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# Differential Clinical Significance of Medical Information

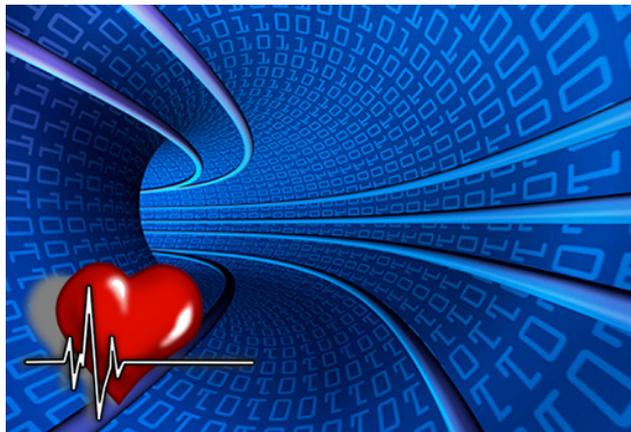
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Mathematical Expression of it Needed



# Differential Clinical Significance of Medical Information;

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Col. Ioannis C. PAPACHRISTOS, M.D.

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Written initially *in Greek* on **Aug. 29, 2015** :

[www.icp-med.gr/engl/books/grdcsmi/](http://www.icp-med.gr/engl/books/grdcsmi/)

**English** version written on **Jan. 22, 2016** :

[www.icp-med.gr/engl/books/dcsmi/](http://www.icp-med.gr/engl/books/dcsmi/)

**ISBN 978-960-93-7835-2**

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*To Prof. Peter Goldstraw, the gentleman who taught me "the Art" (as Hippocrates referred to it) and Ethics; he has always been so wise and kind a mentor that I can never repay the debt I owe him.*

“Those diseases which medicines do not cure, the iron cures; those which iron cannot cure, fire cures; and those which fire cannot cure are to be reckoned wholly incurable.”

Hippocrates's *Aphorisms*, Section VII, 87 [1]

“Ὅκῶσα φάρμακα οὐκ ἰῆται, σίδηρος ἰῆται· ὅσα σίδηρος οὐκ ἰῆται, πῦρ ἰῆται· ὅσα δὲ πῦρ οὐκ ἰῆται, ταῦτα χρὴ νομίζειν ἀνίατα.”

Ἱπποκράτους *Ἀφορισμοί*, Τμήμα Ζ', 87 [2]



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## Medical Information

In pre-Hippocratic era Medicine was practised less as applied science and more as worship of Aesculapius and other deities. The very concept of "*Indications*" (e.g. to apply some treatment or to carry out some procedure etc.) did *not* even exist: if a patient had addressed three consecutive '*ijate*-physicians' \* for the very same health problem of his, he would have been provided with an entirely different piece of therapeutic advice from each and every one

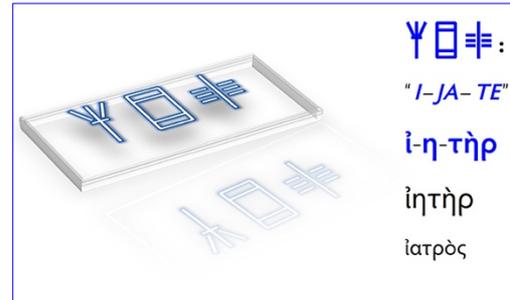


Figure 1

of the three healers, since each of them would give his own personal advice "*at will.*" There was a *Darkness* of Absence of rationalism, a *chaos* of viewpoints that were arbitrary, subjective and unsubstantiated.

It was only when Hippocrates invented the very concept of "*Indications,*" that medical Mind shined in the darkness; according to Hippocrates's famous 87<sup>th</sup> "*Aphorism*" the cauterization (with "fire" – "πῦρ") of an abscess was only *indicated* to be carried out, if attempted surgical drainage of it (by a scalpel made of "iron" – "σίδηρος") had previously failed; similarly, surgical treatment or drainage of the same abscess (with scalpel made of "iron") was only *indicated* after failure of prior application of "*medication*" ("φάρμακα").

