Educational strategies for tolerance to uncertainty in students and health professionals: systematic review.

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Abstract: In recent decades, interest in uncertainty tolerance (UT) in health professionals has increased. Poor ability to tolerate uncertainty has been linked to higher levels of stress and increased likelihood of burnout syndrome. However, UT is not considered in the health professions curriculum, and its presence is relegated to the hidden curriculum. It is necessary to know what educational strategies can be helpful for teachers to address UT in future professionals. This review aims to identify these educational strategies and their effectiveness. A search was carried out in the databases "PubMed", "Scopus", and "Cinahl", and after applying a screening process, seven articles were selected and finally analysed. The results have identified three models of educational strategies: "strategies based on visual thinking", "strategies based on interaction with animals", and "conventional educational strategies". We conclude by highlighting, on the one hand, that no strategy has shown greater efficacy than the rest and, on the other hand, UT has been studied, mainly in the medical community. In the future, research of higher quality and oriented to all health professions must be carried out.

Keywords: ambiguity; uncertainty; tolerance; intolerance; education; health.

1. Introduction

Today, there is no doubt that uncertainty is inherent and forms a fundamental part of clinical practice. It is present in every patient-health professional encounter [1-2]; for this reason, in recent decades, efforts have been made to understand clinical uncertainty and how to tolerate professional situations under uncertainty [1, 3-6]. Han et al. [7] emphasise the subjective character of uncertainty and its multiple manifestations, defining it as "*the subjective perception of ignorance*". Approaching the "Clinical Uncertainty" (CU) concept, Bhise et al. [8] define diagnostic uncertainty as: "*Subjective perception of an inability to provide an accurate explanation of the patient's health problem*". Recently, Lee et al. [9] defined CU as: "*the dynamic subjective perception of not knowing what to think, feel or do*"; this definition reflects not only the subjectivity of uncertainty but also that it is a constantly changing process and involves action.

To organise knowledge, different CU taxonomies have been developed. Hillen et al. [1], in their "*Integrative Model of Uncertainty Tolerance*," structure uncertainty in three dimensions: cognitive, emotional, and behavioural. Lee et al. [9] conducted a new taxonomy focused on being a tool for medical education. This taxonomy comprises three dimensions that interrelate with each other as a continuum. The three proposed dimensions are: "*sources of uncertainty*", "*subjective influences of uncertainty*", and "*responses to uncertainty*". How uncertainty is dealt with can give rise

to different manifestations, both positive and negative [10]. Uncertainty Intolerance refers to negative or so-called maladaptive responses, which are strongly associated with high levels of stress and anxiety [11]. This can lead to the development of burnout syndrome in professionals. Another consequence of intolerance to uncertainty is the request for more diagnostic tests, with the consequent increase in healthcare costs and possible discomfort caused to patients [12-13].

In this sense, it is essential to instruct healthcare professionals in managing tolerance to uncertainty from their initial academic training [9]. Although there is a broad consensus on the importance of addressing tolerance to uncertainty, this is not reflected in the health profession's curricula, leaving it relegated, in most cases, to the "hidden curriculum" [14]. Curricula train students to deal with cases in structured situations using evidence-based algorithms. When faced with clinical reality, there is an inevitable conflict in which uncertainty is present [2, 9]. Furthermore, we must bear in mind that interpersonal communication skills differ between professionals when encountering the patient; this should be another aspect to be considered in the training of students [15]. Currently, we find in the literature different proposals for dealing with uncertainty. This systematic review aims to identify the different educational strategies used and determine which are most effective in improving tolerance to uncertainty.

