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RESEARCH ARTICLE

SIMULATION AS A TOOL FOR THE DEVELOPMENT OF CLINICAL REASONING

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ABSTRACT

The Flexner Report "Medical Education in the United States and Canada" is the publication on medical education among the proponents and detractors of this pedagogical proposal. This model has disadvantages within which the scientific approach is noted away from the integral vision of the human being. Clinical reasoning is the centerpiece of medical practice and is an undefined construct and that formal programs of medical schools do not include. It is extremely difficult to teach students to replicate the expert's reasoning, if they do not yet have their own experience, or with structured knowledge. This experience is only acquired by comparatively relating a clinical problem, with similar situations seen above. In medical education, the simulation focuses on placing the student in a context that mimics clinical reality and is defined as a technique that replaces or expands a real experience through a guided experience, replicating real-world aspects in a way interactive- At the undergraduate boarding school, a trained physician is expected to develop and competencies related to health problem care. **The objective** of this work is to evaluate the development of Clinical Reasoning in Undergraduate Internal Physicians, taking into account the use of clinical simulation within the different curricula. ***Material and Methods:*** A prospective multicenter experimental study was conducted, with under graduate in-house physicians, (MIP) students from four medical schools. Curriculums were analyzed, taking into account whether or not they included clinical simulation scenarios as a teaching tool. Sand formed two groups, MIP that were taught with simulation scenarios and had no teaching with simulation scenarios. They were evaluated in a real clinical scenario during the preparation of the medical history of a randomly selected patient in the General Surgery service. ***Results:*** 24 (100%) MIPgroup I evaluated with clinical simulation in their curriculum we obtained the following results: Regarding the Interrogation aimed at obtaining important data for the current condition 20 (83.3%), they obtained excellent score, 3 (12.5%) they scored well, 1 (4.2%), scored regularly, and 0 scored poorly. As for obtaining data for the integration of diagnosis, 21(87.5%) they scored excellent 1 (4.2%) got well score 0 got regular score and 2 (8.3) got poor score. Speaking of physical data collection, the result was: 20 (83%) with a score of excellent, 3 (12.5%) with a good score, 1 (4.2%) with a regular score and 0 with poor score. For diagnostic supplementation studies it refers to 21 (87.5%) scored excellent 1 (4.2%) scored well 1 (4.2%) scored regular and 1 (4.2%) got poor score. In treatment evaluation 23 (95.8%) got an excellent score of 0 had good score, 1 (4.2%) had a regular score, 0 got poor score. The 27 (100%) MIP group II without clinical simulation in its curriculum, the results were as follows: Regarding the Interrogation aimed at obtaining important data for the suffering actat, 3 (11.2%) got an excellent score, 5 (18.5%) scored well, 19 (70.3%) they got a regular rating, 0 got poor grade. As for obtaining data for the integration of diagnosis, 7 (26%) got an excellent score, 5 (18.5%) scored well, 9 (33.3%) scored regular, 6 (22.2%), scored poorly. Speaking of physical data collection, the result was: 4 (14.8%) with a score of excellent, 4 (14.8%) with a good score, 7 (26%), with a regular score and 12 (44.4%), with a poor score. As for diagnostic supplementation studies refersto ,4 (14.8%) scored 6 (22.2%) got a goodscore, 9 (33.3%) obtained a regulatory scoreof8 (29.7%) got poor score. In treatment evaluation 3 (11.1%) scored at 3 (11.1%) had a good score, 11 (40.7%), had a regular score, 10 (37%) got poor score. ***Conclusions:*** The fundamental axis of medical training is clinical reasoning; in the student and in the doctor his learning represents a challenge, since traditionally education medicine has been based on the memorization of contents. The antecedent of a curriculum that includes clinical simulation scenarios favors the development of non-technical skills within which clinical reasoning stands out. Internal physicians who were trained under an academic program with clinical simulation not only develop specific clinical medical skills and abilities, but also the application and development of clinical reasoning, during the stage of building the medical history.

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INTRODUCTION

Abraham Flexner's Report "Medical Education in the United States and Canada" presented in 1910 is the most cited medical education publication and reference for multiple debates among the proponents and detractors of this pedagogical proposal (Flexner, 1910). Of all the contributions contained in the Flexner report, five of them were readily accepted and can now be considered widespread.

