

# Medical load and the mathematics of the medical system in a nation

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## Abstract

In this paper, I describe medical load and the mathematics of the medical system in a nation.  
The paper ends with "The End"

## Introduction

The concept of **medical load** is fundamental to the medical economy.  
Moreover, the concept leads to the **mathematics of the medical system in a nation**.  
In this paper, I describe medical load and the mathematics of the medical system in a nation.

## Medical load of a hospital

The **staff population of the  $i^{th}$  hospital in the medical system of a nation** is

$$S^i = G^i + D^i + N^i + A^i$$

where

$G^i$  is the number of **general physicians** in the  $i^{th}$  hospital  
 $D^i$  is the number of **specialized departmental doctors** in the  $i^{th}$  hospital  
 $N^i$  is the number of **trainee nurses** in the  $i^{th}$  hospital  
 $A^i$  is the number of **ambulance drivers** of the  $i^{th}$  hospital

The **patient population of the  $i^{th}$  hospital in the medical system of a nation** is

$$P^i = \sum_{g=1}^{d^i} p_g^i + \sum_{j=1}^{d^i} p_j^i + p_{icu}^i + \sum_{k=1}^{a^i} p_{p_k}^i$$

where

$p_g^i$  is the number of patients in the **general ward** of the  $i^{th}$  hospital  
 $d^i$  is the number of **departments** in the  $i^{th}$  hospital  
 $p_j^i$  is the number of **patients in the  $j^{th}$  department** of the  $i^{th}$  hospital  
 $p_{icu}^i$  is the number of patients in the **intensive care unit** of the  $i^{th}$  hospital  
 $a^i$  is the number of **ambulances** of the  $i^{th}$  hospital  
 $p_{p_k}^i$  is the number of **probable patients** in the  $k^{th}$  ambulance of the  $i^{th}$  hospital

The **medical load of the  $i^{th}$  hospital in the medical system of a nation** is

$$L^i = \frac{P^i}{S^i}$$

## Aggregate variables of the medical system in a nation

The **total number of hospitals** in the medical system in a nation is  $H$ .

The **total number of patients** in the medical system in the nation is

$$P = \sum_{i=1}^H P^i$$

The **total number of staff** in the medical system in the nation is

$$S = \sum_{i=1}^H S^i$$

## Medical load of the medical profession in a nation

The medical load of the medical profession in a nation is

$$M = \frac{P}{S}$$

## Medical load of the medical system in a nation

The medical load of the medical system in a nation is

$$L = \frac{P}{H}$$

## The mathematics of the medical system in a nation

The mathematics of the medical system in a nation is

**The total patients equation:**

$$MS = LH$$

**The distributed load equation:**

$$L = \sum_{i=1}^H L^i$$

**The medical professional load bounds:**

$$M_{min} \leq M \leq M_{max}$$

**The medical system load bounds:**

$$L_{min} \leq L \leq L_{max}$$

where

$M_{min}$  is the minimum medical load of the medical profession in the nation

$M_{max}$  is the maximum medical load of the medical profession in the nation

$L_{min}$  is the minimum medical load of the medical system in the nation

$L_{max}$  is the maximum medical load of the medical system in the nation

## Normal operation of a hospital

If the medical load of the hospital is **within** 1.5 standard deviations of the mean of the medical loads of a **representative national sample** of hospitals, that hospital is said to be in **normal operation**.

## Non-normal operation of a hospital

If a hospital is **NOT** operating normally, that hospital is said to be in **non-normal operation**.

Non-normal operation of a hospital is **rarely** observed **during peace**.

Non-normal operation of a hospital is **usually** observed **during epidemic**  
or **during war**, or **during both** in the form of **biological war**.

## The measure of stress on the medical system in a nation

The measure of stress on the medical system in a nation is

$$\kappa = \sqrt{\frac{H_{nn}}{H_n + H_{nn}}}$$

where

$H_n$  is the total number of hospitals that are operating normally

$H_{nn}$  is the total number of hospitals that are operating non-normally

## The measure of strain on the medical system in a nation

The measure of strain on the medical system in a nation is

$$\eta = \sqrt{\frac{L - \mu_L}{L_{max} - L_{min}}}$$

where

$\mu_L$  is the mean of  $L$

**The End**