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RESEARCH PAPER

Comparative Study of Three Factors That Determine Human Learning in Two Different Stages of Change

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Abstract: In this work, a pilot project for losing weight was carried out with a sample composed of 50 patients selected from the health zone of the Health Centre in Calaceite (Spain). A comparative study of the scores self-given by the patients to three learning factors (motivation, reward and difficulty) at the contemplative and action stage phases of change was carried out, in order to elucidate whether correlations could be found between the three factors. When the patients changed from the contemplative to the action stage, a significant increase in the scores corresponding to the motivation and the reward items could be found, whilst no differences were encountered for the difficulty item. The results revealed a positive bilateral correlation between the motivation and the reward items for the results of the scores self-given by the patients to these items. The self-evaluation made by the patient assigning scores to these three could constitute a valuable tool for the professional, in order to propose changes in the routines, habits or activities of the patient that could lead to a greater probability of success in the therapeutic diet treatment.

Keywords: obesity, behavioral sciences, health education, primary health care

INTRODUCTION:

Ever since the dawn of ages, human behavior has been a matter of study and evaluation by means of different academic disciplines, such as psychology, sociology, economy, anthropology, philosophy or pedagogy. As far as the individual behavioral conduct is concerned, both genetic (conduct or instinct) and social and environmental (social norms, culture, etc.) factors are fundamental. The former is characterized by its difficulty in achieving modifications in the conduct, since these genetic factors appear in an inborn natural way, whilst the latter it is affected by its variability, because the adaptation to the environment becomes determined by the flexibility or rigidity of that given environment [1,2].

Despite the inherent complexity on the study of human behavior, it is generally agreed that the individual aims at achieving a stable life for the sake of the individual's own benefit and commodity in an ever changing world. Thus, the individual has to continuously learn and adapt himself/ herself to the environment, by exploiting his/her own qualities or "strengths" and avoiding his/her "weaknesses".

According to Galli [3], the tendency of an individual toward achieving a learning of something depends on: the expected reward, the expectative of accomplishing what it is proposed and the intensity of the individual's motivation; being the latter a subject that has been analyzed and discussed according to different theories (Hull [4], Bandura [5], Heider [6] and Weiner [7]) in relation to the factors that compose the individual's motivation.

Currently, the "Transtheoretical Model of health behavior change" (TTM or change stages) [8] is used as a mean to assess the readiness of a person toward acquiring a new conduct by modifying non healthy behaviors.

Following this approach proposed by Prochaska and Diclemente [8], each patient could undergo various change phases before reaching a stable change phase, often occurring ups and downs in the stages of changes continuum toward healthy habits. Each phase is characterized by a different motivation stage:

a. Pre-contemplative stage: No problems in the conduct exist.
b. Contemplative stage: The individual has doubts about his/her own conduct, but does not have willingness of changing.
c. Determination/Preparation: The individual decides to try the change and needs some confidence to achieve it.
d. Change or action: The decision taken is put in practice.
e. Maintenance: Focus on maintaining and consolidating changes.
f. Relapse: Back to the former conduct and to previous states.

With this system, the sanitary professional assesses the state of the patient in a subjective manner, by means of a non-protocolled interview which could condition the answers of the patient in a certain moment.

Therefore, it is considered necessary to count on a tool by means of which the stage of change of a patient can be

evaluated by the patient, and thus the professional could propose a change of routine, habit or activity.

The objective of the present work is to elucidate whether there exists a relation between the phases of change states assigned by the professional ("Contemplation" and "Action" [8]) and the numeric scores assigned by the patients (1: minimum – 10: maximum) [9] to the items that determine the disposal for learning [3]: "Motivation", "Difficulty" and "Reward".

These items are included in the "Test for predicting the success in the change (Test Bimbela)" [10], which is intellectually and legally protected under the Registry of the Intellectual Property of the Gobierno de Aragón (Spain) since May 2013.

