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VALIDATION OF THE RATIO SCALE OF THE DIFFERENTS TYPES OF PAIN

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The main aim was to validate the ratio scale derived from the non-metric continuum of the intensity of the different types of pain using cross-modality matching. Magnitude estimation method and cross-modality matching were used with perceived line lengths. The study was formed by 30 outpatients from various specialty clinics, 30 physicians and 90 nurses. The results were: Cancer Pain, Myocardium Infarct Pain, Renal Colic, Burn Injury Pain, and Childbirth Labor Pain were regarded as the pains of greater intensity; the rank order of pain intensity for the different types of pain, comparing the different psychophysical methods used resulted in levels of significant agreement. The conclusion was that the relation between the magnitude estimates and cross modality matching estimates of the line-lengths is a power function, and the scale for the different types of pain is valid, stable and consistent.

DESCRIPTORS: pain measurement; psychophysics; pain

VALIDACIÓN DE LA ESCALA DE RAZÓN DE LOS DIFERENTES TIPOS DE DOLOR

El objetivo general fue validar la escala de razón derivada para el continuo no métrico de intensidad de los diferentes tipos de dolor por medio del método de emparejamiento intermodal. Fueron utilizados los métodos de estimación de magnitud y de emparejamiento intermodal con la modalidad de respuesta en largo de líneas. Participaron 30 pacientes de ambulatorio de diferentes clínicas, 30 médicos y 30 enfermeros. Los resultados mostraron: Dolor en el Cáncer, Dolor por Infarto del Miocardio, Dolor por Cólico Renal, Dolor por Quemadura y Dolor en el Parto; que fueron considerados los tipos de dolor de mayor intensidad; el orden de las posiciones de la intensidad de los diferentes tipos de dolor, cuando se compara los diferentes métodos psicofísicos utilizados, resultó en niveles de concordancia significativa. Concluimos que la relación entre las estimativas de magnitudes y las estimativas de largo de líneas es una función exponencial y la escala de los diferentes tipos de dolor es válida, estable y consistente.

DESCRIPTORES: medición del dolor; psicofísica; dolor

VALIDAÇÃO DA ESCALA DE RAZÃO DOS DIFERENTES TIPOS DE DOR

O objetivo geral foi validar a escala de razão derivada para o contínuo não métrico de intensidade dos diferentes tipos de dor, por meio do método de emparelhamento intermodal. Foram utilizados os métodos de estimação de magnitude e de emparelhamento intermodal com a modalidade de resposta em comprimento de linhas. Participaram 30 pacientes ambulatoriais de diferentes clínicas, 30 médicos e 30 enfermeiros. Os resultados mostraram dor no câncer, dor por infarto do miocárdio, dor por cólica renal, dor por queimadura e dor no parto, considerados os tipos de dor de maior intensidade; as ordenações de posições da intensidade dos diferentes tipos de dor, comparando os diferentes métodos psicofísicos utilizados, resultaram em níveis de concordância significativos. Conclui-se que a relação entre as estimativas de magnitudes e as estimativas de comprimento de linhas é uma função de potência e a escala dos diferentes tipos de dor é válida, estável e consistente.

DESCRITORES: medição da dor; psicofísica; dor

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Disponible en castellano / Disponível em língua portuguesa

INTRODUCTION

Pain is a problem that must be faced by the health team; it is a symptom that can have acute or chronic characteristics and may worsen health state if it is not adequately relieved. However, as it is a complex and subjective phenomena, one may say that individuals in pain must be treated respecting their totality and individuality.

We recognize the importance of assessing pain, its management, and control, the American Society of Pain established this symptom as the "fifth vital sign", emphasizing that pain assessment is as important as the assessment of the other four vital signs and that health professionals need to record this phenomena. Thus, it is necessary to use scales to produce measure parameters and, consequently, an adequate pain control.

Studies on painful phenomenon are increasingly focusing on the complexity of their dimensions. Approaching other aspects rather than the sensitive ones makes it easier to understand this phenomenon. Broad and comprehensive understanding of the painful perception is important because it deals with other aspects besides pain intensity, such as the affective and motivational aspects of pain and the assessment of it.

