DEVELOPING A COMPARATIVE SCALE OF DIFFERENT NOCICEPTIVE AND NEUROPATHIC PAIN THROUGH TWO PSYCHOPHYSICAL METHODS

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The general aim of this study was to create a comparative scale of different types of pain through different psychophysical methods and different samples. The psychophysical methods used were magnitude estimation and category estimation. The participants were 30 patients from different outpatient clinics, 30 physicians and 30 nurses. The results were: 1) cancer pain, myocardial infarction pain, renal colic, burn-injury pain, and labor pain were considered more intense, regardless of the psychophysical method used or sample studied; 2) The ranking of different pain intensities, comparing the different psychophysical methods used, resulted in significant agreement levels with Kendal values close to 1.00; 3) There were divergences in the perception of the intensities of some types of pain. These divergences were especially observed between professionals and patients.

DESCRIPTORS: pain measurement; psychophysics

ESCALONAMIENTO COMPARATIVO DE DIFERENTES DOLORES NOCICEPTIVOS Y NEUROPÁTICOS POR MEDIO DE MÉTODOS PSICOFÍSICOS VARIADOS

El objetivo general fue escalonar los diferentes tipos de dolor existentes, comparándolos entre ellos, siendo investigados por medio de diferentes métodos psicofísicos. Los métodos psicofísicos utilizados fueron el método de estimación de magnitudes y el de estimación de categorías. Participaron 30 pacientes de ambulatorio de diferentes clínicas, 30 médicos y 30 enfermeros. Los resultados mostraron que el dolor causado por: cáncer, infarto del miocardio, cólico renal, quemadura y parto, fueron considerados los tipos de dolor de mayor intensidad, independientemente del método psicofísico utilizado o de la muestra estudiada. El orden de posiciones de intensidad de los diferentes tipos de dolor, comparando los diferentes métodos psicofísicos utilizados, resultaron en niveles de concordancia significativa con valores de Kendal próximos de 1,00. Se encontraron divergencias en la percepción de las intensidades de algunos tipos de dolor, estas divergencias fueron observadas principalmente entre profesionales y pacientes.

DESCRIPTORES: dimensión del dolor; psicofísica

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O objetivo geral foi escalonar os diferentes tipos de dor existentes, comparativamente entre si, sendo investigados por meio de diferentes métodos psicofísicos. Os métodos psicofísicos utilizados foram o método de estimação de magnitudes e o de estimação de categorias. Participaram 30 pacientes ambulatoriais de diferentes clínicas, 30 médicos e 30 enfermeiros. Os resultados mostraram que a dor no câncer, dor por infarto do miocárdio, a dor por cólica renal, dor por queimadura e a dor no parto foram consideradas os tipos de dor de maior intensidade, independente do método psicofísico utilizado ou da amostra estudada. As ordenações de posições da intensidade dos diferentes tipos de dor, comparando os diferentes métodos psicofísicos utilizados, resultaram em níveis de concordância significativa com valores de Kendal próximos de 1,00. Houve divergências na percepção das intensidades de alguns tipos de dor, essas divergências foram observadas principalmente entre profissionais e pacientes.

DESCRITORES: medição da dor; psicofísica

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INTRODUCTION

Health professionals' main function is to alleviate pain and suffering. For that, they need to get rid of beliefs, preconceptions and previous individual experiences, and understand the patient with pain in his(er) totality as a unique being with particular characteristics.

In addition to understanding someone's pain, it is also important to understand the person *per se*, what this person perceives and feels and how (s)he deals with these feelings[1].

Pain is composed of two elements: "the original sensation and the reaction to this sensation", that is, response to a painful sensation depends on a series of individual intrinsic and extrinsic aspects. Thus, measuring a painful sensation is a complex task[2].

The history of pain measurement was analyzed and three branches of activity were identified, which are: psychophysics, multidimensional questionnaires using standardized descriptors and intensity scales[3]. The authors report that such historical concern arises from the need to establish reliable, valid and sensitive measures to define the efficacy of analgesics and other therapies.