1.1. Measuring clinical uncertainty

Multiple scales have been developed to measure uncertainty in different disciplines. The three most commonly used scales in the literature reviewed are Budner's "Tolerance of Ambiguity Scale" (TOAS), "Physicians' Reactions to Uncertainty" (PRU) and "Tolerance of Ambiguity" (TFA). One of the best-known and widely used scales is the "Budner Tolerance of Ambiguity Scale (TOAS). However, its reliability and internal consistency have been refuted [16]. This questionnaire consists of 16 items and uses a 7-point Likert scale. Gerrity et al. [17] developed the Physicians' Reactions to Uncertainty (PRU) questionnaire, which initially consisted of 22 items. This scale explored two dimensions, "anxiety due to uncertainty" and "refusal to disclose uncertainty to others". Subsequently, the scale was adapted and now consists of 15 items and 4 study dimensions: "anxiety due to uncertainty", "concern about poor outcomes", "refusal to disclose uncertainty to patients", and "refusal to disclose errors to medical colleagues" [18]. The PRU scale is also characterised by a 6-point Likert scale and acceptable Cronbach's alpha coefficients [19]. As for the TFA scale, it consists of 7 items and uses a six-point Likert scale; it is noteworthy that it associates tolerance to ambiguity as a trait linked to personality and, although the scale was initially used in physicians, it is a scale that can be used with different populations [13].

2. Methods

The objectives of the present work include identifying in the literature the educational strategies that have been implemented to improve tolerance to clinical uncertainty, analysing the results obtained with these strategies to know their effectiveness, and structuring the patterns of approach that have been implemented. The PRISMA reporting elements framework for systematic reviews and meta-analyses has been used to guide and ensure the high quality of this systematic review.

2.1 Literature review

Firstly, Pubmed was used as it is one of the databases specialising in health sciences, with more than 19 million bibliographic references. Secondly, we used Scopus, as it is one of the largest databases of citations and abstracts of peer-reviewed literature. In addition, it includes 100% of what is indexed in MEDLINE and EMBASE. Finally, we selected the Cinahl database for its prominence in bibliographic references in nursing, physiotherapy and occupational therapy. Table

1 summarises the number of studies identified and the search descriptors considered for each database.

Table 1. Search equation

Database	Search descriptors	No. of studies
PUBMED	("ambiguity"[Title/Abstract] OR "uncertainty" [Title/Abstract]) AND ("tolerance"[Title/Abstract] OR "intolerance"[Title/Abstract] OR "aversion"[Title/Abstract]) AND "education" [Title/Abstract].Filters applied: From 2012/01/01 to 2021/12/01, Español	n = 91
SCOPUS	TITLE-ABS-KEY ((("ambiguity" OR "uncertainty") AND ("tolerance" OR "intolerance" OR "aversion") AND "education") AND (LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012/12/01)) AND (LIMIT-TO (LANGUAGE, "English")))	n = 310
CINAHL	("ambiguity" OR "uncertainty") AND ("tolerance" OR "intolerance" OR "aversion") AND "education". Limiters - Date of publication: 2012/01/01-2021/12/01. Specify by Language: - English	n = 62

2.2. Inclusion criteria

Considering the main objective of identifying and analysing educational strategies to improve clinical uncertainty management, the following inclusion criteria were established. As a first criterion, "Tolerance to Uncertainty" (TU) should be one of the variables to be identified in the selected scientific output. Moreover, it should be evaluated before and after the intervention. The second criterion established is to verify the existence of an educational intervention aimed at improving tolerance to uncertainty. The third criterion is that the selected studies are conducted with groups of health professionals or health sciences students, where uncertainty is assessed in clinical practice. The fourth criterion is that the papers are written in English or Spanish and the selected articles are original and published in peer-reviewed journals. Exclusion criteria were publications corresponding to conferences, book chapters, reviews and editorials. Works not in the language established in the inclusion criteria and works before January 2012.

2.3. Procedure

The words considered for the search were: "ambiguity", "uncertainty", "tolerance", "intolerance", "aversion", and "education". Uncertainty and ambiguity were considered because they are often used interchangeably in the literature [1, 9]. The words "tolerance" and "intolerance" were chosen because they refer to both positive and negative reactions to uncertainty, and "aversion" was added as an analogue to intolerance. The word "education" was selected to obtain a

