

# Discovering a New Human Vital Sign

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## Abstract

Several factors are here enumerated and the early steps in the process are elucidated for elevating an apparent biologic marker, termed Response Consistency, to the level of a vital sign. The possibility became evident as a result of seeking a simple psychological process in order to augment expensive leading edge medical research methods of studying human pain.

## Introduction

My old medical school Dorland's, American Illustrated Medical Dictionary 21<sup>st</sup> Edition copyright 1947, definition of the term 'vital' is "pertaining to life". It lists only "pulse, respiration and temperature" for 'Sign, vital' among its almost 11 solid pages of what must be hundreds of different medical terms referencing various human signs. Most of us often use that term loosely to include some of the other biologic markers such as blood pressure and even sometimes erythrocyte sedimentation rate. Now, in 2003, the U.S. Patent Office lists some 1764 patents, back only to 1975, under the term 'marker, biologic' and 2253 under 'marker, pain' –my major area of interest.

While we have in the past always considered such signs, now more commonly termed biologic markers, as being of paramount importance lately they seem to be of even greater interest particularly if they point the way to clinical conditions that are of known major medical significance for humans. Perhaps if we choose to make a distinction between the older term and that of today we can limit the former definition to only those markers or signs that actually are of a more universal degree vital to what our, now also broader, term for human life may actually be. Although only of anecdotal interest, I have admittedly not yet uncovered how far back the term 'vital' can be traced for such a sign as the pulse rate –perhaps to William Harvey himself.

Since my own interest in this larger panoply is limited to the area of pain, I might mention that

many clinicians now consider blood pressure as the fourth vital sign. And lately, pain is allegedly being given the exalted position of the fifth sign according to Marni Jackson's book<sup>1</sup> which is cited in Healthcare Inspirations<sup>2</sup> covering the new requirement of the Joint Commission on Accreditation of Health Care Organizations' (JCAHO). It is now required that a pain inquiry must be made and recorded when a patient's medical history is taken. In the strictest sense of a definition of the term 'sign' one might better include an objectively visible phenomena of the pain rather than simply a subjective complaint, which takes us to the body of the subject of this presentation.

## Response Consistency as a Biologic Marker

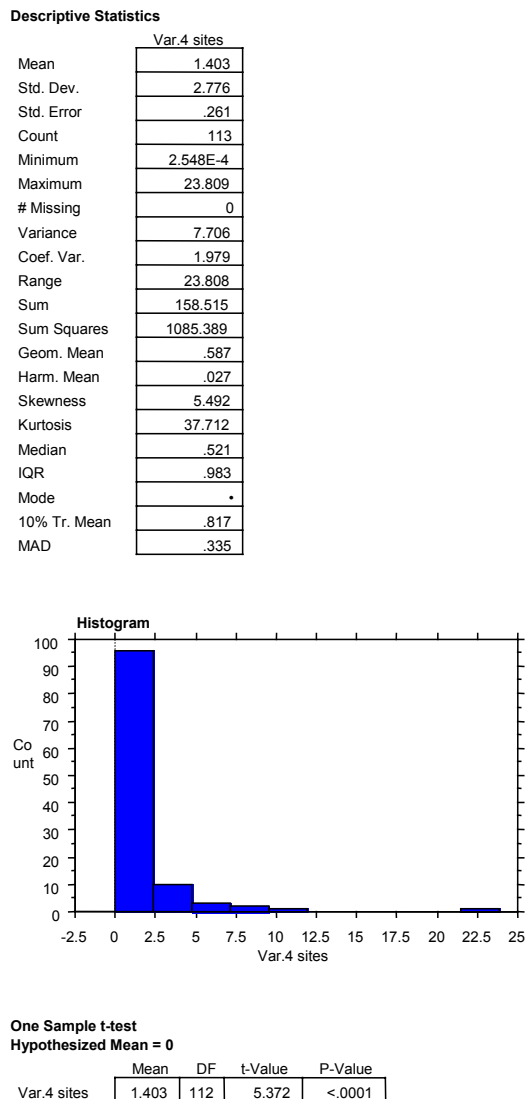
Because almost all of the work in the past, where both acute and chronic pain is concerned, has been dependent upon the subjects own, mainly verbal, assessment of his or her perception of a noxious stimulus, only limited interest in a more objective method of measurement has been evident in the realm of actual scientific physiologic studies until recently. That is to say that all methods of depicting or documenting the patient's interpretation of a stimulus, such as that described by the broad term 'pain', have been based upon his or her subjective assessment since there are few if any really objective methods like, for example, now the recently introduced functional MRI, PET and SPECT scans that are available. Thus we can say that the medical specialty termed Cranial Nuclear Medicine is now showing us that there can be a clear picture of the presence or absence of higher neurological levels of a stimulus rather than the simple measurement of the nerve's electrical conduction which can hardly be traced beyond the level of its first synaptic juncture and certainly does not lend itself well to in vivo study. True where lower animal studies are involved there have been techniques that have been adapted to rigorous scientific methods of studying the response to noxious agents: for example, the tail twitch of rats when subjected to heat; terming it 'pain' while recognizing that there may be almost no relationship

to that experienced by the human. But here again one is at a lose for something more adaptable that can truly, some day, encompass all significant factors such as ethnic and gender origin or even general well being which go into a subjective response when it comes to the use of such a vague term as pain. Until that is achieved we can not actually speak of a real pain threshold knowing that a variability of the subject's past or even immediate circumstances, such as a recent meal prior to testing, can confound the result.

