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Assessment of anxiety in patients undergoing computed tomography and magnetic resonance imaging examinations

Abstract

Anxiety is a common emotional response in healthcare settings and can compromise patient cooperation and the quality of diagnostic tests. The main objective of this study was to assess the anxiety levels of patients undergoing computed tomography (CT) and magnetic resonance imaging (MRI) scans, relating them to sociodemographic variables such as age, gender and level of education.

This is a quantitative, descriptive-correlational study conducted at the Radiology Department of the Algarve University Hospital Centre – Portimão Unit. The sample included 113 individuals assessed using the State-Trait Anxiety Inventory (STAI Y-1) questionnaire.

The results showed that patients undergoing MRI had significantly higher levels of anxiety compared to those undergoing CT.

It was also found that men, older individuals and patients with lower levels of education were more vulnerable to anxiety.

This study reinforces the importance of early identification of factors that influence patient anxiety during imaging exams, allowing for the implementation of information, preparation, and support strategies that contribute to reducing anxiety and improving diagnostic quality.

Keywords: anxiety, magnetic resonance imaging, computed tomography, sociodemographic factors, patient preparation

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Introduction

The aim of this research is to assess the anxiety levels of patients undergoing Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) examinations and to relate this to age, gender and level of education.

Currently, definitions of anxiety vary greatly depending on the theoretical model considered. In general, all refer implicitly or explicitly to a feeling of unease that manifests itself physiologically as tachycardia, nausea, sweating; motorically as hyperactivity and flight; cognitively as attention and anticipation; emotionally as fear, panic and phobias; and motivationally as the desire to escape from the traumatic situation. Anxiety manifests itself as a feeling of insecurity or fear, without any real basis for danger. In healthcare, some of these reactions directly interfere with test results, making accurate diagnosis difficult and requiring the tests to be repeated.

One of the factors that determine the onset of a state of anxiety is the performance of diagnostic tests, such as MRI or CT scans. These tests make the patient feel threatened by the possibility of disease.

Previous studies, such as those by Salim,[1] Lukins,[2] Grey,[3] Phillips and Deary,[4] reveal that undergoing MRI scans leads to increased anxiety levels in patients, and that anxiety can be substantially reduced with relaxation activities, additional information about the scan, and changes to the environment of the equipment room.

Methodology

The data were collected from two groups of patients who underwent CT and MRI scans at the Radiology Department of the Algarve University Hospital Centre - Portimão unit (CHUA), using the STAI Y-1 anxiety questionnaire. The questionnaire consists of 20 statements designed to assess how respondents feel 'right now, at this moment'.

In order to obtain a concise and reliable answer to the primary question, two hypotheses were formulated:

H1: There are significant differences between anxiety levels and the type of examination. H2: The level of anxiety is related to the gender, age, and level of education of the user. This is a purely quantitative descriptive-correlational study, using a clear and objective questionnaire for data collection.

The sampling process was based on the randomness of the sample collected, which based on a structure of "randomness" of the individuals targeted by the study.

Results

The study was conducted in the Radiology Department of the Algarve University Hospital Centre, Portimão Unit. TheState-Trait Anxiety Inventory Form Y-1 was used to obtain the data. This has been widely used in research and clinical practice and comprises separate scales to measure the state (STAI form Y-1) of anxiety. It consists of 20 statements that assess how users feel "now, at this moment".

When responding to the STAI, users mark a cross on the test sheet next to the number on the right of each item that best describes the intensity of their feelings: (1) not at all; (2) a little; (3) moderately; (4) very much. To obtain the STAI Y-1 score, simply add up the values of the twenty items, bearing in mind that some of them are inverted. The reversed items are: 1, 2, 5, 8, 10, 11, 15, 16, 19, and 20. Omitting three or more responses invalidates the survey.

The questionnaires were administered directly, delivered and collected at the same time to all patients who were in the waiting room prior to undergoing CT or MRI scans.

All respondents were given a verbal explanation in advance by the researcher regarding the examinations they would undergo and asked to give their consent to complete the questionnaire.

The target population of the study was all adult users over the age of 18 who underwent an MRI or CT scan at CHUA.

The sample is a random convenience sample, as only patients undergoing these procedures were selected.