The purpose of measuring is to assign value to a feature, trait, or state. In the case of pain measurement, the purpose is to give value to the pain experienced and/or perceived. Psychophysics is an experimental branch of Psychology that deals with measuring and assessing mechanisms and processes entailed in different sensitive and perceptive modalities[1].

The values of the exponent supply information on the basic properties of the *"inflow-outflow"* of the sensory and the perception dimension being studied; this features the rate at which an "*outflow"* system, indexed by the sensation, grows because of the *"inflow"* of the stimulus. The power function advocates that the principle of invariance between stimulus and sensation ratio, can be applied to all sensory systems, and is essential to survival of the body, that is, the sensory transducer works as a expander of the encouraging energy when necessary[2].

Magnitude estimation is based on the judgment of individuals to several stimuli, and it is one of the methods used to produce a ratio scale. The idea is to match perceived intensity of a physical stimulus with another perception. It is defined as the process to assign numbers proportional to social or clinical stimulus that reflect the intensity of the subjective answer. This method has important features as a measure strategy for subjective concepts such as pain[3].

When magnitude scales are designed, they should undergo psychophysics validation processes with the use of cross-modality matching which is specifically developed to check exponents obtained by ratio or magnitude estimation, according to the types of response used.

The paradigm of cross-modality matching supplies a method to confirm the power law, which checks the featured exponent and relates the magnitude of stimulus with the magnitude of subjective answer. Thus, instead of having subjects combining numbers to stimulus intensities, they use line lengths (tape measure) as a type of response. Thus, to rate a pain intensity scale, each subject may be guided to point out the size of tape measure that corresponds to the intensity of pain, the greater the pain, the greater the length of the line[4].

Psychophysics assess sensory, desirable, and cognitive components of pain, thus, it is very important to enhance its assessment, especially because it supplies ways to measure pain perception in its several dimensions[5].

The problem to assess and measure pain becomes psychophysical ant it involves detection, discrimination, and magnitude of the answer to the painful stimulus, thus, psychophysics presents the central assumption that the perception system is a measuring mechanism[6].

Measuring pain has been considered as a main challenge for those that want to control it adequately, since pain is understood as a complex, individual, and subjective perceived experience, that may be quantified only indirectly. Ever since pain has been studied in different ways in the investigation with animals, human beings, in laboratories or in clinical situations, integration of the knowledge from these domains has increased.

The search for understanding how the painful phenomena occur, how it is perceived by those experiencing it, and by those treating it results from the main goal professionals from the field have, which is to try to adjust treatment according to the source of pain, with no personal interferences in this process.

OBJECTIVES

General objectives

- To rank the different types of pain present, comparing them using different psychophysical methods;
- To validate the ratio scale derived to the nonmetric continuum of intensity of the different types of pain using cross-modality matching.

Specific Objectives

- to assess if the rank of the different types of pain derived from the two psychophysical methods are similar;
- to check stability and/or equivalence of the ratio scale, using two different answer modalities, numerical (magnitude estimates) and visual (line length).

MEASURING PAIN

Experiment – Validation of the ratio scale of the different types of pain using magnitude estimation method and cross-modality matching with the answer using line lengths

This study has been approved by the Ethical Committee of the Hospital das Clínicas of the Medical School of Ribeirão Preto, University of São Paulo. All participants gave their written consent, signing the term approved by this committee after they were verbally explained about the research, its objectives and accepted to take part.

This is an experimental quantitative study using Psychophysics as the paradigm and theoretical reference[2-4].

Methods

Participants: Thirty outpatients from different clinical specialties took part in the study; they were over 18 and were chosen from a convenience sample that could present any of the types of pain studied. Sixty health professionals, 30 physicians and 30 nurses also chosen from a convenience sample, specialized in different areas. The place of study was the Hospital das Clínicas of the Medical School of Ribeirão Preto.

Material: Pens and notepads, on the first page there were specific instructions for each psychophysical method and, in the following pages, a list with 20 different types of pain and their respective definition. Additionally, a professional tape measure with 5 meters in length was used.