- Four-year curriculum
- Two years of Basic Science
- Two years of Clinical Teaching
- Linking the School of Medicine to the University.
- Establish income criteria among which stand out: knowledge in Mathematics and Science.

However, the Flexner report itself provides for a number of recommendations whose implementation over time has been limited.

- Integration of Basic and Clinical Sciences
- Stimulating active learning
- Limiting memory learning
- On the part of teachers, emphasize that in physicians learning represents a permanent work.

Looking for the reason why the latter have been difficult to adopt, we find that it requires greater investment of time and effort, and that in the medical sciences reforms and growth, have focused on scientific aspects rather than education; to achieve this require managers who are doctors and educators (Flexner, 1910). The Flexnerian model also has disadvantages within which the scientific approach is removed from the integral vision of the human being. Today one of the mainmotivations of the medical student, it focuses on passing exams, so the memorization of content becomes a daily practice, but this goes hand in hand with insufficient knowledge retention, which negatively impacts long-term memory and with this on medical practice.

Clinical Reasoning: Clinical reasoning is at the heart of medical practice. In addition, it is the knowledge that medicine is at the moment, the know-how that configures the professional activity, the ability to observe and reflect the doctor, its integrative judgment and the problem(s) that lead to the patient – individual or collectively – to resort to an expert. That is, each and every part of the constituent aspects of medical practice converge (Pelaccia, 2011). Traditionally clinical reasoning has been a poorly defined construct by the medical community at large, and has been included within generic terms such as "the art of medicine," but it is something that formal programs of medical schools and medical courses specialization does not include the current concepts on this subject obtained from various research streams. We say that it is something that a good doctor should do well, but in the educational process is still handled as something that cannot be explained in words and that must be learned by imitation of the expert or someone with more experience. It is therefore of paramount importance that in the training process of the physician from the first year the research findings and current concepts on this subject are discussed, to understand the factors involved in the acquisition of skills clinical reasoning, and try to teach and evaluate them in a formal way (Djulbegovic, 2012). Barrows (1980) describes the term: clinical reasoning, as "the cognitive process needed to evaluate and manage a patient's medical problem." Norman (2005) notes that modern research that seeks to shed light on clinical reasoning, has been conducted over the past four decades, by scientists from various disciplines with varied perspectives such as sociology, psychology clinical psychology and medical education (HS. Barrows, 1980). It is extremely difficult to teach students to replicate the expert's reasoning, if they do not yet have their own experience, or with structured knowledge. This experience is only acquired by comparatively relating a clinical problem, with similar situations seen above. Therefore, an important part of the curriculum should allow the student from the beginning of their training to be in contact with a varied and important number of simulated and real clinical cases, in order to acquire their own experience (Djulbegovic, 2012 and HS. Barrows, 1980).

