RESEARCH ARTICLE

EFFECT OF THE USE OF VIRTUAL REALITY ON STATE ANXIETY IN PATIENTS DURING PREOPERATIVE CARE

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ABSTRACT

Background: This research goes on the line of studies focused on the evaluation of the effect of the use of virtual reality on the state of anxiety in patients; specifically, during the preoperative care. Anxiety is a problem that patients manifest before entering a surgical procedure, either due to the risk of the surgery to which they will be subjected, due to lack of information, or due to the predisposition of their character to anxiety (trait anxiety).A state of high anxiety can put surgery at risk, affecting the patient's vital signs, leading the anesthesiologist to increase the dose of anesthesia or, in extreme cases, forcing to reschedule the procedure. Evaluating preoperative anxiety is one of the functions of the surgical nursing staff, as well as proposing and evaluating alternatives in order to reduce the state anxiety of patients. **Objective:** To evaluate the effect of virtual reality on state anxiety in patients during preoperative care. **Method:** A descriptive, cross-sectional and prospective research was carried out on a sample of 19 patients scheduled for different types of surgeries. In order to measure the level of anxiety before and after the use of virtual reality lenses, an instrument was applied during preoperative care. Vital signs, state anxiety and self-perception anxiety were assessed. For measuring the state anxiety level, a modified version of the Spielberger' State-Trait Anxiety Inventory was used. Statistical analysis was performed with parametric and non-parametric hypothesis tests for related samples, as appropriate. **Results:** Occurrence of statistically significant changes in vital signs, state anxiety and self-perception of anxiety before and after the use of virtual reality was corroborated ($p < 0.05$).This suggests the reduction of general anxiety on patients during preoperative care while using virtual reality lenses. Results obtained are compatible with most part of the antecedent literature on the subject, which states that virtual reality is a technique has shown favorable results for the treatment of anxiety in different surgical or clinical contexts. **Conclusions:** The use of virtual reality lenses favorably affected the reduction of state anxiety in the patients analyzed during the perioperative care. This suggests that virtual reality technique has great clinical potential.

INTRODUCTION

Since the moment the patient is hospitalized for surgery, he enters a state of anxiety due to both external and internal factors. This is because they get into a totally unfamiliar environment: the hospital. Patients who undergo surgery face high levels of concern and anxiety in the face of the uncertainty of what will happen to them during the intervention, if they will survive, what will happen afterwards and what will be their prognosis for their life in the future. Likewise, when it comes to patients undergoing regional or local anesthesia, the state of consciousness while undergoing surgery implies an increased level of stress, since they can see the entire team and staff inside the operating room doing their work. In addition, in spitethe drugs used to sedate, anesthetize and help to block pain during the procedure by anesthesiologists, patients undergoing cardiac surgeries such as catheterization and angioplasty are normally awake during surgery.

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Therefore their mind keeps working, imagining if the surgery will be successful or if some complication will endanger his life.Preoperative anxiety is a phenomenon that has attracted the attention of researchers for several decades. Previous papers on this matter have sought to understand it, measure it and develop techniques in order to mitigate it. Anxiety is understood as a type of mental state or condition that human beings experience when facing with threatening events. It manifests itself in psychological and physiological changes. As a feeling, anxiety is a normal subjective experience; however, as a psychological symptom, it is usually presented in different psychiatric conditions, becoming a disorder. Besides, anxiety disorders are very common in primary health care: approximately one in ten patients seen daily has some type of anxiety disorder.(1) When the patient's anxiety rises, physiological changes arise in the body, such as an increase in blood pressure, heart rate, and respiratory rate, among others. This is so because, when facing with an anxiety situation, muscle tension increases as the body prepares for running away by filling the muscles with blood, for which it needs the heart to increase its heart rate. All of this brings symptoms such as dizziness, sweating, mydriasis, paresthesia, digestive