The sample size consists of 113 individuals, a number derived from Poisson's ideology, which considers the number of occurrences limited in time, i.e., 60 days.

Of the total sample, 65 patients (57%) underwent CT scans, and 48 (42%) underwent MRI scans.

Of the 48 patients who underwent MRI scans, 21 were male and 27 were female. Five of these patients were aged 30 or under, six were aged between 30 and 40, 13 were aged between 40 and 50, nine were aged between 50 and 60, and 15 were aged over 60. Of those surveyed who underwent this type of examination, 3 were illiterate, 20 had completed primary education, 17 had completed secondary education, and 8 had completed higher education.

Of the 65 individuals who underwent CT scans, 27 were male and 38 were female. Four of these patients were aged 30 or younger, five were aged between 30 and 40, eight were aged between 40 and 50, 20 were aged between 50 and 60, and 28 were over 60 years old. Regarding the educational background of the patients who underwent CT scans, 3 were illiterate, 20 had completed primary education, 17 had completed secondary education, and only 8 had completed higher education.

The Statistical Package for Social Sciences (SPSS) for Windows, version 20, was used to perform the statistical analysis of the data.

The internal consistency analysis of the measurement instrument using Cronbach's alpha coefficient revealed that the STAI form Y-1 has an overall value of 0.910, which indicates excellent reliability for measuring anxiety in patients undergoing CT or MRI.

Several types of tests were used to relate the different variables. The non-parametric tests used for relationships with asymmetric continuous variables include Mann-Whitney and Kruskal-Wallis.

In inferential statistics, in the study questions/type of examination, it appears that regardless of the type of examination, there are no significant differences for any item in the questions (Table 1).

Table 1 Inferential statistics Questions/Examination

	Exams		
Questions	**CT**	**MRI**	**Overall**
Calm	0.622	0.336	0.317
Safe	0.341	0.363	0.179
Tense	0.307	0.366	0.888
Exhausted	0.004	0.019	0.521
At ease	0.389	0.371	0.215
Disturbed	0.152	0.056	0.939
Concerned	0.111	0.706	0.273
Satisfied	0.612	0.688	0.903
Scared	0.248	0.629	0.557

Table 1 Continued...

Relied	0.825	0.279	0.559
Confident	0.596	0.515	0.392
Nervous	0.211	0.59	0.549
Restless	0.027	0.112	0.51
Undecided	0.086	0.764	0.1421
Relaxed	0.662	0.539	0.983
Happy	0.707	0.885	0.847
Concerned	0.014	0.157	0.368
Confused	0.764	0.524	0.496
Stable	0.295	0.278	0.848
I feel good	0.549	0.946	0.585

The data show that, overall, patients undergoing MRI had higher levels of tension, insecurity and fear when compared to those undergoing CT, who were calmer and more confident. These results confirm that MRI is the exam that triggers the most anxiety, possibly due to the more enclosed environment, longer duration of the exam and feeling of claustrophobia. (Table 2)

Table 2 Average comparison questions / type of examination

Questions	**Type of examination**	
	CT	**MRI**
I feel calm	56.95	57.0/
I feel safe	63.79	47.8
I feel tense	54.5	60.39
I feel exhausted	57.86	55.83
I feel comfortable	59.66	53.4
I feel disturbed	58.89	54.44
At present, I am worried	61.72	50.61
I feel satisfied	59.15	54.08
I feel scared	56.8	57.27
I feel relaxed	60.07	52.84
I feel confident	58.36	55.16
I feel nervous	57.09	56.88
I am restless	58.02	55.63
I feel undecided	60.35	52A6
I feel relaxed	61.34	51.13
I feel happy	58.32	55.21
I am worried	59.59	53.49
I feel confined	56.98	57.03
I feel like a stable person	60.72	51.97
I feel good	61.15	51.39

The analysis of the averages shows that CT patients feel more secure (63.79%), while MRI patients show greater tension (60.39%) and insecurity (47.80%). This reinforces that the perception of the exam directly influences the level of anxiety, with MRI being associated with greater emotional discomfort.

