 – 55%** |
| **Severely Underweight** | **< 75%** |
| **Underweight** | **75 – 84%** |
| Normal Weight | 85 – 119% |
| Overweight | 120 – 129% |
| Obese | 130 – 140% |
| Morbidly Obese | > 140 % |


# 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 # 1

42-year-old Hispanic male admitted to *Texas Center for Infectious Disease* (TCID)

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

# Nutritional Assessment
# Case study # 1

MC, 42 y/o Hispanic male
Admitted to the TB hospital

**Diagnosis:** Disseminated TB (lungs and bowel), DM, Chronic diarrhea, severe malnutrition

| Age: | Sex: | Ht: | Wt: | Usual Body Weight: |
|---|---|---|---|---|
| 42 | M | 5'7" | 77.8 | 142 Lb |
| **Frame Size:** | **Ideal Body Weight:** | **% IBW:** | **BMI:** | **Classification** |
| Medium | 142 Lb | 54.7 | 12.2 | Severely underweight |

**Labs**:

ALB: 2.0
Hgb: 9.7
Hct: 26.3
GLUC: 161
WBC: 4.2
Hgb A1C 13.4%

**Risk Factors:**

- >20% underweight
- Disseminated TB
- GI TB
- Poorly control diabetes
- Smoker
- Lack of family support

# Nutritional Assessment
# Follow Up Case # 1

Diet advance slowly, pt. refuses to eat meals on regular basis, several episodes of hypoglycemia. Severe metabolic acidosis. Discharged after 1 year of treatment

| Age: | Sex: | Ht: | Wt: | Usual Body Weight: |
|---|---|---|---|---|
| 42 | M | 5'7" | 114 Lb ↑ | 142 Lb |
| **Frame Size:** | **Ideal Body Weight:** | **% IBW:** | **BMI:** | **Classification** |
| Medium | 142 Lb | 80 % | 18 | underweight |

**Labs**:

| | Adm. | d/c |
|---|---|---|
| ALB: | 2.0 | 3.2 |
| Hgb: | 9.7 | 12.1 |
| Hct: | 26.3 | 35.2 |
| GLUC: | | 161 |
| WBC: | 4.2 | 4.8 |
| Hgb. A1C | 13.4% | |

- Chronic pancreatitis/pancreatitis insufficiency
- Chronic condition, not reversible medication lifelong

**High risk of relapse**

# Case Study # 2

# Case Study # 2

**Ms. RM**: 82-year-old Hispanic female

- Admitted to hospital with **septic shock** and **multifocal pneumonia**
- Generalized weakness; non-ambulatory for the past 2-3 months
- Transferred to **ICU** for intensive care

# Case Study # 2

- Declining health with severe malnutrition and cachexia
- Significant dental issues (poor dentition)
- 20 Lb weight loss
- Incontinence of urine and stool for the past 2 weeks
- Pulmonary tuberculosis with cavitary lesions on chest X-ray
- Poor prognosis

# Case study # 2

RM 82 y/o female
Admitted to TCID

Diagnosis: Pulmonary cavitary TB
Malnutrition

| Age: | Sex: | Ht: | Wt: | Usual Body Weight: |
|---|---|---|---|---|
| 82 | F | 4'8'' | 65.7 Lb | |
| **Frame Size:** | **Ideal Body Weight:** | **% IBW:** | **BMI:** | **Classification** |
| **Small** | **97lb** | **67.7lb** | **14.1** | **Underweight/ Severely underweight** |

**Labs**:

| | |
|---|---|
| ALB: | **1.1** |
| Hgb: | **7.7** |
| Hto: | **24.2** |
| GLUC: | |
| WBC: | 5.4 |

**Risk Factors:**

->20% underweight
-Infectious disease
- Poor dentition

# Nutritional Assessment
# Follow Up Case # 2

Marked improvement during TB treatment. Soft diet with ensure. Good response to treatment and eating better after dental work

| Age: | Sex: | Ht: | Wt: | Usual Body Weight: |
|---|---|---|---|---|
| 45 | M | 4'8" | 98lb ↑ | |
| **Frame Size:** | **Ideal Body Weight:** | **% IBW:** | **BMI:** | **Classification** |
| Small | 97 Lb | 100% | 22 | Appropriate weight |

**Labs**:

| | |
|---|---|
| ALB: | 3.2 |
| HGB: | 12.9 |
| HTO: | **39.4** |
| GLUC: | **97** |
| WBC: | 3.8 |

# Case Study # 2

## Pictures Updated

November 2017

April 2018

**"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!