There are some studies in the psychophysics area focusing on pain perception, which use experimental pain induction in different samples, aiming to compare "reactions to sensations". Psychophysics defines the threshold and tolerance to pain by inducing experimental pain and comparing ethnical groups, genders at different ages and different life habits, among others variables[4-5].

In addition, the psychophysical method can be used in studies on clinical pain that results from pathological conditions. The psychophysical law is also known as Stevens' power law. It is related to the psychological magnitude and physical intensity of a stimulus and can be described by a power function, which relates stimulus and subjective response in a curve[6-7].

This function describes a situation in which a geometric increase in physical magnitude corresponds to a geometric increase on the subjective or psychological scale. Its exponent reflects a relative rate of increase between the two scales and, thus, the principle that equal ratios between stimuli produce equal ratios between responses[7].

In the magnitude estimation method, elaborated by Stevens' Modern Psychophysics, individuals select and use a range of numbers that represent their subjective amplitude. Opposed to this method is the category estimation method, in which the experimenter arbitrarily chooses the amplitude of categories[6-7].

This method has important characteristics, such as the strategy to measure subjective concepts like pain. Some of these characteristics are: the production of scales as ratios increases the sensitivity of measurement; resulting scales and judgments are reproducible, stable, with records of test and re-test and reliability coefficients close to 0.908; the test is cost-efficient because there is no loss of data and data can be individually or collectively collected[6-8].

The psychophysical method is used in this study to improve the knowledge on this subjective and perceptual phenomenon. The different types of pain, compared among them and between different samples (professionals and patients) were: low back pain, headache, joint pain, burn-injury pain, pain in peripheral neuropathy, pain in repetitive motion disorder, pain in AIDS, postoperative pain, cancer pain, labor pain, pain in temporomandibular joint disorder (TMJ), herpes-zoster, trigeminal neuralgia (facial pain), fibromyalgia, myocardial infarction pain, renal colic, pain in stomach ulcer, biliary colic, menstrual colic and toothache.

OBJECTIVE

Developing a comparative scale of different pain types through different psychophysical methods.

PAIN MEASUREMENT

Comparison between psychophysical scaling methods: magnitude estimation and category estimation

The intensity of different types of pain was evaluated through two independent psychophysical methods: magnitude estimation and category estimation.

Objectives

- to compare scaling of various pain types between different samples;

- to compare the scale derived from ordinal judgments (category estimates) with the scale derived from judgment ratios (magnitude estimates) in the three studied samples;
- to verify whether rankings of pain intensities deriving from the two methods are similar in the studied samples.

METHOD

Participants: 30 patients from different outpatient clinics and 60 health professionals (30 physicians and 30 nurses from the Hospital das Clinicas, University of São Paulo at Ribeirão Preto Medical School, SP, Brazil).
Material: pen and notebook containing specific instructions for each type of psychophysical method on the first page and a list of 20 different types of pain and their respective definitions on the following pages.
Procedure: the psychophysical methods used were magnitude estimation and category estimation.

The participants' task in the magnitude estimation method consisted of attributing a number (numerical value of 100) to each type of pain, proportional to the intensity of pain it possesses compared to the standard stimulus, which was low back pain. For example, if the participant considered a given type of pain two times more intense than low back pain, (s)he should attribute a number two times larger, that is, 200. If the participant considered that a certain type of pain possessed half of the intensity of low back pain, (s)he should attribute a number representing half of it, that is, 50. Participants established 20 estimations, one for each type of pain.

In the second method, the participants' task was to score from one to seven, each different type of pain based on the perceived intensity of pain. Participants were asked to assign the maximum score (seven) to the type of pain with the highest intensity and assign the minimum score (one) to the type of pain with the lowest intensity. The other intermediary scores, two to six, should be used to indicate intermediary degrees of intensity according to participants' perceptions. The different types of pain were randomly presented to each individual. Each individual established one score for each type of pain.

For the magnitude estimates, geometric averages and standard deviations of geometric averages for each type of pain were computed. For the category estimates, average and standard deviations were also calculated for each type of pain. In addition, Kruskal-Wallis' non-parametric test and Mann-Whitney's test were computed to compare pain intensities between samples. Kendall's W was computed to compare concordance between the used methods.