Procedure: Psychophysics methods used were magnitude estimation method and cross-modality matching involving the answer continuum of the line length.

The instrument for data collection was built using the different types of pain: Low back pain, Head ache, Joint pain, Burn pain, Peripheral Neuropathy, Pain due to repeated strain injuries, AIDS pain, Postoperative pain, Cancer pain, Labor pain, Pain due to Temporomandibular Joint Disorder (TMJ), Pain due to *Herpes-Zoster,* Trigeminal neuralgia, fibromyalgia, Myocardial Infarction Pain, Renal colic pain, Pain from Gastric Ulcer, biliary colic pain, Menstrual Cramps pain, and Toothache. For each method used, different instructions were made.

Instructions given to subjects, regardless of the continuum of answer employed, demanded that judgments were performed according to intensity given to one type of pain.

In the method of magnitude estimation, the task of participants was to give a number for each type of pain that was proportional to pain intensity of that type and compare it with Standard stimulus that was low back pain with numerical value of 100. For example, if participants considered that a certain type of pain was two time more intense than low back pain, they should give to it a number twice as big, that is, 200. If participants considered that a certain pain had half the intensity of low back pain, they should give this type of pain a number that was the half, that is, 50.

In the cross-modality matching, involving a response continuum of line length, the task of participants was to match a line length for each pain that was proportional to the intensity of pain, and then compare it to the standard stimulus that was low back pain. This standard stimulus had a 50 cm length. For example, if participants considered that a type of pain was twice as much intense as low back pain, they should match the line length twice as long as the standard stimulus, that is, approximately 100 cm. If participants find that a type of pain had half the intensity of low back pain, they should match a length that would be half of the standard, approximately 25 cm.

Each subject established two estimates for each type of pain, one for magnitude estimation and

another for line length. The same 90 subjects took part in the two tasks, and the tasks were presented in a random order for each participant. Participants made the judgments individually.

For data analysis, geometric means were assessed together with standard deviation of geometric means of the magnitude estimates and line length matching estimates. Rank of positions for each of the different types of pain for each group of participants, that is, outpatients, physicians, and nurses were established. In addition, the function exponent was calculated together with Kendall's coefficient of concordance (W).

RESULTS

In the group of outpatients, the types of pain of greater intensity, both in magnitude estimation and in cross-modality matching (line length) were: Cancer Pain, Myocardial Infarction Pain, AIDS Pain, Renal colic pain, Labor Pain and Fibromyalgia. In the group of physicians they were: Cancer Pain, Renal Colic Pain, Labor Pain, Myocardial Infarction Pain, and Trigeminal Nerve Pain. In the nurses group they were: Cancer Pain, Renal Colic Pain, Myocardial Infarction Pain, Labor Pain and Burn Pain (Table 1).

Table 1 – Geometric Mean of the magnitude estimates (ME) and line length estimates (LL) for the different types of pain ranked (R) according to Outpatients (OP), physicians (Phy.) and Nurses (Nur)