focused search on studies for educational purposes. The following combination of terms and Boolean operators were used: "ambiguity" OR "uncertainty" AND "tolerance" OR "intolerance" OR "aversion" AND "education". The language was specified as English, and the search was limited to the last ten years. Articles published from January 2012 to December 2021 were selected. The search yielded 463 articles distributed, as shown in Figure 1. These were exported to the Rayyan tool (a web and mobile app for systematic reviews) to eliminate duplicates, leaving 329 original articles. The next step consisted of filtering those articles that were reviewed (n=27), editorials (n=9), book chapters (n=3) and conferences (n=1), obtaining, in total, 289 results. Analysing the title and abstract of the articles and after applying the inclusion criteria, 261 references were excluded for the following reasons: "not focusing on, or measuring, tolerance to uncertainty (n=129)", "the population is not healthcare or healthcare students (n=84)" and "did not include an educational intervention (n=48)". In the end, 28 articles met the inclusion criteria for the full-text review. Of these, 21 were excluded for the following reasons: "articles that do not focus on, or measure, tolerance to uncertainty" (n=12), "articles that do not include an educational intervention" (n=8) and "articles to which access is not available" (n=1). This resulted in 7 articles being selected (Figure 1). A single author was responsible for identifying, screening, and selecting articles. Following each stage, the authors held a consensus meeting to verify the process.

2.4. Coding of results

The analysis of the productions was carried out following four dimensions: firstly, the bibliometric characteristics (Table 2), which included authorship, followed by the year of publication, the reference journal and the article's title. Secondly, the research characteristics (Table 3), where the titles of the pieces, the type of research, the sample selected, the sample size, and the instruments used to measure uncertainty, were grouped. Thirdly, the characteristics of the intervention, where the type of strategy used, number of sessions, and duration of the intervention are analysed (Table 4). Fourthly, the evaluation results after the intervention are analysed (Table 5).

3. Results

The results are presented according to the objectives established in this research and the dimensions proposed: bibliometric characteristics, research characteristics, intervention characteristics and outcomes.

3.1. Bibliometric characteristics of production

It is noted that no author repeats participation among the seven selected studies. The years of publication are between 2016 and 2020. Academic Medicine publishes two selected articles; the other studies are published in different journals. Notably, 100% of the journals are educational, and 71.5% (n=5) are medically oriented (Table 2).

3.2. Research Characteristics

An analysis was made of the methodological content of the articles, with emphasis on the type of research, the sample, the research instruments used and the dimension assessed (Table 3).

On the type of research.

It can be seen that mixed research predominates in 71.4% (n=5) of the selected studies, compared to 28.6% (n=2) of the articles using exclusively quantitative methodology. As for qualitative evaluation, in 3 out of the five mixed studies detected [20-22], a questionnaire with open-ended questions was carried out, and in 2 publications [23-24], focus group interviews were conducted.
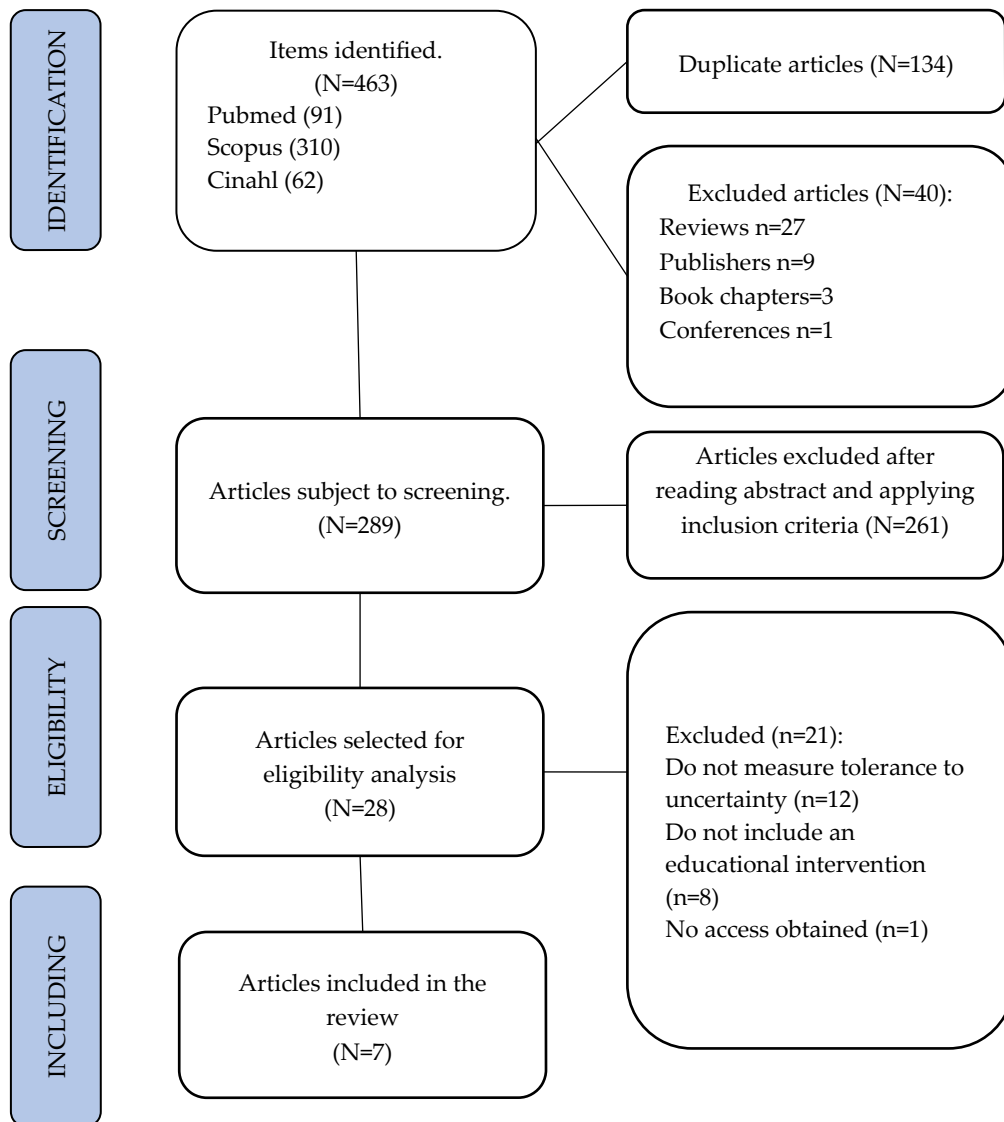
Figure 1. PRISMA flow chart