RESULTS

The results presented in Tables 1 and 2 correspond to the scaling of different pain types in decrescent order, that is, from the pain considered of highest intensity to the one considered of lowest intensity. The scaling is presented according to three studied samples: outpatients' group, physicians' groups and nurses' group. Scaling was performed through two measurement methods: magnitude estimates (Table 1) and category estimates (Table 2).

The types of pain the outpatients considered of highest intensity, both in the magnitude estimation and category estimation methods, were cancer pain, renal colic, myocardial infarction pain and pain in AIDS. The types of pain considered of highest intensity by the physician and nursing groups were equivalent. They were: cancer pain, renal colic, labor pain, myocardial infarction pain and burn-injury pain (Tables 1 and 2).

It is worth mentioning that cancer pain was considered by the three samples as one of the most intense pain types in the two methods used (magnitude estimation and category estimation) and was considered the most intense in the outpatients' and nurses' groups and the second most intense in the physicians' group.

The types of pain considered of lowest intensity by the outpatient group, both in the magnitude estimation and in the category estimation methods, were pain by repetitive motion disorder, pain in TMJ disorder, low back pain and headache; for the physicians' group, they were repetitive motion disorder pain, joint pain, fibromyalgia, low back pain and

menstrual colic; and for the nurses' group, they were menstrual colic, low back pain, repetitive motion disorder pain, pain in TMJ disorder and tooth pain.

Kruskal-Wallis' non-parametric test was used for each type of pain, comparing the studied samples in each of the methods used. When the difference between samples was statistically significant, with $p<0.05$, Mann-Whitney's paired test was used to compare pain scores between samples (patients-physicians; patients-nurses; nurses-physicians). Tables 1 and 2 show the p-values for each type of pain. Next, the types of pain that presented scores with statistically significant differences between the studied samples are presented.

Table 1 – Geometric average of magnitude estimates (ME) for the different types of pain by ranking (R) according to outpatients, physicians and nurses HCFMRP/USP, 2007

Types of pain	Outpatients ME	R	Physicians ME	R	Nurses ME	R	p	Types of pain	Outpatients ME	R	Physicians ME	R	Nurses ME	R	p
Cancer pain	384.25	1	314.61	2	310.50	1	0.5964	Toothache	184.46	11	146.55	12	119.43	16	0.0849
Renal colic	332.67	2	317.31	1	218.26	3	0.0767	Stomach ulcer pain	184.38	12	166.01	8	141.26	11	0.1135
Pain in AIDS	303.60	3	118.42	14	133.11	13	0.0001[1]	Postoperative pain	173.38	13	159.83	10	141.14	12	0.3194
Myocardial Infarction Pain	295.26	4	260.28	4	238.29	2	0.2281[2]	Herpes-zoster pain	148.41	14	190.00	7	151.13	9	0.3834
Biliary colic	259.88	5	162.04	9	151.37	8	0.0184[3]	Menstrual colic	133.09	15	110.20	16	82.57	20	0.0562
Fibromyalgia	230.58	6	86.44	19	142.33	10	<0.001[4]	Headache	132.79	16	157.52	11	124.32	15	0.3899
Peripheral neuropathy pain	209.75	7	123.27	13	154.24	7	0.0134[5]	Pain in TMJ disorder	109.50	17	114.80	15	116.70	17	0.9066
Labor pain	208.22	8	297.69	3	181.73	5	0.0577	Low back pain	100	18	100	17	100	19	1.000
Trigeminal Neuralgia (facial pain)	203.23	9	197.22	6	169.73	6	0.3351	Repetitive motion disorders	96.03	19	83.15	20	115.76	18	0.2331
Burn-Injury pain	184.86	10	198.65	5	211.75	4	0.9170	Joint pain	85.37	20	94.86	18	127.89	14	0.0236[6]

1- Pain in AIDS – statistically significant differences between patients-physicians and between patients-nurses, $p<0.017$.
2- Myocardial infarction pain – statistically significant differences between patients-nurses, $p<0.017$.
3- Biliary colic – statistically significant differences between patients-nurses, $p<0.017$.
4- Fibromyalgia – statistically significant differences between patients-physicians, $p<0.017$.
5- Peripheral neuropathy pain – statistically significant differences between patients-physicians, $p<0.017$.
6- Joint pain – statistically significant differences between patients-nurses, $p<0.017$.