Types of Pain	OP ME	R	OP LL	R	Phy. ME	R	Phy. LL	R	Nur. ME	R	Nur. LL	R
Cancer Pain	277.80	1	98.50	1	345.72	2	135.45	1	335.81	1	125.13	1
Myocardial Infarction Pain	225.20	2	84.60	2	265.57	5	110.33	4	279.69	3	115.92	3
AIDS Pain	204.70	3	77.50	4	100.03	16	61.79	14	134.56	13	75.91	9
Renal Colic Pain	177.70	4	83.30	3	383.47	1	130.19	2	294.75	2	118.86	2
Labor Pain	152.60	5	64.50	6	330.39	3	116.48	3	275.53	4	104.47	4
Fibromyalgia	135.00	6	70.20	5	74.70	20	42.00	19	136.98	11	79.06	8
Biliary Colic Pain	127.30	7	63.40	7	194.08	8	85.32	9	175.29	6	83.04	7
Gastric Ulcer Pain	110.80	8	61.20	8	156.53	11	76.70	10	146.68	8	74.41	10
Burn Pain	104.70	9	61.10	9	211.04	7	99.08	7	239.13	5	96.94	5
Trigeminal Neuralgia	104.50	10	47.80	14	268.74	4	105.92	5	115.66	17	68.02	14
Toothache	102.20	11	60.10	10	158.83	10	71.58	11	139.77	9	72.98	12
Low back pain	100.00	12	50.00	13	100.00	17	50.00	17	100.00	19	50.00	20
Head ache	93.40	13	44.90	17	143.32	12	58.99	15	120.17	16	59.93	17
TMJ disorder pain	92.60	14	46.20	15	123.21	14	62.86	13	123.39	14	66.45	16
Post operative pain	87.00	15	53.70	11	177.17	9	87.87	8	173.70	7	89.28	6
Peripheral Neuropathy pain	85.10	16	51.30	12	101.40	15	64.87	12	138.76	10	73.75	11
Menstrual cramp pain	70.70	17	45.00	16	126.35	13	56.78	16	108.78	18	67.47	15
Repeated strain injuries	96.90	18	35.60	19	76.42	19	41.00	20	92.37	20	52.93	19
Joint Pain	58.00	19	36.20	18	82.66	18	47.55	18	122.67	15	58.80	18
Herpes Zoster Pain	42.60	20	27.80	20	222.12	6	101.14	6	136.80	12	72.44	13

Table 1 also presents the different types of pain classified as smaller intensity types. In the group of outpatients, the types of pain assessed as smaller intensity, both in the magnitude estimates and in lines length, were *Herpes Zoster* Pain, Joint Pains, Repeated strain injuries, and Menstrual Cramp Pain; in the group of Physicians they were Repeated strain injuries, Fibromyalgia, Joint Pain and Low back pain; in the group of nurses they were: Low back pain, Repeated strain injuries, Joint Pain, Menstrual Cramp pain. Outcomes showed greater difference among groups referring to less intensity pain.

Kendall's coefficient of concordance (W) was applied to estimates of methods used, comparing the rank for the different types of pain. For the group of outpatients W=0.87, for the group of nurses W=81, and for the group of physicians W=0.86. This indicates that ranking of the two estimates are highly agreeable, with statistically significant $p<0.001$.

In picture 1, geometric means of line length estimates for the group of outpatients are projected in logarithmic coordinates, according to the corresponding geometric means of the numerical estimates for each type of pain. A straight line with an inclination (exponent of the power function) of 1.40 was formed. However, as observers tend to limit the amplitude of the adjustments according to the variable they control, on Picture 2, these means in reversed coordinates have been projected that is, magnitude estimates according to the corresponding estimates of line length for each type of pain with a 0.66 inclination of the straight line.

Psychophysical scale of the different types of pain in the group of outpatients was assessed, and the geometric mean of the exponents was 0.96.

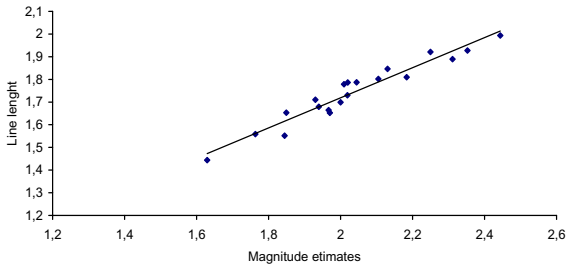

Figure 1 – Correlation between logarithms of geometric mean of line lengths and logarithms of geometric mean of magnitude estimates given to the different types of pain, outpatients, $r^2 = 0.94$

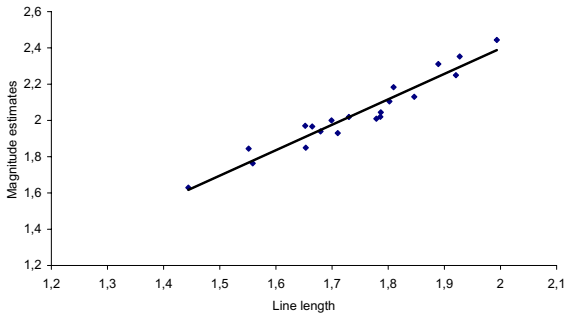

Figure 2 - Correlation between logarithms of the geometric mean of magnitude estimates and logarithms of the geometric mean of line lengths given to the different types of pain, outpatients, $r^2 = 0.94$