Table 2. Bibliometric characteristics of the research

Authors	Year	Magazine	Title
Corinne Zimmermann, Jennifer T. Huang & Elizabeth A. Buzney	2016	Journal of Museum Education	Refining the Eye: Dermatology and Visual Literacy
Lynne Murphy, Jacqueline Wilson and Stacey Greenberg.	2017	Journal of Experiential Education	Equine-Assisted Experiential Learning in Occupational Therapy Education
Deepthiman Gowda, Rachel Dubroff, Anna Willieme, Aubrie Swan-Sein, and Carol Capello.	2018	Academic Medicine	Art as Sanctuary: A Four-Year Mixed-Methods Evaluation of a Visual Art Course Addressing Uncertainty Through Reflection
Kevin T. Liou, Daniel S. Jamorabo, Rabih M. Geha, Constance M. Crawford, Paul George and Fred J. Schiffman.	2019	Medical Teacher	Foreign bodies: Is it feasible to develop tolerance for ambiguity among medical students through Equine-Facilitated learning?

Garth W. Strohbehn, Stephanie J. K. Hoffman, Molly Tokaz, Nathan Houchens, Ruth Slavin, Suzanne Winter, Martha Quinn, David Ratz, Sanjay Saint, Vineet Chopra and Joel D. Howell.	2020	BMC Medical Education	Visual arts in the clinical clerkship: a pilot cluster-randomised, controlled trial
Krisztina Fischer, Amy M. Sullivan, Edward Krupat, and Richard M. Schwartzstein.	2019	Academic Medicine	Assessing the Effectiveness of Using Mechanistic Concept Maps in Case-Based Collaborative Learning
Deborah A. Taylor; Bethany J. Picker; Donald R. Woolever; Erin K. Thayer; Ari B. Galper; Patricia A. Carney	2018	Family Medicine	A Pilot Study to Address Tolerance of Uncertainty Among Family Medicine Residents

Focusing on the quantitative aspects, five of the seven studies use a quasi-experimental design with pre- and post-intervention evaluation, while 2 use a randomised clinical trial.

About the sample and population.

The sample size in the publications evaluated according to the study population has an average number of participants per article of 55 with a standard deviation of 53.4. The maximum sample size is 170 cases [21], and the minimum is 12 participants [25]. The study population mainly comprises doctors in training, medical students or residents (n=6). In 57% (n=4) of the references analysed, the population corresponds to medical students [21,23-25], and the remaining 28% of the population studied are doctors already residents [20,26]. It is noteworthy that the population focuses on occupational therapy students only in the study by Murphy et al. [22].