When comparing by gender, it was observed that, in CT scans, men feel more exhausted, restless and worried, while in MRI scans, these feelings are more pronounced in women. This difference suggests that both gender and type of examination are relevant variables in the perception of anxiety. (Table 3)

It was found that, in the CT scan, patients over 60 years of age showed higher levels of concern and confusion, while in the MRI, individuals between 40 and 50 years of age showed greater anxiety and concern. Thus, age appears to be a determining factor in increased anxiety, especially in older age groups. (Table 4)

Table 3 Averages by gender in CT/MRI

Questions	CT Examination		MRI	
	Male	Female	Male	Female
I feel calm	31.72	33.91	22.48	26.07
I feel safe	30.56	34.74	22.69	25 91
I feel tense	35.67	31.11	22.52	26.041
I feel exhausted	40.65	27.57	19.5	28.39
I feel comfortable	30.72	34.6	22.6	25.98
I feel disturbed	36.54	30.49	20.79	27.39
At present, I am worried	37.26	29.97	23.69	25.13
I feel satisfied	34.35	32.04	23.62	25.19
I feel scared	35.85	30.97	23 5	25.28
I feel relaxed	33.59	32.58	22.14	26.33
I feel confident	31.61	33.99	23.1	25 59
I feel nervous	36.3	30.66	23.3	25.41
I am restless	38.69	28.96	21.17	27.09
I feel indecisive	37.31	29.93	25.07	24.06
I feel relaxed	31.85	33.82	25.83	23.46
I feel happy	32	33.71	24.81	24.26
I am worried	39.56	28.34	21.4	26.91
I feel confused	33.76	32.46	25.81	23.48
I feel like a stable person	30.24	34.96	26.81	22.7
I feel good	31.44	34.11	24.36	24.61

Table 4 Averages by age group in CT/MRI

	Age group TC					Age group RM				
Questions	<= 30	]30, 40]	]40, 50]	]50, 60	> 60	<= 30	]30 , 40]	]40, 50]	]50, 60	> 60
Calm	22.88	21.7	3331	37.25	33.34	11.9	17.75	25.46	30.94	26.7
Insurance	22.88	30.9	29.38	35.03	34.41	15	15	2727	32.67	24.17
Tense	23.88	23	35.69	342	34.46	14.4	21.08	26.08	25.5	27.27
Sold out	43.63	21.5	34	32.1	33.89	12	21.75	29.81	25.39	24.63
At ease	22.63	34.4	35.63	33.73	32.96	153	17.83	25.04	29.28	26.9
Disturbed	19.5	24.7	30.5	33.55	36.73	16	16	27.73	32.17	23.33
Currently concerned	17.25	19	37.88	29.53	38.84	17.5	21.17	27.42	24.11	25.87
Satisfied	16.5	22.5	37.06	36.03	33.91	10.1	19.67	27.35	32.17	24.17
Scared	28.75	195	37.44	35.6	32.89	13.5	26.83	23.81	28.39	25.5
Rested	35.13	25.4	43.69	31.98	31.73	12.9	16.92	25.62	32.33	25.73
Confident	22.13	25.4	37.13	34.55	33.63	13.6	24.17	26	24.89	26.73
Nervous	23.13	22.4	46.44	29.65	34.86	15.6	23.58	22.08	31.67	25.63
Restless	22.38	21.1	40.56	33.48	34.14	125	24.33	32.04	25.83	21.23
Undecided	24.75	23.4	34.88	29.83	37.63	20.8	20.08	24.96	32.61	22.23
Relaxed	22.88	193	36.19	37.38	32.86	163	17.42	21.54	33.61	27.17
Satisfied	15.75	17.6	37.5	32.93	36.98	10.7	17.25	26	25.94	29.83
L am concerned	27.25	15.6	37.81	36.58	33	16.7	25.33	27.62	26.44	22.9
Confused	18	18	31.69	3153	38.84	14	19.83	2623	24.94	28.1
Stable	16.25	24.3	37.5	30	37.8	14.4	17	24.5	25.33	28.57
I feel good	16.13	24.7	35.94	29.7	38.41	115	19.75	2927	235	27.2

With regard to education, it was found that illiterate individuals or those with basic education had the highest levels of anxiety, concern and confusion in both tests. On the contrary, patients with secondary and higher education showed greater calm and confidence, confirming that a higher level of education is associated with lower anxiety in the face of complex medical procedures. (Table 5)