discomfort, palpitations and diarrhea.(2)If these changes in vital signs are very accentuated, the surgical procedure may be compromised, hindering its performance. The natural function of anxiety is to prepare the body to get used to the demands of external events. Nevertheless, in today's world, anxiety states often exceed people's own capacities for handling and emotional containment, resulting in a psychophysiological lack of control. Thus, the vast majority of patients who are scheduled for some type of surgical intervention experience a series of reactions in the preoperative period as a way of mental, emotional and physical protection that can influence the surgical process. The consequences of the lack of control over the patient's anxiety can range from the need to increase the dose of anesthetic drugs to the suspension of the surgery.(3) Given the above, it is necessary to work on the derivation of anxiety and stress coping strategies that allow patients to have better emotional control during preoperative care. This is a task that must involve all medical-surgical personnel, including nurses, who have an ethical obligation to seek alternatives in order to ensure the well-being of the patient and respond to their needs, either inside the hospital or at home.(4)One of the functions of the nursing staff that works in the operating room area is to receive the patient, verifying that they are preparedfor surgery. This process involves installing the patient in the pre-anesthetic unit, monitoring him/her and preparing him/her psychologically for the procedure. (5)It is at this time when the staff must have the ability to evaluate the patients' state anxiety, and, if necessary, apply techniques or use certain tools to help them cope.

In order to deal with it, patient's preoperative anxietyneeds to be measured. First, it is necessary to recognize the difference between anxiety as a transitory state or condition of the person at a certain moment, generally associated with external factors (state anxiety); and anxiety as a trait, which is a relatively stable anxious propensity that manifests when a patient already has feelings of worry and tension in his day-to-day life, regardless of the particular moment or experience he is living (trait anxiety). Certainly, during preoperative care, interventions of the nursing staff may be directed only towards the treatment of state anxiety. (6) Once the state anxiety of the patient is known, techniques should be applied in order to control it. For this, virtual reality devices for treating state anxiety in patients have gained interest in recent years. We name"third dimension" or "virtual reality"to the operating systems that work through software in order to generate representations of reality in real time. These representations are nothing but optical and sound illusions. Simulation made with virtual reality can refer to virtual scenes, creating a world that only exists in the computer and that emulates places or objects that exist in reality. Virtual reality systems also allow to capture the implicit will of the user in their natural movements, projecting them inside the virtual world. In addition, virtual reality allows access to a complete immersion experience in a virtual world, disconnecting the person's senses from reality, which gives the patient the sensation of being inside an alternate reality. (5)(7)In short, virtual reality lenses transport people to another place; a sense of "being there" that researchers call "psychological presence".(8) Research on the use and effects of virtual reality devices in the medical and clinical contexts is an emerging field that is still little explored. The first original proposal for the use of this technology in order to reduce patient's anxiety arose at the University of Seattle, United States, where "cognitive psychologist Hunter Hoffman and his colleagues developed a

virtual reality game called SnowWorld, to help patients to withstand the treatment of serious burns". According to their results, pain perceived by the patient can decrease up to 50% while using virtual reality lenses. This data is verifiable through the monitoring of brain activity related to pain. (9) According to a lecture given by José Luis Mosso at the Medicine and Virtual Reality Encounter held in California in 2006, virtual reality experience prior to minor surgery is capable of halving the amount of sedation a patient needs and, in many cases, avoid its use altogether: "In a study of 140 patients it was found that those who used virtual reality reported 24% less pain and anxiety than the control group. Similar results were obtained in a small randomized trial". Additionally, it was estimated that this helps to reduce the cost of procedures by 25%, although it was noted that the data has not yet been fully analyzed to come up with an exact figure. On the other hand, reducing the doses of the drug also downsizes the risk of complications and the recovery time for patients (9).