In pursuit of a suitable inexpensive biologic marker to be used in selecting which patients would most economically lend themselves to the study of chronic pain I have begun to recognize that there maybe an underlying definable universal factor to the concept of its perception. This was published in the electronic Journal of the Chronic Pain Institute<sup>3</sup> in some detail using the StatView statistics computer software tool of SAS Institute Incorporated. In there I tried to clarifying that variances from the Mean of each individual's aggregate test readings, rather than simply taking the Average, is best used as an expression of the significance of that subject's consistency in arriving at a repeated quantifiable judgment relative to a measurable stimulus in the form of skin pressure. The testing was done in a way so as to sharply reduce such confounding variables as inter-operator variation by having the subjects actually apply the stimulus to themselves in order to judge the degree of skin pressure; yet the interpretation of their perception was read and recorded only by the technician who had no other input or control — in order to achieve a double-blind single-subject result.

While working with the first group of 113 subjects I recognized that there is a rather finite degree of consistency of perception in terms of each students ability to blindly (only the technician having access to the response) return to the same measurement reading in judging 5 episodes of skin pressure, which I termed Response Consistency (RC). It seems to underlie all of their perception, at least to skin pressure because there was a rather tightly grouped Mean covering the total of the 113 dental students who each self-judged 20 pressure points of their own skin pressure as can be noted in greater detail when read in that publication.

The Mean of this population sample of 113 dental students is demonstrated in the Descriptive Statistics of Fig. 1 below along with its Frequency Distribution.



**Figure 1.**

This resultant high degree of consistency in the overall group as well as in most of the individuals does not seem to me to be completely explainable on the basis of a possible sample bias of dental students relative to the geographic general population as such. A bias which could be the result of the rigorous training that all dental students are involved with due to their experience with dental instruments

and the like when it comes to the perception and interpretation of many different forms of skin pressure. The concept, of there being a fixed baseline degree of consistency throughout the population at large, is born out further by the fact that there was a smaller, but statistically significant subgroup (Past Unus. Pn) of the cited population sample made up of individuals who had experienced at least one episode of more than minor pain in their background. These had a greater degree of variance (2.112 kg/cm<sup>2</sup>) as opposed to the total student sample Mean (1.403 kg/cm<sup>2</sup>). This may be due to a mechanism of memory that was pointed out by Gazzaniga<sup>4</sup>, termed the attentional system. Of note is that when, the Past Unus. Pn subgroup (n=22) was compared, by Unpaired t-test with the 113 student Mean it showed a significant difference giving a P-Value of .0011 by using Fisher's PLSD. Rather conversely the Present Pn subgroup (n=28), who were actually experiencing some degree of what they termed pain, such as a headache or backache during the time of testing, showed only a P-Value of .2596 by Unpaired t-test relative to the Mean of the same sample 113 dental student population.

### The Possible Universality of Response Consistency

In the Facial Pain Clinic at the School of Dentistry of the University of the Pacific, we recently performed another, but somewhat differently designed experiment, which lends itself sufficiently to comparison on the basis of being a second sample from the broad geographic general population because it incorporated the testing principles cited above. Taking that study as a second sample of a dental student population we get some insight into what could in the future be considered a wide ranging Response Consistency baseline at least for skin pressure in certain groups such as dentists. We also can get a glimpse of the possibility that there may be more universality here than would simply be reflected in using the term 'biologic marker'.

Here, we had 94 more dental students utilizing the same techniques in the first part of a similar sequence of test performance as that of the earlier

sample of 113 dental students. However for this experiment an electronic skin pressure measuring device, the Commander algometer of JTech Instruments, was used which could account for the group's Mean of all the Variances (Var 4T) this time being 1.837 giving a P-Value of .5595 when a Paired t-test was done to compare this 94 student population sample to the earlier 113 student sample (Var 4RC) as shown in Fig. 2 below.

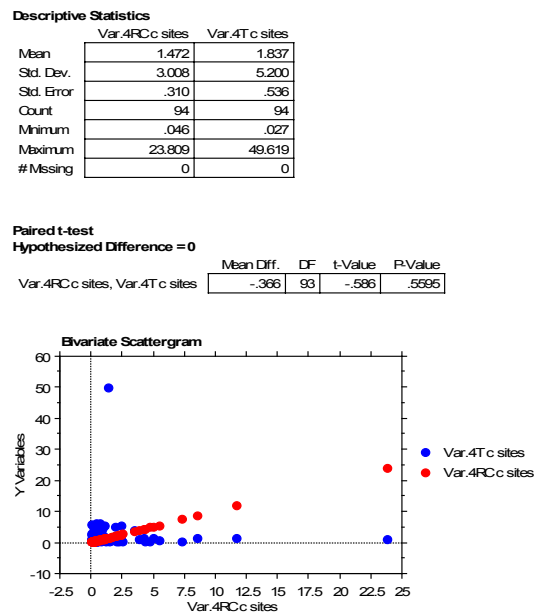


Figure 2.