On instruments and dimensions

71.4% (n=5) of the articles in this review used a validated questionnaire to measure tolerance to uncertainty. The other two publications (29.6%) opted for a self-developed questionnaire [21-22]. Among the five articles that used validated questionnaires, 80% (n=4) used Budner's Tolerance of Ambiguity Scale (TOAS). In 75% (n=3), only tolerance of uncertainty was assessed by this scale and in the study by Taylor et al. [26], TOAS was used in combination with the Physicians' Reaction to Uncertainty Scale (PRUS) and Intolerance of Uncertainty Scale (IUS). The only publication that used the validated Tolerance for Ambiguity (TFA) questionnaire to assess uncertainty was the paper by Gowda et al. [24].

Table 3. Research Characteristics

Articles	Methodology	Population	Sample size	Test
Zimmermann (2016)	Mixed/Quasi-experimental	Dermatology residents	28	Budner's Tolerance of Ambiguity Scale (TOAS) Modified
Murphy (2017)	Mixed/Quasi-experimental	Occupational therapy students	64	Brief questionnaire 5-point Likert-type scale
Gowda (2018)	Mixed/Quasi-experimental	1st-year medical students	47 (35 made pre/post)	Tolerance for Ambiguity (TFA),

Liou (2019)	Quasi-experimental Pre/Post	1st and 4th-year medical students	Seven first and five fourth	Budner's Tolerance of Ambiguity Scale (TOAS)
Strohbehn (2020)	Mixed/Cluster randomised clinical trial	Clinical internship in internal medicine (IM)	39 (2 interventions and one control group)	Tolerance of Ambiguity Scale (TOAS)
Fischer (2019)	Mixed/Randomised clinical trial	1st year medical and dental students	170 (n= 43 experimental group n= 127 control group)	Questionnaire prepared in-house
Taylor (2018)	Quasi-experimental Pre/Post	Resident family doctors	25	Physicians' Reaction to Uncertainty Scale (PRUS), Intolerance of Uncertainty Scale (IUS), Budner's Intolerance for Ambiguity Scale (BIAS),

3.3. Intervention characteristics

The interventions carried out can be classified into three groups: interventions based on visual thinking strategies, interventions based on animal interactions, and conventional academic interventions.

A) Interventions based on visual thinking strategies.

In three selected articles, the intervention method was based on visual thinking strategies through works of art. Visual Thinking Strategies (VTS) "is a pedagogical approach that involves discussions of artwork aimed at encouraging students to look carefully, verbalise their observations and ideas, and interact with others regarding their interpretations of the images" [27]. VTS contributes to enhancing reflective, communicative and empathetic skills and improving observational skills. Regarding tolerance of uncertainty, thoughtful observation of artistic images can lead to multiple interpretations. There is an intrinsic ambiguity when sharing arrangements with peers, generating uncertainty when confronting the exchange of ideas. Zimmermann et al. [20], in their study at the Boston Museum of Art, conducted 4 VTS sessions lasting 180 minutes each. Strohbehn et al. [23] guided three sessions, each lasting 60 minutes, at the University of Michigan Museum of Art and in the hospital conference room. In the study by Gowda et al. [24], six sessions, each lasting two hours, were held at the Metropolitan Museum in New York.

B) Interventions based on animal interactions.

In the words of Angela Masini [28], equine-assisted therapy can be carried out in different disciplines, with the animal being the central axis of the session. In 2 of the selected articles, the horse was used to facilitate the educational intervention. The interaction with the animal has the characteristics to be a source of uncertainty for the participant; it is a new experience, and the communication with the animal is ambiguous. Murphy et al. [22] their study conducted an "Equine Assisted Occupational Therapy" (EAOT) intervention in a 90-minute session. During the session, participants were divided into groups of 10 or 8 and given a series of activities to complete. One of the activities was to create an obstacle and have the horse overcome it. Liou et al. [25] also conducted a single interaction session with the horse for 210 minutes. In this session, the participant's goal was to make the horse comply with some directives, such as moving three steps forward.

C)   Conventional academic interventions.