The most direct antecedent of this research is a thesis in Psychology presented in 2016 by González de la Torre Benítez and Martín Ruiz-Berdejo, entitled "Effectiveness of a short intervention program with virtual reality for anxiety reduction in preoperative general surgery patients". In this study, the authors analyzed 60 patients during preoperative are who were exposed to therapeutic virtual reality as a part of the application of cognitive-behavioral psychological techniques. They used the Surgical Anxiety Screening Test for measuring anxiety before and after the intervention, and took measurements on the amount of anesthetic drugs that had to be administered in each case (ramifentanil and midazolam). Statistical analysis was performed using medians analysis and the Mann-Whitney U test. The results showed statistically significant differences between the experimental and the control groups in terms of preoperative anxiety ($U = 0$, p. = 0.001) and administration of midazolam ($U = 45.50$, $p = 0.003$) and remifentanil ($U = 2.00$, p. <0.001).Their conclusion points out to a clear positive effect of the use of virtual reality tools in order to reduce patients' anxiety during preoperative care; however, it should not be forgotten that, in this study, exposure to virtual reality was accompanied by a psychological intervention that included many more elements. Therefore, it is difficult to distinguish to what extent the positive results were or not due to virtual reality alone, and to what extent due to the psychological and technological strategy as a whole (10).

It is possible to find more literature on the relationship between virtual reality and anxiety outside the surgical field, especially in the fields of clinical analysis (11), mental disorders treatment (12) —specifically in anxiety disorders (13) (14) (15) (16)—, oncological diseases (17) and chronic diseases (18). All these studies support the possibility of taking advantage of technological advances in the creation of virtual reality devices, since exposure to virtual reality has proven to be a useful tool in order to improve the experience of patients in situations of stress and anxiety.According to the results of most of thesebackground studies, the use of virtual reality devices is able to reduce the anxiety of patients before and during surgery. However, given the novelty of this resource, further research is still required to be fully sure of its usefulness in these contexts. In this article, we expose the results of an investigation that measured the response of patients to the induction of virtual reality experiences applied with the purpose of reducing or attenuating their anxiety levels

during preoperative care.The general objective was to corroborate whether or not there is a change in the anxiety-state of the patients during the preoperative period before and after the use of virtual reality. The particular objectives were to identify changes in vital signs, state anxiety and self-perceived anxiety of the patients before and after the use of virtual reality. The study was carried out at the Naval Medical Center of Mexico, a health institution that stands out for its efforts to keep up with the incorporation and use of technologies to improve the work of professionals and the experience of patients.This hospital has high-tech medical equipment used during complex procedures and shows a deep concern about the development of new technological alternatives.Following this trend, the use of virtual reality applied on patients who will undergo surgery has been seen as promising, with the purpose of reducing anxiety levels with those who enter the operating room.

MATERIALS AND METHODS

An experimental, longitudinal, prospective, comparative and quantitative design study was conducted, carried out in the period between the months of November and December 2020 in the surgical rooms of the Naval Medical Center.The population consisted of adult patients in programmed surgery, from which a sample of 19 units was extracted by means of selective-intentional sampling based on consecutive cases. Patients of both genders, older than 18 years of age and undergoing elective surgery, were included.Patients admitted for medical emergencies, who did not agree to participate in the study and / or who were under anxiolytic treatment, were excluded.Records of patients with audiovisual alterations, difficulty responding to the administered instrument or whose questionnaire was incomplete, were eliminated. The questionnaire prepared measured 6 variables with 23 dimensions and 28 indicators.The total number of items in this instrument was 30. Once the information was collected, a descriptive statistical analysis was performed taking measures of central tendency, dispersion, and simple frequencies and percentages for profile indicators, comorbidities, and risk factors.The distribution of the dependent variable was explored using a Shapiro-Wilk test contrasted against the normal distribution.For the variables that yielded parametric values, a Student's Ttest for related samples was applied, in order to discover differences or similaritiesfor the anxiety values before and after the application of virtual reality. For variables without parametric distribution, the Wilcoxon test was used. Finally, crosstabs were performed in order to identify associations with comorbidities and risk factors. Chi-square statistic was used.