For the above Paired t-test of the two different student samples, the 113 student sample was reduced randomly using the Simple Random Sample technique of blindly dropping one of every 6 student cases thereby providing only 94 students for a better comparison analysis. Their Bivariate Scattergram, in Fig. 2 above, demonstrates fairly good grouping of both samples, but the better linearity of the RC group, in red, suggests that the repetition of a more identical study, to avoid all factors of unfamiliarity with the different type of testing equipment, will reveal greater sampling uniformity which could well provide added insight from the standpoint of the Response Consistency concept. All statistical analyses for both samples was done with the StatView program, version 5.0.1 of SAS Institute Incorporated.

A detailed publication of this study will follow later, but where this presentation is concerned I am here pointing up only the relevant portion pertaining to Response Consistency Testing. It gives further encouragement to the idea of now seeking comparison to a few samples from the general geographic population at large.

### **The Bigger Picture**

One might well be tempted to say that since these two samples do compare somewhat favorably despite having been achieved using two different types of algometers, that they can be taken as reflective of the human population at large, however there are several important points that must now be considered:

First, in all seriousness, can we really take two admittedly good-sized samples as being reflective of a population of millions or even billions of people? Hardly. Never-the-less, back when the concept of using the term ‘vital sign’ to reflect the universality of certain clinical findings was first established, and that may not be so long ago, likely no really major world wide sampling procedures were used to reach those conclusions. Rather they were based upon logic, which is the mainstay of almost all of our medical knowledge even to this day. Since when are humans actually considered to be infallible and why then can we not arrive at a rather finite quantification of our human fallibility? Using this form of reasoning it should be clear that we must recognize even human infallibility, in the form of total consistency, should be discernable given a certain degree of ingenuity in deriving ways of measuring it.

Second, we should recognize that the point made earlier, concerning the suspected group bias, in terms of the ability in young dentists to interpret the perception of skin pressure, must be taken seriously enough to argue for the broader undertaking of geographic population sampling methods using randomly chosen individuals rather than homogeneous groups. If we then see the probable long-term value to be achieved by such a task, it seems quite evident that the

recognition and subsequent measurement of this form of central nervous system physiology now termed Response Consistency will provide great dividends in the study of various mental mechanisms. I am presently undertaking to bring together funding for such an endeavor under the Federal Internal Revenue Services’ income tax exemption letter that the Chronic Pain Institute holds. This should allow us to set up further testing of more public samples. Should one wish to view those credentials in more detail they can be found by choosing the selection ‘References and Credentials’ at:

<http://www.ChronicPainInstitute.org> .

Third, one must keep in mind that we are actually interested in finding a meaningful sign to inexpensively point to certain mental conditions in the future which at the moment are being studied by the very expensive techniques just mentioned. As a consequence we are not simply looking only for universality of a human characteristic. Such can be any type of minor attribute of which by far the majority do not have any clearly defined medical uses when it comes to the day to day maladies of patients compared to the level of importance of pulse, respiration and temperature. Therefore there would seem to be little if anything gained by an expenditure of a large portion of our medical financial resources solely for testing of the population at large in order to define the universality of RC alone. To the contrary, it is important to also show its applications to real medical needs.

In order to embark on such a broad quest as identifying the medical need for the observation of Response Consistency as above defined, both this described experiment as well as the one already published carried with them the identical set of 72 questions many of which as yet, time and money, have not permitted the important task of submission to data mining procedures. However the difference in statistical significance of the two groups already mentioned: that is, Past Unusual and Present Pain, is a good start in this direction of establishing specific medical needs for this concept. As can be recognized in more detail when the previously cited electronic publication<sup>3</sup> is read, these two subgroups contain adequately large enough samples to allow for comparison of their Means relative to the general

public. When one studies further the notable difference in the aggregate responses of the reasonably good sized subgroup labeled Past Unusual Pain, this could be expected to provide new insight into the physiology of the central nervous system's perception mechanism for specific types of stimuli: namely, in this instance skin pressure.

In the 72 questions of each subject's response, made up of multiple choice answers, there are quite a few additional ones for future analysis such as: an inquiry concerning previous virus infections and others that are relative to various physical complaints of the subjects. Thus the response to those questions is expected to point the way further to the medical significance of all of the data gathered in both studies.

### **Conclusion**

It will likely take many other experiments before one can clearly make the connection of Response Consistency with what has been described as the 'attentional system', mentioned above. However, at this point, I am confident that at least a similar explanation will sooner or later become apparent, relative to some form of a subject's memory of a past painful event, which will account for a measurable difference in Response Consistency in most humans. Then what will remain to be seen is whether certain individuals actually demonstrate a difference from the Norm of the geographic population at large in terms of its comparison with the Mean of that subject's aggregate readings when it comes to conditions like Past or even Present Pain and other human mental conditions such as Mania and Depression.

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### **Key Words:**

Biologic Marker, Response Consistency, Pain

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