MATERIALS AND METHODS:

A. Selection of patients for the case study:

The pilot project was carried out with a sample composed of 50 patients (26 male and 24 female) selected from the health zone of the Health Centre in Calaceite (located in the province of Teruel, in Aragon, Spain). The health zone is composed of the villages of Arens de Lledó, Lledó, Cretas, Mazaleón, Valdeltormo and Calaceite, having a total of 4245 patients.

The patients from the sample aged at an average of 54.8 years ($\pm$ 8.0 SD) and maximum and minimum values of 65 and 35 years of age respectively. The Body Mass Index (BMI) of the patients in the sample averaged 33.5 kg/m^2 ($\pm$3.4 SD).

For the selection of patients, a revision of the patients from the Health Centre which reunited the inclusion criteria (see below) was made, by means of the Computerized Clinic History (CCH). The patients matching the required inclusion criteria were contacted by phone, and they were invited to participate in this Programme for Losing Weight. Of all the 1121 active patients from this population, an 18 % (202 people) was selected because of having a BMI $\geq$ 30. Additionally, a 29 % of the 1121 active population (325 people) were contacted by phone because their BMI was unknown. Of these latter 325 patients, a 42 % did not attend the nursing practice for being weighed, whilst the 58 % remaining (650 people) did attend and could be weighed in order to determine their BMI. 227 people out of 650 (35 %) had a BMI $\geq$ 30.

Afterwards, and with the exception of the phase of change stage, all the rest of the inclusion criteria above described were checked for the sample of preliminary screened patients. As a result, only an 18 % of these (77 people) matched the criteria and thus were selected for having a personal interview with the nurse. After the interview process, only those patients that were considered to be in a contemplation phase were selected for the study. Thus, only 50 patients out of the total population of the total of 1121 people constituting the active population (4.5 %) from the health zone could be selected.

B. Methodology:

Prospective study of quasi-experimental intervention (January 2012 – December 2013) with a group of patients from a nursing practice of a rural Health Centre in the province of Teruel (Aragón, Spain). This Programme was regarded as one of the initiatives for quality improving by the Health Aragonese Service in 2013, after being positively evaluated by the Research Ethics Committee of Aragón (CEICA).

The inclusion criteria for this study were as follows:
a. Men and women aged between 30 and 65
b. Body Mass Index (BMI) > 30 kg/m^2.
c. Waist-hip ratio > 0.8
d. Framingham Test, high, medium and low risk.
e. Contemplative phase of the patients to be treated (the patients are aware of their health problem).
f. One or more of the following nursing diagnostics NIC/NOC [11-13]:
a) Alteration of the nutrition by excess, related to a higher caloric supply compared to the energy consumption.
b) Alteration of the activity-exercise pattern related to sedentary lifestyle.
c) Alteration of the body image related to alimentary disruption and excess of weight.
d) Self-esteem deficit related to an inefficient individual confrontation and overfeeding.

The exclusion criteria used for selecting the patients were:

Individuals with pharmacologic treatment derived from disruption of affective and mood statuses (according to DSM V classification) [14] diagnosed thyroid disruption; and individuals under treatment with oral anti-diabetics or insulin, since these can directly affect the needs of food intake of the individuals.

Once the selected patients signed the participation agreement, they were proposed to self-evaluate their level of motivation, of reward and of difficulty [3] that perceived before initiating the Programme for Losing Weight. Thus, scales ranging from 1 to 10 (1 minimum -10 maximum) [9] were established for evaluating the three items or emotional factors that determine the behavioral change. Hence, in the eventuality of a patient perceiving a minor Motivation, Difficulty or Reward, the individual punctuated these items with the lowest values from the numerical scales and *vice versa*. Accordingly, the same self-evaluation was done again after one month since the beginning of the treatment, in order to check whether variations in the results existed.

C. Statistical Analysis:

The statistical analyses were carried out by means of the SPSS.15 software. A confidence level of 95 % (significance level α = 0.05) was established. Initially, a descriptive analysis of the socio-demographic data has been done, by calculating their mean and typical deviation.