RESULTS

Of the 19 patients that made up the sample, 11 (57,9%) were men and 8 (42,1%) were women. The average age was 48.74 (± 18,90) years, being23 the minimum and 88, the maximum. 9 (47,4%) patients had a history of previous surgeries and 10 (52,6%) did not.The most common service in which they underwent surgery was general surgery (n = 9; 47,4%), followed by orthopedics (n = 4; 21,1%), urology (n = 4; 21,1%), and oncology (n = 2; 10,5%).Most of the sample had higher education (n = 7; 36,8%), while the rest were distributed in the upper middle levels (n = 6; 31,6%), basic education (n = 5; 26,3%) and no instruction (n = 1; 5,3%). 12

(63,2%) patients were married; 3 (15,8%), single; 2 (10,5%), widowers; 1 (5,3%) divorced, and 1 (5,3%) lived in a common-law union. 10 (52,6%) declared themselves as Catholic; 3 (15,8%) Protestants, and 6 (31,6%) only said "I am a believer", without specifying a cult. The main risk factor for triggering anxiety prior to surgery was the level of risk of said procedure. 8 patients (42,1%) underwent intermediate risk surgery; 7 (36,8%), high-risk surgery; and 4 (21,1%), lower risk surgery. In addition, 9 patients (47,4%) underwent spinal type anesthesia; 6 (31,6%) general anesthesia; and 4 (21,1%) local anesthesia. Regarding the knowledge of who their surgeon and anesthesiologist were, in 14 cases (73,7%) the patients had previously met their surgeon, while in 5 (26,3%) they did not; however, 100% of the sample stated that they had previously met their anesthesiologists. Regarding comorbidities associated with preoperative anxiety states, only 2 (10.5%) cases had a previous diagnosis of anxiety disorder; 7 (36.8%), depression; and 12 (63.2%), hypertension.

For the variables that allowed a parametric analysis (Shapiro-Wilk $p > 0.050$), the Student's T test for related samples was chosen in order to test the occurrence of a change in vital signs before and after the application of virtual reality. Results yielded a statistic $t = 2.664$ with a p value of 0.016, which is why it canestablished that there is a statistically significant difference between both measurements ($p<0.050$). On the other hand, in the case of heart rate, the mean before virtual reality was 75.53 (± 10.49) beats per minute, while after virtual reality it fell to 72.32 (± 7.71). Results showed a statistic $t = 2.879$, with p value of 0.010. Being this value <0.050, it is corroborated that their heart rate had a decrease. In the case of variables that did not meet the parametric criterion of normality (Shapiro-Wilk $p \leq 0.050$), the Wilcoxon test for related samples was chosen. For systolic blood pressure, the mean was 127.53 (± 10.35) mmHg before virtual reality, and 122.26 (± 7.54) after. For respiratory rate, the mean was 18.58 (± 2.29) breaths per minute before virtual reality, and 17.53 (± 1.42) after. The results yielded values of $p<0.050$. Therefore the null hypothesis was rejected and we accepted that the median of the differences between the measurements before and after virtual reality is different from zero; in other words, there was astatistically significant change in vital signs tending to a decrease (see Table 1).

As for the difference in the patients' state anxiety values before and after virtual reality, final scores of the STAIwere considered. When carrying out the normality test, one of the measurements obtained a $p$value ≤ 0.050 in the Shapiro-Wilk test, so it was decided to apply the Wilcoxon test for related samples. In the measurement carried out before virtual reality, a mean score of 44.63 (± 6,922) was obtained, which implies that patients in general had state anxiety; after virtual reality, this value decreased to 34.58 (± 8.10). The result of the Wilcoxon test yielded a $p$value of 0.000, so the null hypothesis was rejected and it was accepted that the median of the differences between both variables is different from zero; that is, there was a statistically significant change consistent with the decrease in the anxiety-state scores according to the scale used. Regarding the patient's perception of the effect of the use of virtual reality on his state-anxiety level prior to surgery, we used the variables contained in the subjective anxiety measurement battery. This battery was composed primarily of a scalar variable and an ordinal variable. First, we asked patients to evaluate how anxious they felt on a scale of 1 to 10 before and after virtual reality.