Table 2 – Geometric average of category estimates (CE) for the different types of pain by ranking (R) according to outpatients, physicians and nurses. HCFMRP/USP, 2007

Types of pain	Outpatients CE	R	Physicians CE	R	Nurses CE	R	p
Cancer pain	6.20	1	6.13	2	6.33	1	0.6203
Myocardial infarction pain	6.10	2	5.57	4	6.03	2	0.1124
Pain in AIDS	5.83	3	3.80	15	4.77	9	<0.001[1]
Burn-injury pain	5.83	4	5.13	5	5.60	4	0.3673
Renal colic	5.63	5	6.17	1	5.70	3	0.1881
Fibromyalgia	5.37	6	3.33	19	4.77	8	<0.001[2]
Trigeminal neuralgia (facial pain)	5.27	7	5.10	6	4.60	11	0.2171
Labor pain	5.20	8	5.93	3	5.17	5	0.1332
Biliary colic	4.90	9	4.40	12	4.70	10	0.3506
Postoperative pain	4.87	10	4.67	8	4.93	6	0.4530
Toothache	4.83	11	4	14	4.07	17	0.0533
Peripheral neuropathy pain	4.83	12	4	11	4.77	7	0.0598
Herpes-zoster pain	4.57	13	4.50	10	4.47	13	0.9248
Joint pain	4.37	14	3.67	17	4.57	12	0.0030[3]
Stomach ulcer pain	4.33	15	4.80	7	4.40	14	0.9171
Headache	4.27	16	4.67	9	4.20	15	0.9608
Low back pain	4.13	17	3.47	18	4.10	16	0.0323[4]
Pain in TMJ disorder	4.07	18	4.27	13	3.93	18	0.7705
Menstrual colic	4.	19	3.77	16	3.33	20	0.2584
Repetitive motion disorders	3.77	20	3.13	20	3.87	19	0.0271[5]

1- Pain in AIDS – statistically significant differences between patients-physicians, between patients-nurses and between physicians-nurses, $p<0.017$.
2- Fibromyalgia – statistically significant differences between patients-physicians and between physicians-nurses, $p<0.017$.
3- Joint pain – statistically significant differences between patients-physicians and between physicians-nurses, $p<0.017$.
4- Low back pain – statistically significant differences between patients-physicians, $p<0.017$.
5- Repetitive motion disorders – statistically significant differences between physicians-nurses, $p<0.017$.

There were important divergences between studied samples in both methods and differences between patients and professionals are highlighted (patients-physicians, patients-nurses). These data suggest that professionals and patients have different perceptions regarding these types of pain. We observe that numerical values in both methods are underestimated by professionals. Compared to patients, professionals almost always presented smaller values.

We highlight that pain in AIDS presented the highest number of divergences between samples. There were differences between patients and physicians and patients and nurses in the magnitude estimation method and differences between patients and physicians, patients and nurses and also between physicians and nurses in the category estimation method.

Cancer pain was considered the most intense pain in the majority of the studied samples and in the different psychophysical methods used. Cancer pain is a frequent symptom in patients with cancer and presents significant intensity. This daily pain manifests itself in more than one place in the body and, when it is not continuous, it remains for several hours per day. Pain occurs in patients with cancer through several discomforts, such as "cutaneous lesions, unpleasant odors, anorexia, cachexia, lack of sleep, fatigue, anxiety, depression, experience of feeling mutilated and disfigured, anticipatory mourning, economic hardship, spiritual distress"[9].