Clinical Simulation: The simulation is older than man. Many living beings simulate to ensure survival on the evolutionary scale. Some animals mimic, change color, or shape, and thus go unnoticed in front of their predators. Human beings have used simulation in order to protect themselves; in the genesis, passages such as Rebekah's are described in costume of Jacob using goatskin to receive Isaac's blessing and inheritance: In the Middle Ages seizures were simulated by chewing soap to produce foam in the mouth and evade service Military (Nuance, 2008). Aviation has invested in the use of simulation for training by offering its education environments realistic, safe, cost-effective and flexible in which the skills necessary for the future working life are acquired. High-fidelity flight simulators aimed at developing technical and non-technical skills have been developed. Simulation-based safety programmes have been developed at nuclear plants, regularly developing complex crisis and emergency scenarios (Palés Argullós, 2010). In medical education, the simulation focuses on placing the student in a context that mimics clinical reality and is defined as a technique that replaces or expands a real experience through a guided experience, replicating real-world aspects in a way Interactive (D M Gaba, 2004). The use of simulators in medical education seems to be a very current theme however the oldest evidence available of its use dates back to the year 1027 in which Wang Weiyi describes the use of wax-covered bronze mannequins for learning the acupuncture and moxibustion techniques. In the eighteenth century and is the so-called parire machine used by Angélique Marie Le Boursier-Du Coudray in training for childbirth care by doctors and midwives of the time (Gydnea Lourdes Aguirre Dávila and B. Seguy, 2008). However, we can talk about modern Clinical Simulation from Helsinski's 1964 statement that protects people as research subjects by laying the groundwork for today's medical care to focus on patient and patient rights development of education is developed in an environment of high demand, always focusing on patient safety and technological development (Manzini, 2000). In 1958, Americans Peter Safar and Bjorn Lind demonstrated that word-of-mouth and mouth-to-mask ventilation could save lives. His research raised a question: How to train people to acquire these skills, and the answer created a clear need for mannequin training. Asmund Laerdal, work on this project and developor the first simulator for medical training (Breivik Harald, 1978 and Bjørn Lind, 2005). Abramson and Denson develop a mannequin develop a mannequin with features such as breathing, heart noise, pulses, blood pressure, eye and mouth movement; however, it was never achieved to introduce medical schools despite positive reports, since the need for simulation teaching was not clear (Paul Bradley, 2006). The institutions that offer the medical career increase progressively, however the number of clinical fields for teaching is less and less, this makes the educational process complicated; not mentioning the characteristics of some health institutions, in terms of the management of serious patients, or the realization of special techniques, diagnosis and treatment with the participation of multidisciplinary teams where teaching becomes Difficult (Oscar Román, 2009). Kolb (1975) develops an Experiential Learning Model with four fundamental elements; Experience, Reflection, Conceptualization and Application, this constitutes a learning cycle that usually starts with the experience but can start in any of the four elements. [15] Since the 1960, the challenge of: how to evaluate clinical reasoning has been raised? Since it has traditionally been considered part of the personality or natural talent of the physician for problem solving in the clinical area. One of the forms of evaluation is the presentation of problems to the medical student, with simulated and structured clinical cases such as PMP (Patient Medical Problem) where with a written clinical picture, the student requests information and gives this comes to a diagnosis; however, one of the limitations of the PMP is reliability; i.e. the possibility of obtaining equal scores by repeating the same evaluation instrument with another clinical case. Some studies state that not always, under this type of test it is possible to distinguish the student or experienced physician from the novice, besides that we know that clinical reasoning changes according to the presentation of different problems and patients (Barrows, 1980).

Undergraduate internship is the theoretical-practical academic level that is carried out as part of the medical degree curricula, as a stage that must be covered before social service, professional examination and the respective degree (Official Mexican Standard). Usually undergraduate internship is done in a second-tier health unit and it is the time when in-training physicians approach the patient comprehensively with a hospital approach; it is at this stage that complex skills are developed that complex skills are developed that complex skills are developed that complex skills are developed that complex skills are developed that complex skills are developed that complex skills are developed that complex skills are developed that complex skills are developed that complex skills are developed that will allow the management of clinical problems. In this period, it is expected that the trainee physician will developand competencies related to the care of health problems with responsibility in diagnosis, treatment, prevention and rehabilitation; this stage is the preamble to what will be the professional life (R.M.Tapia, 2007). Son few research works that focuses on assessing the impact of long-term simulation-based trainings. Kuduvalli in 2009 evaluated the retention and transfer of skills in emergency medicine and anesthesia teams through courses based on high fidelity simulation using statistical methods (Kuduvalli, 2009). The problem underpinning this research is related to the fact that in the Mexican state of Tamaulipas there are ten educational institutions that offer the academic program of medicine.