Table 1. Result of the Student's T test for vital signs

		Blood pressure (diast.) Before virtual reality vs. Blood pressure (diast.) After virtual reality	Heart rate before virtual realityvs. Heart rate after virtual reality
Relateddifferences	Media	4.474	3.211
	Standard deviation	7.321	4.860
	Typ. Error of the average	1.680	1.115
	95% Confidence interval for the difference — Inferior	0.945	0.868
	Superior	8.002	5.553
t		2.664	2.879
gl		18	18
Sig. (bilateral)		0.016	0.010

Table 2. Comparison of results obtained vs. background studies

Author	Country (year)	Type	N	Main results	Analysis technique
Hoffman et al.	United States (2017)	Intervention	Not stated.	Pain perceived by the patient can decrease up to 50%.	Brain activity monitoring.
Mosso	United States(2006)	Clinical trial	140 patients	Experimental group had 24% less pain and anxiety than control group.	Not stated.
González de la Torre Benítez and Martín Ruiz-Berdejo	España (2016)	Control study	60 patients	Differences between experimental and control groups in terms of preoperative anxiety (U = 0, p = 0.001) and administration of midazolam (U = 45.50, p = 0.003) and remifentanil (U = 2.00, $p<$ 0.001) were found.	Análisis de medianas y prueba U de Mann-Whitney
Vázquez Palacios	España (2019)	Clinical trial	15 patients	Distraction using virtual reality is an effective technique in order to reduce the stress level (W = 154, P = 0.073).	Kruskall-Wallis test.
Espinoza et al.	(2013)	Intervention	11 oncologicalpatients.	Moods and emotions tend to show positive changes when patients are subjected to virtual reality.	Notstated.
Flujas Contreras et al.	(2017)	Intervention	6 patients, children and adolescents with chronic diseases.	Virtual reality-based therapy showed moderate results.	Notstated.
Torres Sánchez	Mexico (2020)	Empirical, longitudinal, comparative, quantitative experimental study.	19 adult patients undergoing general surgery.	A significant change in state anxiety on patients during preoperative care was measured before and after the use of virtual reality.	Wilcoxon test and Student's T test for related samples.
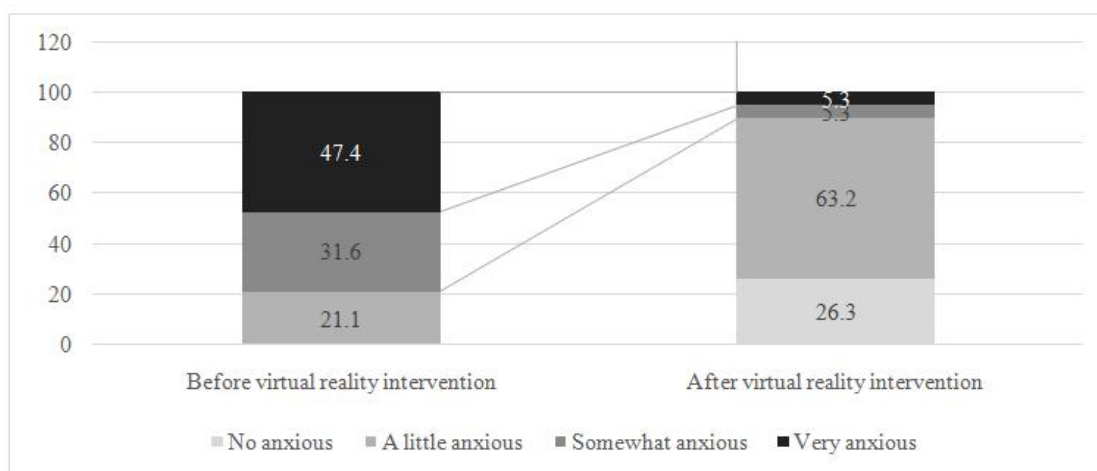
Graph 1. How anxious or worried about your surgery do you feel right now?