A study[10] compared the different types of pain using the Visual Analogue Scale (VAS) for the intensity of pain (sensitive dimension) and for the level of discomfort (affective dimension) caused by such stimuli. Study participants were: 87 patients with low back pain, 20 patients with pain in shoulder and neck, 38 patients with myofascial temporomandibular disorder pain, 19 with causalgia, 17 with cancer pain and 23 in childbirth. Results revealed that patients with cancer pain and patients with non-cancer chronic pain presented high rates of pain in the affective dimension (level of discomfort), while patients in childbirth and with experimentally induced pain presented lower rates in the sensitive dimension. These findings suggest that the perception of pain is related to life-threatening processes, which increases the experience of pain when compared to non-threatening processes (childbirth and experimentally induced pain). Another observation refers to pain during childbirth. Women who focused on the birth of their child presented lower rates in the affective dimension than those who simply focused on the pain itself. It suggests that the interpretation of the process causing the pain influences its perception and that the extent to which it represents a threat to life and quality of life increases the affective dimension of clinical pain.

We highlight that myocardial infarction pain is among the five most intense pain types in this study. However, none of the studied samples rated it higher than cancer pain. "Someone who experiences a heart attack has the same chances of dying of another attack in the short course as someone who has cancer of dying of cancer in the short course"[11]. This author stresses that metaphors linked to cancer imply processes linked to a sentence of death, a "curse", a disease considered an "invincible destructor"[11].

An interesting comparison between cancer and cardiovascular diseases corroborates the results of this study: "of all diseases, cancer is the one that causes the strongest psychological impact. Not only because of imminent death, which is the destiny of all of us, but because of its progressive and painful approximation, with potential natural or post-therapy mutilation. The risk of sudden death of cardiovascular diseases is less scaring. The perception that cancer is incurable, coupled with fear of its potential radical therapy and images of body alterations caused by its treatment, is terrifying"[12].

Observing Tables 1 and 2, one can perceive that, for the outpatients' group, pain in AIDS occupies the third position, both in the magnitude estimation and category estimation methods. It is interesting to notice the outpatient group's concern with this type of pain.

Pain in AIDS does not figure among the ten most intensive types of pain in any of the methods used for the physician group and occupies the ninth place according to the nurses' group in the category estimation method. This type of pain presented statistically significant differences between patients and physicians and between patients and nurses in the magnitude estimation method. There were statistically significant differences in all samples (patients-physicians; patients-nurses and physicians-nurses) in the category estimation method. These findings reveal divergences between the perception of patients and professionals.

Greater concern with cancer pain than pain in AIDS is perceived. The individual with cancer, according to the stigma created for such diseases, "does not deserve" such suffering and, thus, is worthy of pity and attention. Individuals with AIDS, on the other hand, are not worthy of such feelings because of their "behaviors that could potentially lead to the disease".

A recent study[13] found that 67% of a sample representative of a population of adults with HIV reported pain during the four weeks previous to the interview. The authors stress that the pain related to HIV is caused by direct effects of the virus on the central and peripheral nervous system, immune suppression, treatments and several disorders associated to the virus presence.

Pain in AIDS has other important aspects to be taken into account, such as prejudice related to the syndrome, disfigurement, self-esteem disorders, rejection of family and friends, removal from work and leisure activities. Cancer pain and pain in AIDS present similar aspects.

However, the social aspect of pain perception should be kept in mind. Based on the analysis of results found in the study, we can infer that the meaning of this painful phenomenon is also influenced by the society itself, that is, it is affected by the stigma created for the disease that causes it.

Labor pain also occupies the third and fifth positions when considering physicians and nurses, respectively. For the outpatients' group, it occupies the eighth position. An anthropological study, carried out through the ethnographic method with participant observation and semi-structured interview, aimed to examine childbirth at a public maternity of a Brazilian capital, focusing on the perspective of young women and adolescents. Results revealed that women report that labor is dominated by fear, loneliness and pain. "By the way, it confirms stories these women heard about labor pain out of the hospital, whether from relatives and friends, or the media in general". They stress the absence of a companion during labor for institutional reasons, which would produce a greater sense of security and better coping. The authors consider that cultural meanings are inseparable from physical sensations[14].