Afterwards, the patient's attitude has been classified according to the classification proposed by Prochaska and Diclemente [8] for the determination of the phase of stage change, and the average results from the preliminary and

ulterior evaluations made by the patients for each item have been calculated on a scale from 1 to 10.

Finally, after checking the normality of the results by using the Pearson's χ^2 contrast, a T- Student Test has been used for evaluating the relationship between the punctuations of the reward and motivation items and the actuation stages previously determined (action and contemplation).

RESULTS:

Table 1 shows the scores assigned by the patients for the three items of motivation reward and difficulty both initially at the contemplation stage, and afterwards, during the action stage. These scores given by the patients to these three emotional factors in both stage phases were analyzed by means of the T-Student test.

Table 1. Results for the scores of the three factors in the contemplation and action stages.

	Stage phase	Range of scores	Mean	Standard deviation	Standard error of the mean
Motivation	Contemplation	4.2-6.9	5.6	1.3	0.5
	Action	6.9-9.8	8.4	1.5	0.6
Reward	Contemplation	5.8-7.7	6.8	1.0	0.4
	Action	9.1-9.9	9.5	0.4	0.2
Difficulty	Contemplation	6.9-8.6	7.8	0.8	0.3
	Action	6.5-8.6	7.7	1.0	0.4

The statistical analysis reveals significant differences observed in the scores given both to the motivation and reward items depending on the stage phase of the patients. In both cases, when the patients were found to be in an action stage, the scores given to both emotional factors were much higher than those given when being at the contemplative stage. The motivation was increased by a 33 % and the reward was increased by a 29 % when changing from the contemplation to the action stage. Regarding the difficulty item, the statistical analysis did not reveal significant differences in the scores given both in the contemplative and action stages, showing very similar values in both cases.

Given the results obtained, it was also elucidated whether there existed some kind of correlation between these two quantitative variables, motivation and reward. Thus, the Pearson's correlation coefficient was applied with a significance level of $\alpha = 0.01$.

Figure 1 shows the data results obtained for the scores of both items in the form of dispersion diagram. A significant bilateral correlation equal to 0.95 could be found between both items, revealing a positive correlation of the data.
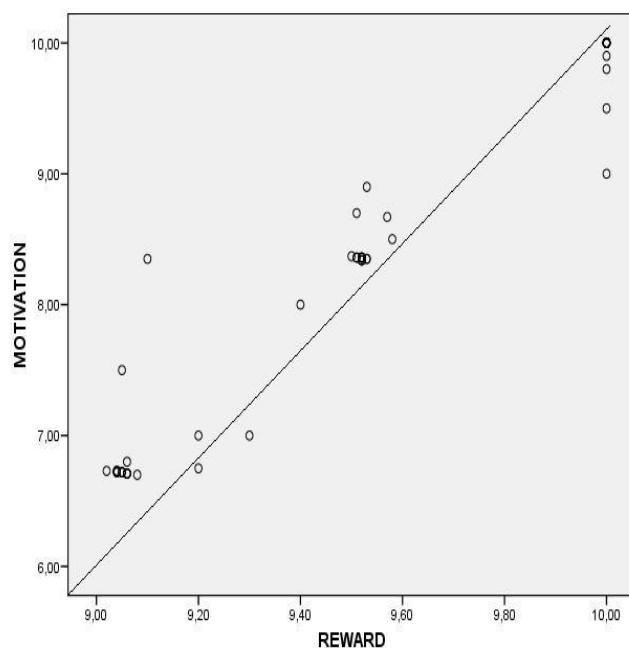

Figure 1. Motivation/reward dispersion diagram.

DISCUSSION:

It is worth mentioning that during the initial interview, a large number of patients gave a very positive score to the reward item, despite many of these patients reckoned that they lacked enough motivation for achieving the goal. This could be attributed to fear of the unknown or to finding themselves in a situation of uncertainty.