Two and a half millennia have elapsed since Hippocrates's era. We have, therefore, nowadays the luxury to recommend treatments, operations etc. to our patients on the solid basis of "*Indications*" unanimously accepted by the global clinicians' and / or academic community; such

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\* *I-JA-TE*: Archaic Greek (Hellenic) word for physician, doctor or *healer*, often found in Homer's *Iliad* ('rhapsody' or 'book' IV, verse 190, IV 194, XII 518 etc.: the events described occurred in 1,188 or 1,190 BC, since the conquest of *Troy* dates back to those years according to dating of archaeological finds at *Iliion*), but also appearing in *Linear b* script on a *XIII* century BC clay tablet (tablet № "Eq 146," Nat. Archaeol. Museum in Athens, found at *Pylos*, Ano Englianos Palace, **Fig. 1**).

indications have been set by Collective Bodies (Committees of Medical Scientific Societies), because they had been adequately validated and proven as correct. We similarly now have “Contraindications” unanimously accepted; e.g. treatment of NSCLC<sup>†</sup> with Surgery is indicated [3] for stages I<sub>a-b</sub>, II<sub>a-b</sub> and III<sub>a</sub><sup>‡</sup> of it, but it is contraindicated for stages III<sub>b</sub> and IV<sup>§</sup>.

In other words, some pieces of medical information are so *Significant* and important that they decisively affect clinical Decision-Making, e.g. by warranting, forcing or dictating a particular method of treatment. Such is the information of the accurate Stage in a case of a NSCLC patient (it may be an indication<sup>\*\*</sup> for Surgical treatment), but such may also be information of other kinds (e.g. information regarding a specific patient's *fitness*<sup>††</sup> to withstand and survive major surgery). Information of such a *high degree of Significance* essentially **determines** the medical clinical manoeuvres in a given patient's case and, therefore, his whole further course, *Prognosis* and final outcome.

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† NSCLC: Non-Small Cell *Lung Cancer*.

‡ It is *only* for the *subgroup* of T<sub>3-4</sub>N<sub>1</sub> cases (of stage III<sub>a</sub>) that surgical treatment is unanimously accepted as indicated.

§ It is also contraindicated for the N<sub>2</sub> subgroup of cases (of stage III<sub>a</sub>), according to part of the literature.

\*\* or a Contraindication

†† or Unfitness

## Information measured and accurately Quantified

It took quite long for "*Information*" to be precisely defined as a concept itself and determined in order to be accurately measurable and *mathematically quantifiable*. In the distant past, various amounts of information were transmitted orally either by *rhapsodes* or minstrels (measurable by number of verses or rhapsodies **++**) or by the sounds of the Talking Drums of Africa [4]. During *history* the information could be stored and carried in *Written* form (inscriptions on stone, clay, papyrus, parchment, paper or other materials, 'measurable' by number of words or pages or volumes), but it had not yet become the focus of attention itself [5]. The information was not fully determined as precisely measurable, even when it started being electronically transmitted, initially by *telegraph* (by using the Morse code, cables carrying electrical current and relays), thus resulting in *charging per word* transmitted. Finally, the information was not even defined as an accurate concept during its transmission by telephone (one may remember the charges every three minutes for long-distance domestic phone calls in the past).

There *couldn't* be, of course, any progress of the Science of "Informatics" **§§** as long as information *per se* was *not* itself absolutely defined with precision, allowing its mathematical expression as an amount *accurately quantifiable*.

World War II changed it all: during it the vital needs of cryptanalysis for numerous messages intercepted forced Alan *Turing* to materialize a version **\*\*\*** of his abstract, fanciful and imaginary "*Universal*" machine, but also to focus on "*Information*" itself, as needing a way to mathematically measure it.

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**++** Homer's epic poetry: The *Iliad* and the *Odyssey*

**§§** "*Informatique*" in French or, in English: "*Computer Science*."

**\*\*\*** A machine (dubbed '*the Bombe*') built and extensively used at Bletchley Park to invert the enciphering of any number of German Enigma messages; the Enigma code settings were changing on a daily basis

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