Geometric means of estimates of line lengths of physicians have been projected in logarithmic coordinated according to the corresponding geometric means for each type of pain. A straight line with a 1.34 inclination (exponent of the power function) was made. Likewise, these means were presented in reversed coordinates, that is, magnitude estimates according to the corresponding line lengths for each type of pain, with a 0.70 inclination in the straight line. The respective pictures have not been presented in this article; however, they present the same features of the previous pictures.

Psychophysical scale of the different types of pain in the group of physicians was validated, and the geometric mean of the exponents was 0.96.

In the group of nurses, geometric means of line length estimates have been projected in logarithmic coordinates according to the corresponding geometric means of the numerical estimates for each type of pain. A straight line with a 1.42 inclination (exponent of the power function) was built. These means are in reversed coordinates, that is, magnitude estimates according to line lengths for each type of pain, with a 0.65 inclination of the straight line. The respective pictures have not been presented in this article; however, they present the same features of the previous pictures.

Psychophysical scale of the different types of pain in the group of nurses was validated and the geometric mean of exponents was 0.96.

Exponent value for the three groups studied was 0.96. Such values were close to those predicted, that is, 1.00, when line lengths and magnitude estimate matching were directly involved. The proof of equivalence between empirical exponent and that predicted in a calibration task, directly involving sensations between the two methods is a strong evidence of the validity of magnitude estimation and, thus, of the power law or Stevens's law[4].

Correlation between magnitude estimation and line length is a power function with a non-significantly exponent different from 1.00. Agreement between these scale values is high, indicating the scales are homogeneous and consistent.

DISCUSSION

An ideal instrument to assess and measure pain must reach the following criteria: have the properties of a ratio scale, supply immediate information on accuracy and faithfulness of the performance of subjects on the scale answers given, be simple to use with patients in pain, in clinical and research contexts, be able to assess sensitive and affective dimensions of pain, be useful both for experienced and clinical pain, and enable confident comparisons between both types of pain[7].

The action of intradermal sufentanil used with or without lidocaine for the treatment of pain induced by thermal stimulus has been studied using magnitude estimates. Nine healthy volunteers took part in the study, they received five thermal stimuli in the forearm at different temperatures, which ranged from 44° to 52°C, and so they estimated intensity of pain. After stimulus, they received salt solution, or lidocaine, and/or sufentanil + lidocaine; then they assessed pain

again at 6, 30, 60, 90, 120 and 150 minutes after injection of the medication. Results showed that, at 6 minutes after administration of medications, the sites were lidocaine and lidocaine + sufentanil were administered obtained a mean of 83% less pain than the other sites. However, there was no difference among the painful sensation in the sites where lidocaine and lidocaine + sufentanil were applied, or among sites where sufentanil and salt solution were applied. At 30 and 60 minutes these pain scores were smaller 38% and 20% respectively, in the use of lidocaine compared to the salt solution and sufentanil. At 90 minutes, and in the following minutes, the pain scores were the same as those before medication. These results suggest that intradermal sufentanil has no analgesic effect, and that in the combination with lidocaine, sufentanil neither strengthens nor prolongs the analgesic effect of this medication[8].

It can be highlighted by this study that the use of psychophysical method for magnitude estimates that leads to a ratio scale, enables to know when a pain is greater or smaller than another.

The perception of thermal pain and the displeasure was studied comparing two groups, the South Asian (India, Pakistan and Bangladesh) and Caucasian English. Forty men took part, 20 from each ethnic group. For this, sensory quantitative test was used that defines not only stimulus but also the answer. Thermal stimulus was applied to the forearm and patients were requested to assess through magnitude estimate the threshold of cold, heat detection, and the threshold of pain due to heat or cold. Additionally, the threshold of sensory detection was used with the method of ascending limits, when changes on the temperature were detected, the patient was asked to signal (the temperature ranged from 8º to 50º C). The measure of intensity and displeasure regarding pain with a numerical scale of 0-100 was also used for thermal stimulus at 46, 47, 48 and 49º C. Results showed that there were no differences on the perception of cold and heat between the two groups. However, there were statistically significant differences between the two groups for the threshold and the intensity of pain due to heat; South-Asians demonstrated smaller threshold for heat and greater sensibility to pain. Perception of intensity expression and report of pain are influenced by the social and cultural environment[9].