The study mentioned above can help in the discussion of the results appointed here. Although labor pain is related to childbirth and not to a disease or life-threatening process, it was considered one of the most intense pain types. We have to bear in mind that the approach of the childbirth process in Brazil is precarious and generates feelings of fear, loneliness and abandonment, which lead to higher tension levels and increased painful perception. Another observation is that pain considered of lower intensity, like those caused by repetitive motion disorders, joint pain and low back pain, are types of pain with high prevalence in the population, with high frequency in daily life, and cause physical and social incapacity[15-17]. However, they are not life threatening and are related to work, gender, age, stress, sedentariness, among others.

Kendall's coefficient of concordance (Kendall's W) was computed for both scales in this study. Kendall's coefficient ranges between -1 and 1, with negative values indicating an inversely proportional relation between variables, that is, as the values of a variable increase, the values of another variable decrease. Positive values indicate a directly proportional relation between variables, that is, as the values of a variable increase the values of another variable also increase. Values close to zero, negative or positive, indicate independence between variables, that is, the behavior of a variable does not influence the other.

Kendall's coefficient of concordance applied to the estimates, comparing the different methods (magnitude estimation and category estimation) for the different types of pain, resulted in $W=0.68$ for the outpatient group from different outpatients clinics, $W=0.89$ for the physicians, and $W=0.78$ for the nurses. It indicates that the rank of pain intensity obtained from the estimation of the two methods presents concordance for the three groups and also that the estimates are statistically significant, $p<0.001$.

There are some essential differences in the obtained scales. It is possible to establish the rank, the differences and especially the ratios between the degrees of pain intensity in the magnitude estimation method. In the category estimation method, on the other hand, it is only possible to establish the rank and differences between pain intensities. In the rank estimation method, only the rank of pain intensities can be obtained.

Authors of a previous study[18] stress that there are two main problems with the use of category scales. First, because the number of categories with which stimuli are judged is fixed the method introduces some biases. This is the reason why category scales are especially sensitive to contextual effects, such as

amplitude of categories and frequency of stimuli. In the case of pain measurement, a large source of error is the embarrassment caused to the participant by the imposition of an upper limit at the end of the continuum of pain, that is, at the end of the pain measurement scale. Second, category scales do not permit statements regarding difference ratios between the obtained measures. It is possible to say that a measure is larger than the other or subtract one from the other, but it is not possible to infer to what extent one measure is larger or smaller than the other.

In the category estimation method, it is not possible to know the ratios between pain intensities, that is, one cannot tell to what extent cancer pain is considered more or less intense than burn-injury pain. We can say, by observing Table 2, that menstrual colic (ME=317.31) is considered by the physicians' group about twice more intense than preoperative pain (ME=159.83); while the nurses' group considered cancer pain (ME=310.50) twice more intense that pain in peripheral neuropathy (ME=154.24).

These comparisons can also be carried out between the groups. For example, we can state that pain in AIDS is considered two and a half times more intense by the outpatients' group (ME=303.60) than by the physicians' group (ME=118.42), and twice more intense than that considered by the nurses' group (ME=133.11). It also presents similar intensity between nurses (ME=133.11) and physicians (ME=118.42). Several other comparisons between samples and within samples can be performed, since the ratio scale allows for this kind of comparison.

CONCLUSIONS

- Cancer pain, myocardial infarction pain, renal colic, burn-injury pain and labor pain were considered the most intense types of pain, regardless of the method used or sample studied, in addition to pain in AIDS, considered by the outpatients' group one of the most intense pain types.
- Pain in temporomandibular joint disorder, joint pain, repetitive motion disorder pain, menstrual colic and low back pain were considered the least intense types, regardless of the method used or sample studied.
- Ranking of intensities for different types of pain, comparing the different psychophysical methods used, resulted in a significant level of concordance.
- This study permitted deeper reflections on the perception of the painful phenomenon and its meaning in our culture, comparing professionals and patients through a valid and reliable method. There were divergences in the perception of intensities of some types of pain, mainly between professionals and patients (physicians-patients, nurses-patients).
- A profile of perception of different types of pain in our society was established. The data collected raised original characteristics for this study. Such characteristics are shown through the comparison of different types of pain judged by different samples.

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