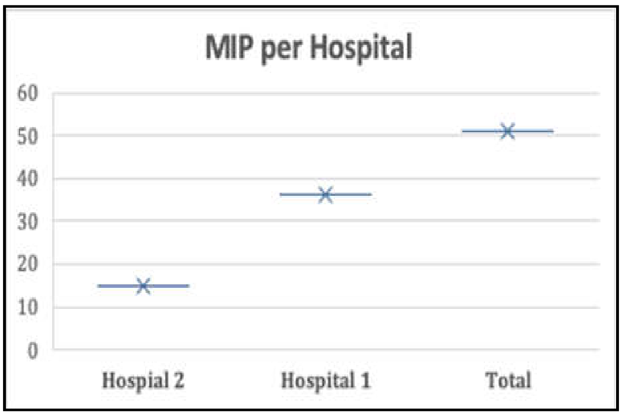
Simulation centers are increasingly integrated, and work basically on skill development; few institutions integrate clinical simulation into their curriculums in order to develop non-technical skills such as clinical reasoning. The objective of this work is to evaluate the development of Clinical Reasoning in Undergraduate Internal Physicians, taking into account the use of clinical simulation within the different curricula. Evaluate how to interrogate the patient focused on obtaining important elements for the current condition. Evaluate how the data obtained in the interrogation are integrated into an initial diagnosis. Evaluate how the data obtained in the physical exam are integrated into a diagnosis. Evaluate the criterion for the application for studies for diagnostic supplementation (radiological and laboratory). Evaluate the proposed treatment for the diagnosed condition. Compare the evaluated elements among undergraduate in-house physicians who took an academic program with integrated clinical simulation scenarios.

MATERIAL AND METHODS

A prospective multicentric experimental study was conducted, with undergraduate doctors, students from four medicalschools, attached to two hospitals in the conurbation area of Tampico, Madero and Altamira cities in the Mexican State of Tamaulipas; 1 July 2018 to 30 June 2019. Sand evaluated the clinical reasoning, with a rubrica, built and validated by the academia of Clinical Sciences of the Bachelor of Physician Surgeon of the Institute of Higher Studies of Tamaulipas IEST-Anahuac and the headquarters hospitals where undergraduate in-house physicians were evaluated. The technique used was direct observation, which requires delving into the clinical case and maintaining an active, and permanent reflective role, with the aim of identifying the development of clinical reasoning during the development of medical history.
The observation and application of the evaluation rubric was made by a single observer who is the principal investigator of this study, which was divided into five stages, the interrogation, integration of data for diagnosis, data collection Through physical examination, diagnostic supplementation studies, and treatment, each item will obtain the following excellent scores, either regular or deficient. An analysis of the curricula of all medical schools where undergraduate physicians study participants were analyzed, taking into account whether or not they included simulation scenarios clinical clinic as a teaching tool. Taking this as a basis two groups were formed, MIP that had teaching with simulation scenarios (Group I. 24) and MIP that did not have teaching with simulation scenarios (Group II. 27). The evaluation instrument was applied to all undergraduate inmate physicians in a real clinical scenario during the preparation of the medical history of a randomly selected patient in the General Surgery service of both hospitals.

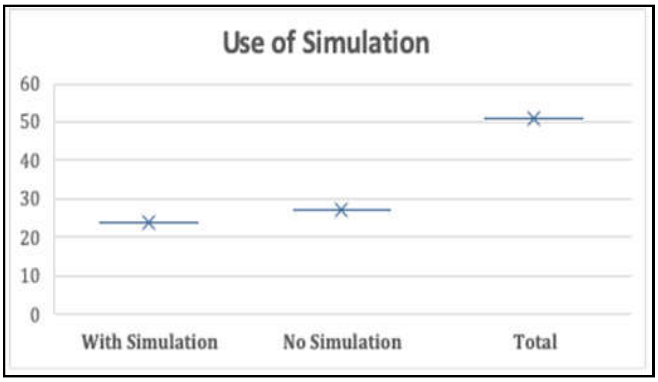
RESULTS

The total number of undergraduate inmate physicians (MIPs) evaluated was 51 (100%) 36 (70.5%) are the first hospital (H1) and 15 (29.5%) to the second hospital (H2).



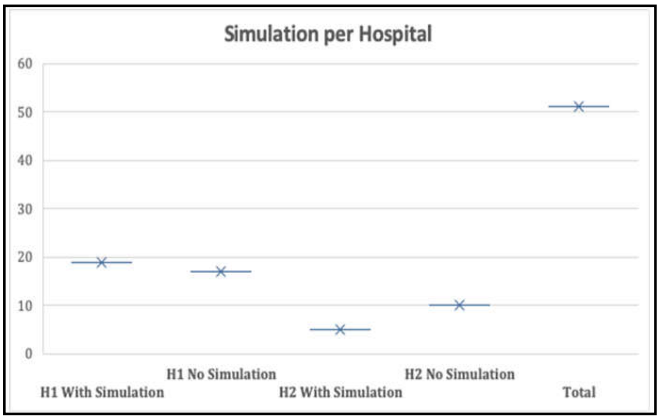
Graphics 1

Between the two hospitals 24 MIP (47%) Group I, they had a bachelor's degree course, with clinical simulation and 27MIP (53%) Group II, they did not have this discipline in their curriculum.