Nonetheless, the results obtained show that, during the contemplative stage, the patient is aware of the overweight problem that suffers, but is not worried about it, and this becomes reflected in the lower scores self-given by that patient when compared to those assigned when the patient is in the action stage. Contrarily, when the patient is in the action stage, the patient is ready for undergoing the treatment and willing to solve the overweight problem. Besides, being aware of the change of conduct needed, the patient's motivation becomes significantly increased and that becomes also reflected in the scores given to the three items. The patient is aware of the difficulty in achieving the goal by modifying the conduct, habits and routines throughout the whole treatment, but the motivation becomes significantly increased, and so is also the perception of the expected reward, since the patient progressively realizes about the benefits encountered while losing weight during the development of the treatment (less fatigue, more agility, increased self-esteem, etc.).

In order to be able to maintain an attitude, the patient needs a stimulus that can increase the motivation for achieving the reward. This stimulus necessarily requires the learning of a behavior which would enable the patient to predict the apparition of the reward [15]. The present study proves that such learning can be achieved through the modification of the behavioral conduct when subjecting the patient to a Programme for Losing Weight, which yields a significant increase in both the motivation and the reward perceived by the patient, hence raising the probability of success in losing

weight when undergoing a therapeutic diet treatment. To the best of our knowledge, no other previous studies can be found in the literature that analyze the variation of the motivation and reward depending on the stage of change in a programme for fighting obesity.

It could be proposed that the stimulus for the patient in order to maintain a positive attitude toward following the programme for losing weight and enduring the whole process, despite its perceived difficulty, could be a success in losing weight as the treatment evolves. Such positive stimulus could provoke a pleasant sensation in the patient while preparing this patient for the apparition of the reward, which could therefore reinforce the motivation and also boost the perception of the expected reward.

Recent studies in mice [16] have revealed that the maintenance of an attitude for achieving the desired goal is a task that can be fulfilled owing to the dopamine neurotransmitter, which conditions the value of the long-term rewards. Furthermore, the levels of dopamine are even thought that could be used in the decision making process, being considered a system of internal guidance for reaching the objective. Thus, the dopamine could be a signal that would prepare an individual for the apparition of the reward [17], even in those cases in which the process followed does not produce a pleasant sensation, as has been proven in the studies with hyperdopaminergic mice [18].

These facts are in agreement with the results observed in the present work, and could also explain why no differences have been found in the scores given by the patients for the difficulty item between both change phases, contemplation and action.

It has also been previously found that brain dopamine helps individuals covering the "virtual gap" that separate them from their goal [19]. Comparative studies have been carried out between people ready to make efforts for achieving a reward and individuals with less predisposal [20], revealing a different release of dopamine in some brain areas from both groups. As a result such release is greater in areas related to the reward and motivation in the first case, while the latter released more dopamine in those brain areas related to the emotion and the perception of risk.

These facts are in agreement with the observations found in this work, and could explain why the scores given to the motivation and reward items by the patients in the action stage are much higher than in the case of the scores given in the motivation stage.

Finally, the positive correlation of the data found in the diagram representing the motivation against reward scores given by the patients reflected an increase in the motivation as the expected reward increased, which could be related to an increase in the size of the dopamine signal, directly related with the size of the expect reward [16].

CONCLUSIONS:

A correlation can be found between the stage phases of change contemplation and action assigned by the professional, and the numerical scores given by the patients

(1 minimum – 10 maximum) to the emotional items that determine the readiness for learning: motivation, reward and difficulty. As a result, the self-evaluation made by the patient could constitute a valuable tool that could enable the patient to assess the change stage in which that patient is, thus allowing the professional to propose a change in the routines, habits or activities of the patient and permitting to achieve more successful results in the therapeutic diet treatment.

A noticeable increase in the scores given to the motivation and reward items could be found when the patients moved from the contemplative stage phase to the action stage. On the other hand, no changes were found in the scores given by the patients to the difficulty item in the contemplative and action stages.

It is finally considered that the self-evaluation made by the patient giving numerical scores to these three items (motivation, reward and difficulty), could be useful for preliminary exploring and subsequently dealing with the concerns of the patient at the beginning of a treatment in an educative programme for behavioral change, and could well serve as a reference in the determination of the degree of variation during the process for losing weight.

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