Two selected articles opted for interventions based on procedures considered typical in traditional teaching. Fischer et al. [21] introduced concept mapping (MCM) as a method for problem-solving. They had an intervention group versus a control group and conducted eight sessions of small clinical cases lasting 60 to 90 minutes each. Taylor et al. [29] included specific reading, reflective writing and discussion on the topic of uncertainty in the curriculum over a period of 4 weeks.

Table 4. Intervention characteristics

Articles	Intervention	Duration of the intervention
Zimmermann (2016)	Visual Thinking Strategies (VTS)	Four sessions of 180 minutes
Murphy (2017)	Equine-assisted occupational therapy (EOAT)	90 minutes
Gowda (2018)	Museum-based course, Observation and Uncertainty in Art and Medicine (OUAM)	Twelve hours were divided into six sessions, 2 hours.
Liou (2019)	Equine-facilitated workshop	210 minutes
Strohbehn (2020)	Visual art	2 and 3 sessions (1 hour)
Fischer (2019)	Mechanistic Concept Maps	Each mini-case session was 60 to 90 minutes long, two sessions per day, four days per week.
Taylor (2018)	Specific readings, reflective writing, discussion and outpatient skills, development using psychosocial/behavioural	Four weeks

3.4. Production results

In terms of quantitative assessment, Murphy et al. and Liou et al.'s articles [22, 25] statistically significant differences were observed after educational intervention. Liou et al. [25] found substantial differences in the first-year medical students group but not the fourth-year medical students. Murphy et al. [22], although they obtained post-test improvements in different areas, it was only statistically significant in "comfort with ambiguity" (Table 5). In 2 studies, Gowda et al. and Taylor et al. [24, 26] showed improvements in the tests after the intervention, although no significant results were detected. In 3 of the seven selected articles [20-21, 23], no changes were found in the post-test assessment. Regarding qualitative assessment, in interventions based on visual thinking strategies [20, 23, 24], positive responses were reported regarding improved observation, perception of uncertainty, teamwork and exploration of different points of view. In the article by Murphy et al. [22], in which interventions based on animal interaction were carried out, the benefits of active listening, communication and problem-solving were highlighted. As for conventional academic interventions, in the study by Fischer et al. [21], participants stated that using MCM helped them explain concepts and avoid misunderstandings and arguments in group work.

Table 5. Production results

Article	Objective/Intervention	Results
	Interventions based on visual thinking strategies.	
Zimmermann (2016)	To explore the effects of a 'visual thinking' (VTS) curriculum programme on tolerance of uncertainty and teamwork.	No changes were observed in the TOAS and CSAS tests.

Gowda (2018)	To learn about the effects of the programme "Observation and Uncertainty in Art and Medicine" on coping with uncertainty and developing reflection.	Improvements were observed in the (TFA) test, although not statistically significant.
Strohbehn (2020)	To evaluate the potential benefits of introducing an intensive "Visual art education" programme on empathy, attention and tolerance of ambiguity.	No significant differences were found in the JSPE-S, TOAS, MAAS and SGS tests.
Interventions based on animal interactions.		
Murphy (2017)	To explore the influence of an Equine Assisted Occupational Therapy (EAOT) session on problem-solving, ambiguity tolerance and communication skills.	Participants perceived improvement in all areas, but it was only statistically significant in "comfort with ambiguity" (t = 2.86, p = .01).
Liou (2019)	To evaluate the effects of a semi-structured interaction workshop with horses on ambiguity tolerance.	Significant improvements were found in the TOAS test among first-year students; however, among fourth-year students, there was no change (p= .03).
Conventional academic interventions		
Fischer (2019)	Evaluate using "Mechanistic Concept Maps" to improve teamwork, tolerance of ambiguity and academic improvement.	No significant differences were observed in tolerance of ambiguity at the end of the course. However, students using the MCM method reported feeling more comfortable making mistakes.
Taylor (2018)	To determine the impact of a new curriculum for family medicine residents on tolerance of ambiguity.	No overall improvement in tolerance to uncertainty was observed, but some items were statistically significant.