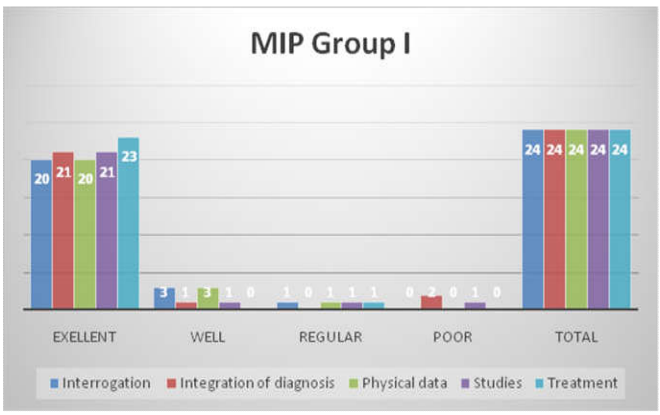
Graphics 2.

In H1; 19 MIP (52.8%) he studied an academic program with simulation; 17 MIPs (47.2%) they took a program without clinic simulation; from H2; 5 MIP (33.3%) completed an academic program with Clinical Simulation and 10 MIP (66.6%) his academic program did not include clinical simulation.



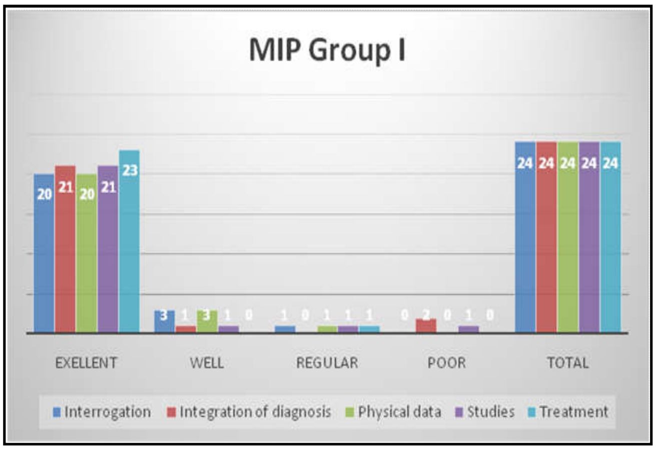
Graphics 3

24 (100%) MIPgroup I evaluations with clinical simulation in their curriculum we obtained the following results; Regarding the Interrogation aimed at obtaining important data for the current condition 20 (83.3%), they obtained excellent score, 3 (12.5%) they scored well, 1 (4.2%), scored regularly, and 0 scored poorly. As for obtaining data for the integration of diagnosis, 21(87.5%) they scored excellent 1 (4.2%) got well score 0 got regular score and 2 (8.3) got poor score.



Graphics 4

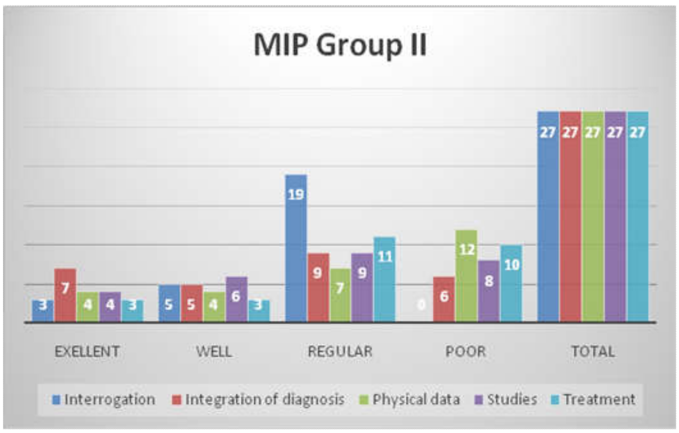
Speaking of physical data collection, the result was: 20 (83%) with a score of excellent, 3 (12.5%) with a good score, 1 (4.2%) with a regular score and 0 with poor score. For diagnostic supplementation studies it refers to 21 (87.5%) scored excellent 1 (4.2%) scored well 1 (4.2%) scored regular and 1 (4.2%) got poor score. In treatment evaluation 23 (95.8%) got an excellent score of 0 had good score, 1 (4.2%) had a regular score, 0 got poor score.