Thus, the present study validates the scale of perception of the different types of pain for our country and more precisely for our region, pointing out the pain considered as more intense and those considered as less intense.

Another study[10] investigated descriptors or higher or lower attribution to chronic pain using psychophysical methods of magnitude estimation and cross-modality matching in the modality of answer in line length. In a first experiment, the magnitude estimation method was used where 30 professionals of the health area (physicians, nurses and psychologists) assessing 100 pain descriptors. Of this experiment, 15 descriptors have been selected from several positions; they were presented on a second experiment to another 30 health professionals that assessed them using two psychophysical methods. Outcomes show that descriptors that described chronic pain best in our culture are depressive, persistent and distressing, and those describing less chronic pain are aggressive, intense, and compressive, both in the magnitude estimation and in the cross-modality matching method. Kendall's coefficient concordance was calculated, W=0.99, showing that the ranking resulting from the two methods are highly agreeable.

CONCLUSIONS

- Cancer Pain, Myocardial Infarction Pain, Renal Colic Pain, Burn Pain, and Labor Pain were considered as the most intensive pain, regardless of the psychophysical method used or the sample studied;
- Repeated Strain Injury, Joint Pain, Menstrual Cramp Pain and Low back pain were considered as the less intensive pain;
- Kendall's value (W) for the three group indicated that ranking resulting from the two estimates were highly agreeable, with $p<0.001$ which is statistically significant;
- Relationship between the magnitude estimates and the matching of line lengths is a power function and the scale of the different types of pain is valid, stable and consistent, because the exponent obtained in the different samples studied was equal to 0.96 to all of them; such exponent was not significantly different for the predicted exponent (1.00).

REFERENCES

1. Faleiros Sousa FAE, Silva JA. A métrica da dor (dormetria): problemas teóricos e metodológicos. Rev Dor: Pesquisa, Clínica e Terapêutica 2005 janeiro/fevereiro/março; 6(1):469-513.

2. stevens SS. Psychophysics: introduction to its perceptual, neural and social prospects. New York: Wiley; 1975.

3. Sennott-Miller L, Murdaugh C, Hinshaw AS. Magnitude estimation: issues and practical application. West. J Nurs Res 1988; 10(4): 414-24.

4. Stevens JC, Mack JD, Stevens SS. Crowth of sensation on seven continua as measured by force of handgrip. J Exp Psychol 1960; 59:60-7.

5. Faleiros Sousa FAE, Silva JA. Avaliação e mensuração da dor em contextos clínicos e de pesquisa. Rev Dor: Pesquisa, Clínica e Terapêutica 2004 outubro/novembro/dezembro; 5:408-29.

6. Da Silva JA, Ribeiro-Filho NP. Avaliação e mensuração de dor: pesquisa, teoria e prática. Ribeirão Preto: FUNPEC-Editora; 2006.

7. Gracely RH, Dubner R. Pain assessment in humans: a reply to Hall. Pain 1981;11:109-20.

8. Hartmannsgruber MWB, Atanassof PG, Budde A, Brull SJ, Kain ZN, Silverman DG. Intradermal sufentanil does not improve lidocaine-induced local anesthesia. Can J Anesth 2003 February; 50(2):153-8.

9. Watson PJ, Latif RK, Rowbotham DJ. Ethnic differences in thermal pain responses: a comparison of South Asian and White British healthy males. Pain 2005 November; 118(1-2):194-200.

10. Sant'Ana RPM, Pereira LV, Saltarelli S, Faleiros Sousa FAE. Chronic pain descriptors: a phychophysical study. Fechner Day 2004; 20:512-7.

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