The Shapiro Wilk test yielded *p*values<0.050, so we tried using the Wilcoxon testfor related samples. The mean subjective anxiety estimated prior to the virtual reality experience was 7.21 (± 2.17) points on the scale from 1 to 10. After virtual reality,it fell to 3.95 (± 2.29). The result showed a *p*value of 0.000, so the null hypothesis was rejected and it was accepted that the median of the differences between the variables is different from zero; that is, there was a statistically significant change in the mean subjective perception of anxiety by the patient. With regard to ordinal variables, a comparison of simple frequencies made possible to estimate at a glance whether or not there was a change in this regard. As can be observed in Graph 1, values of the response options for perceived anxiety tended to move towards a decrease: while 9 (47.54%) patients perceived to be very anxious or worried prior to the intervention with virtual reality, this number dropped to 1 (5.3%) after virtual reality.Likewise, in the measurement before virtual reality, no patient chose"without anxiety", while, after the intervention, 5 (26.3%) persons indicated that they no longer perceived anxiety in themselves. Finally, regarding the general perception of the patients about the usefulness of the intervention with virtual realityin order to reduce anxiety during preoperative care, 13 (68.4%) participants considered that it helped them a lot; 5 (26.3%), that it helped them somewhat; and 1 (5.3%),that it did little. No patient reported that it did not help them nor that, on the contrary, it increased their anxiety.

DISCUSSION

Results obtained are consistent with the general trend of the state of the art that observes positive changes in the anxiety of patients from the use of virtual reality. For example, the results are consistent with those of the study that found in virtual reality an interventional potential for the treatment of anxiety during the preoperative period, (12) as well as with the original observations that identified its potential for the treatment of pain and anxiety in patients within a clinical medical context.(13)(14)Similaritieswere also found with most of the systematic literature review studies that have corroborated that virtual reality is useful for the psychological therapy of anxiety in different types of patients.(14)(15)(16)(17)(19)Likewise, the results were compatible with the observations made from intervention actions where virtual reality was tested as an anxiety treatment technique in psychological therapy.(19)(20)Table 2 offers a comparison of the studies analyzed and their conclusions, contrasted with the results obtained by this investigation.

Conclusion

⟩ The occurrence of a statistically significant change in the state anxiety of the patients during the preoperative period before and after the use of virtual reality was corroborated.

⟩ A statistically significant change was observed in the vital signs of the patients during the preoperative period before and after the use of virtual reality (p<0.05).

⟩ A statistically significant change was observed in the responses of the patients to the STAI'sstate anxiety scale before and after the use of virtual reality (p <0.05).

⟩ A statistically significant change was observed in the perception of the patient about the effect of the use of virtual reality on their anxiety during preoperative care (p<0.05).

⟩ These results are compatible with those of most of the previous literature on the subject.

REFERENCES

Reyes Tincas A. Trastornos de ansiedad. Guía práctica para diagnóstico y tratamiento [Internet]. [quotedDecember 18, 2020]. Available at: http://www.bvs.hn/Honduras/pdf/TrastornoAnsiedad.pdf

Estrada Avilés A. Trastornos de ansiedad [Internet]. [quotedDecember 19, 2020]. Available at: http://psiquiatria.facmed.unam.mx/pdfindex/ansiedad.pdf

Quintero A, Yasnó DA, Riveros OL, Castillo J, Borráez BA. Ansiedad en el paciente prequirúrgico: un problema que nos afecta a todos. Revcolombcir.June 20, 2017;32(2):115-20.

Zabalegui Yárnoz A. El rol del profesional en enfermería. Aquichan. 2003;3(1):16-20.