Graphics 4

The 27 (100%) MIPgroup II without clinical simulation in its curriculum, the results were as follows:

Regarding the Interrogation aimed at obtaining important data for the suffering actat, 3 (11.2%) got an excellent score, 5 (18.5%) scored well, 19 (70.3%) they got a regular rating, 0 got poor grade. As for obtaining data for the integration of diagnosis, 7 (26%) got an excellent score, 5 (18.5%) scored well, 9 (33.3%) scored regular, 6 (22.2%), scored poorly. Speaking of physical data collection, the result was: 4 (14.8%) with a score of excellent, 4 (14.8%) with a good score, 7 (26%), with a regular score and 12 (44.4%), with a poor score. As for diagnostic supplementation studies refersto,4 (14.8%) scored 6 (22.2%) got a good score, 9 (33.3%) obtained a regulatory scoreof8(29.7%) got poor score. In treatment evaluation 3 (11.1%) scored at 3 (11.1%) had a good score, 11 (40.7%), had a regular score, 10 (37%) got poor score.



Graphics 5

Statistical Analysis

Statistical analysis for the objective: Compare the evaluated elements between undergraduate internal physicians who took an academic program with integrated clinical simulation scenarios.

Interrogation to obtain data of the current condition * Groups

Cross table				
Count				
		Groups		Total
		With simulation	No simulation	
Interrogation to obtain data from the current condition	Regular	1	18	19
	Well	3	7	10
	Excellent	20	2	22
Total		24	27	51

Groups	Interrogation to obtain data from the current condition			Total
	Regular	Well	Excellent	
With simulation	1	3	20	24
No simulation	18	7	2	27

Chi square p. 0.000

Chi-square tests

	Value	Gl	Asymptotic significance (bilateral)
Pearson's Chi-square	31.470[a]	2	.000
Reason for plausibility	37.068	2	.000
N of valid cases	51		

a. 1 square (16.7%) have expected a tally less than 5. The minimum expected count is 4.71.

Data collection for diagnostic integration * Groups

Cross table Groups*Getting data for diagnostic integration						
Groups		Obtaining data for diagnostic integration				Total
		Dificiente	Regular	Well	Excellent	
	With simulation	2	0	1	21	24
	No simulation	6	9	5	7	27
Total		8	9	6	28	51

Chi-square tests

	Value	Gl	Asymptotic significance (bilateral)
Pearson's Chi-square	20,561[a]	3	,000
Reason for plausibility	24,630	3	,000
N of valid cases	51		

a. 6 squares (75.0%) have expected a tally less than 5. The minimum expected count is 2.82.

Groups	Obtaining data for diagnostic integration				Total
	Poor	Regular	Well	Excellent	
With simulation	2	0	1	21	24
No simulation	6	9	5	7	27

Chi square p. 0.000

Obtaining data using physical scanning * Groups

Cross table				
Count				
		Groups		Total
		With simulation	No simulation	
Obtaining data through physical exploration	Poor	0	12	12
	Regular	1	7	8
	Ok	3	4	7
	Excellent	20	4	24
Total		24	27	51

Chi-square tests

	Value	Gl	Asymptotic significance (bilateral)
Pearson's Chi-square	27.227[a]	3	.000
Reason for plausibility	33.308	3	.000
N of valid cases	51		

a.4 squares (50.0%) have expected a tally less than 5. The minimum expected count is 3.29.

Groups	Obtaining data through physical exploration				Total
	Poor	Regular	Well	Excellent	
With simulation	0	1	3	20	24
No simulation	12	7	4	4	27

Chi square p. 0.000

Diagnostic competence studies * Groups

Cross table				
Count				
		Groups		Total
		With simulation	No simulation	
Diagnostic proficiency studies	Poor	1	8	9
	Regular	1	9	10
	Ok	1	6	7
	Excellent	21	4	25
Total		24	27	51

Chi-square tests

	Value	Gl	Asymptotic significance (bilateral)
Pearson's Chi-square	26.892[a]	3	.000
Reason for plausibility	30.019	3	.000
N of valid cases	51		

a. 5 squares (62.5%) have expected a tally less than 5. The minimum expected count is 3.29.