4. Discussion

The aim of this review is twofold: on the one hand, to find out what educational strategies have been implemented in recent years to improve tolerance to clinical uncertainty in health professionals. On the other hand, to find out how effective these strategies are. One of the aspects to be highlighted is that 71.4% (n=5) of the strategies used do not correspond to what could be called conventional educational strategies. Alternative strategies based on observation, visual thinking or animal interaction have been used, reflecting tolerance to uncertainty as an aspect that can be developed through non-conventional methods and in environments that differ from the classroom or hospital. In the review by Patel et al. [30] of the 24 articles selected, six used strategies based on medical humanities, three used simulation strategies, one was developed through anatomy training, one was based on equine-facilitated learning and one used tactical decision games. Therefore, it can be said that a high percentage of non-conventional strategies were also observed (54.1 %). Luther et al. [14] consider that tolerance to uncertainty is not explicitly included in the curriculum and, therefore, does not receive the same degree of attention as the rest of the content, being relegated to being dealt with outside the classroom or during non-teaching hours. In the academic environment, structured and programmed, the aim is for the student to acquire scientific knowledge, instructing them in certainties. However, to cope with uncertainty in education, there is a tendency to seek out unfamiliar environments such as art or animal interaction. In general, it can be noted that the results tend to be positive despite the diversity of the educational strategies implemented, the number of sessions and their duration. In 57.14 % (n=4/7) of the articles, there were positive changes in the post-test results, but it should be noted that they were only significant in 28.57 % of the cases. These results coincide with the conclusions obtained by the review developed by Patel et al. [30], which aimed to determine what educational interventions have been

carried out to improve tolerance to uncertainty in medicine. They highlighted that 22 of the 24 publications selected positively impacted tolerance to uncertainty.

In those selected studies, which developed qualitative analyses, 100% of the output obtained a positive response from the participants regarding improved tolerance to uncertainty. In addition, there were improvements in other areas, such as communication, active listening and teamwork. Based on this, it can be inferred that educational interventions may be able to modify tolerance to uncertainty. It is also worth reflecting on the power of these interventions to alter other aspects closely related to CU, such as problem-solving, communication skills and teamwork. In the study by Gowda et al. [24], the "Groningen Reflective Ability Scale" (GRAS) was additionally used in the work of Zimmermann et al. [20], the "Communication Skills Scale" was used. These instruments were implemented to assess the influence of interventions on other dimensions. For the assessment of tolerance to uncertainty, it should be noted that 71.4% (n=5) of the papers used a validated test, with the "Budner's Tolerance of Ambiguity Scale (TOAS)" being used in 57.1% (n=4) of the articles. However, its reliability and internal consistency have been questioned [16]. It should be noted that the Physicians' Reaction to Uncertainty Scale (PRUS), a test specifically designed to assess uncertainty in clinical practice for physicians, was only used in 1 of the publications.

The low quality of the evidence available in the papers analysed is highlighted, as only two articles are RCTs. At the same time, the rest of the studies are quasi-experimental, with small sample sizes**.** These findings are consistent with other previously published research. Alam et al. [31] conducted a systematic literature review to determine how primary care physicians dealt with CU. One of the conclusions they reached was that there is significant heterogeneity in the research conducted; it is scarce and of low methodological quality.

It should also be noted that only 1 of the studies selected from the review (14.28%) included occupational therapists in the sample, compared to the rest of the articles in which the participants were doctors or medical students. These data show the need to develop more research on UT in other healthcare fields where there is contact with the patient in the clinic, such as physiotherapy or nursing. While it is true that for clinical uncertainty in medicine, there are still important questions to be investigated, such as formal inclusion in the curriculum or how experience influences [3] in other fields, such as physiotherapy, clinical uncertainty is almost unexplored [32]. It is appropriate to highlight some limitations of the review. Including seven studies for analysis may be considered too few, so different inclusion criteria could be reconsidered.

Although previous reviews have explored educational strategies for improving tolerance to uncertainty, these have focused on the medical profession. The present work aims to extend existing knowledge to include other health professions likely to experience CU. Patel et al. [30] selected articles focusing exclusively on medical education, and Alam et al. [31] studied uncertainty management in primary care physicians.

5. Conclusions

- Many educational strategies for improving tolerance to uncertainty in health professionals are based on non-conventional educational approaches.
- Educational interventions can be a valuable tool for modifying tolerance to clinical uncertainty.
- Currently, the target population of most published studies on improving tolerance to clinical uncertainty are physicians.

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