Servicio Madrileño de Salud SM de MP. Protocolo de preparación quirúrgica [Internet]. 2012 [quotedDecember 19, 2020]. Available at: https://www.sedar.es/images/site/documentos/Protocolo_Preparaci%C3%B3n_Prequir%C3%BAgica.pdf

Montagud Rubio N. Escala de Ansiedad Estado-Rasgo: qué es y cómo se usa. Un resumen de las características de esta prueba psicológica. [Internet]. Psicología y mente. [quotedDecember 17, 2020]. Available at: https://psicologiaymente.com/psicologia/escala-ansiedad-estado-rasgo

Facultat d'Informàtica de Barcelona. Realidad virtual [Internet]. Retroinformática. El pasado del futuro. [quotedNovember 27, 2020]. Available at: https://www.fib.upc.edu/retro-informatica/avui/realitatvirtual.html

Bailenson J. Realidad virtual: cómo aprovechar su potencial para las empresas y las personas. Spain: Ediciones de la U; 2019.

AméricaEconomía. La realidad virtual está haciendo las cirugías más soportables [Internet]. 2017 [quotedNovember 27, 2020]. Available at: https://clustersalud.americaeconomia.com/la-realidad-virtual-esta-las-cirugias-mas-soportables

González de la Torre Benítez G, Berdejo AMR. Efectividad de un programa de intervención breve con realidad virtual para la reducción de ansiedad en pacientes preoperatorios de cirugía general [Internet]. [Puerto Real, Cádiz]: Universidad de Cádiz; 2016 [quotedDecember 22, 2020]. Available at: https://rodin.uca.es/xmlui/bitstream/handle/10498/18538/ALBA%20MART%c3%8dN_TFG.pdf?sequence=1&isAllowed=y

Vázquez Palacios F. Sistema de Realidad Virtual para la reducción del estrés durante una analítica de sangre [Internet]. Universitat Politécnica de Valencia; 2019 [quotedDecember 22, 2020]. Available at: https://riunet.upv.es/bitstream/handle/10251/128941/V%C3%A1zquez%20-%20Sistema%20de%20Realidad%20Virtual%20para%20la%20reducci%C3%B3n%20del%20estr%C3%A9s%20durante%20una%20anal%C3%ADtica%20de%20sangre.pdf?sequence=1

Brito C. H, Vicente P. B. Realidad virtual y sus aplicaciones en trastornos mentales: una revisión. Rev chil neuro-psiquiatr. June 2018;56(2):127-35.

Powers MB, Emmelkamp PMG. Virtual reality exposure therapy for anxiety disorders: A meta-analysis. Journal of Anxiety Disorders. April 2008;22(3):561-9.

Ling Y, Nefs HT, Morina N, Heynderickx I, Brinkman W-P. A Meta-Analysis on the Relationship between Self-Reported Presence and Anxiety in Virtual Reality Exposure Therapy for Anxiety Disorders. Slater M, editor. PLoS ONE. May 6, 2014;9(5):e96144.

Freeman D, Reeve S, Robinson A, Ehlers A, Clark D, Spanlang B, et al. Virtual reality in the assessment, understanding, and treatment of mental health disorders. Psychol Med. October 2017;47(14):2393-400.

García García ES. Realidad virtual y nuevas tecnologías en el trastorno de ansiedad social: un estudio meta-analítico [Internet]. [Murcia, España]: Universidad de Murcia; 2012 [quotedDecember 22, 2020]. Available at: https://www.tdx.cat/bitstream/handle/10803/107958/TESGG.pdf?sequence=1&isAllowed=y

Espinoza M, Baños RM, García-Palacios A, Botella C. La realidad virtual en las intervenciones psicológicas con pacientes oncológicos. Psicooncología. January 23, 2014;10(2-3):247-61.

Flujas Contreras JM, Ruiz Castañeda D, Botella C, Gómez I. Un programa de bienestar emocional basado en Realidad Virtual y Terapia Online para enfermedades crónicas en infancia y adolescencia: La Academia Espacial. Rev.psic.clin. niños adol. 2017;4(3):17-25.

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