Table 5 Averages by questions/educational qualifications

	Educational Qualifications TC				Educational Qualifications RM			
Questions	Illiterate	Primary education	Secondary education	Higher education	Illiterate	Primary education	Secondary education	Higher education
Calm	37.29	36.32	26.77	19.08	32.67	29.45	20.41	17.75
Insurance	34.63	38.1	24.65	18.92	32.17	26.08	24.5	17.69
Tense	41.54	33.65	25.46	28.58	23.83	25.73	23.83	23
Out of stock	38.79	32.59	27.42	35.83	25.5	21.45	24.65	26.44
At ease	32.54	36.82	28	23.08	34.17	27.4	23.26	16.25
Disturbed	39.04	35.34	27.54	19.5	29.67	25.88	23.56	21.13
currently concerned	42.83	3174	28.38	19.17	36.67	26.15	21.35	22.5
Satisfied	31.63	35.12	29.88	26.5	22.5	28.18	21.24	23

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Table 5 Continued...

Scared	37.13	31.44	30.96	25.67	26.83	26.7	21.97	23.5
Rested	37	32.28	30.46	34.58	22.5	28.15	21.21	23.13
Confident	34.13	31.87	31.15	29.83	28	26.55	23.29	20.63
Nervous	33.46	34.34	29.58	31.92	25.67	26.75	23.74	20.06
Restless	34.04	31.81	30.15	32.5	19.17	24.35	24.5	26.88
Undecided	38.79	31.75	30.54	22.5	26.33	28.45	20.76	21.88
Relaxed	25.96	38.26	26.38	31.58	31	26.98	22.91	19.25
Satisfied	31.42	37.25	27.08	24.92	25	2175	24.62	20.94
Concerned	33.04	3431	29.69	32.67	30.83	22.5	24.24	27.69
Confused	32.58	37.18	25.92	25.5	28.83	29.5	17.56	25.13
Stable	33.13	37.04	24.12	29.08	23.5	29.9	20.71	19.44
I feel good	34.08	35.04	23.38	29.25	24.5	24.55	23.32	26.88

Discussion of results

The results confirm that undergoing imaging examinations is associated with high levels of anxiety, although with a different impact depending on the type of examination.

It was found that patients undergoing magnetic resonance imaging (MRI) have significantly higher levels of anxiety, especially in terms of tension, insecurity and fear, when compared to those undergoing computed tomography (CT), who feel more secure and confident. This finding may be related to factors inherent to MRI, such as the closed shape of the equipment, the longer duration of the examination, claustrophobia and fear of the clinical result.

In the gender analysis, men showed greater exhaustion, restlessness, and concern in CT scans, with this trend continuing for the feeling of exhaustion in MRI. Regarding age, those over 60 were more concerned and confused in CT, while in MRI, individuals between 40 and 50 were the most restless and anxious. These results suggest that age influences emotional response differently, with older individuals being more vulnerable to anxiety in CT scans and middle-aged individuals in MRI scans.

Regarding educational attainment, individuals with lower levels of education (illiterate and primary education) showed higher levels of anxiety, concern, and confusion in both examinations, while patients with secondary and higher education showed greater calmness and confidence. This pattern confirms the positive influence of knowledge and understanding of the examination in reducing anxiety.

Overall, this study shows that the most anxious patients are male, less educated, older, and undergoing MRI. These results corroborate previous research and reinforce the importance of developing specific preparation and support strategies, tailored to the sociodemographic profile of patients, to minimise anxiety and improve the quality of the diagnostic process.[5-15]

Conclusions

We can conclude that patients with higher levels of anxiety are male, have lower levels of education, are older, and undergo MRI scans. Therefore, radiology services should develop strategies to reduce patient anxiety in the future. These strategies may include providing more detailed information about what the examination actually involves, familiarising the patient with the physical space, and providing leaflets with simple and appropriate information.

Limitations of the study

The data presented comes from a single data collection site, which means that the results should not be generalised to other regions, particularly foreign ones.

To improve the study, we propose a larger sample size, a control group, and limiting the study to users who are undergoing this type of examination for the first time.

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