Groups	Diagnostic proficiency studies				Total
	Poor	Regular	Well	Excellent	
With simulation	1	1	1	21	24
No simulation	8	9	6	4	27

Chi square p. 0.000

Treatment * Groups

Cross table				
Count				
		Groups		Total
		With simulation	No simulation	
Treatment	Poor	0	10	10
	Regular	1	11	12
	Ok	0	3	3
	Excellent	23	3	26
	Total	24	27	51

Chi-square tests			
	Value	Gl	Asymptotic significance (bilateral)
Pearson's Chi-square	36.668[a]	3	.000
Reason for plausibility	45.044	3	.000
N of valid cases	51		

a. 3 squares (37.5%) have expected a tally less than 5. The minimum expected count is 1.41.

Groups	Treatment				Total
	Poor	Regular	Well	Excellent	
With simulation	0	1	0	23	24
No simulation	10	11	3	3	27

Chi square p. 0.000

The interpretation of the p-value, in all cases the difference is statistically significant, which can be attributed to the variable of interest, in this case the "simulation"

DISCUSSION

The results were analyzed regarding the level of development of clinical reasoning (excellent, good, regular and deficient) in the stages of the medical history: Interrogation, aimed at obtaining data for diagnosis, clinical diagnosis, intervention and reflection during the simulated practice. This to determine whether students meet the selected stages based on established critical thinking skills, and critical thinking sub-competencies (Flexner, 1910 and Pelaccia, 2011). Since direct observation is the method used in the evaluation of interrogation quality and physical examination, it is important to take this into account during the evaluation of clinical reasoning. Estudents interrogate, explore, build the diagnosis and establish a treatment. The analysis of the content of the results allows to examine and contrast the integration of knowledge (Blanco, 2002). It is not possible to evaluate clinical reasoning by taking into account only the diagnosis; we would be focusing on the outcome and not on the process that depends on the experience of the relationship with the patient's problem; the use of simulated patients shows us an interesting phenomenon (Bloch, 2003). Clinical reasoning and theoretical knowledge, have a close relationship and this allows to evaluate together; that is, we can know that the student has knowledge and that he/she does with that knowledge (White, 2005). In this study, good results are presented in the student who went through an undergraduate medical education supported by simulation, this tells us that the simulated clinical scenarios lived in their universities, generated a experience that was possible to conceptualize and reproduce later in the real clinical scenario during undergraduate internship. Undergraduate in-house physicians who took a curriculum without the support of simulation scenarios will develop clinical reasoning in the same way: with experience and conceptualization, but from scenarios real with real patients. In the literature there are records that show that the area where the simulation has provided the greatest assistance in training is in the context of ercenter, basic and advanced life support as well as proper airway management with or without trauma; it has been shown that the use of this resource has managed to improve and refine the medical act and provide safety to the critically ill patient (Quesada, 2007). Simulation has been used in the teaching of medicine for several decades, representing a new way of learning and teaching. Through simulation, health personnel learn by repeating and experiencing the error before interacting with a real patient (Ruiz Sonia, 2012). Simulation has been employed with positive results for training psychomotor skills, critical thinking skills through clinical practice and communication techniques, competency assessment, development of clinical judgment non-technical skills (Harder Nicole, 2010 and Michell, 2008). Simulation as an innovative educational methodology is based on adult learning; learning based on experience and deliberate practice. Adult learning underpins that simulation promotes adults to be internally motivated and self-directed, that adults learn in a practical and goal-oriented manner; adults want to know the relevance of what they learn and this is done through the feedback and reflection phases (Riancho, 2012). This paper suggests that medical education supported by simulation scenarios contains potential for improving levels of confidence in health professionals; however, part of the success of this innovative form of learning is related to the orientation of the objectives and competencies required for the resolution of a population's health problems. However, the use of simulation should not be a substitute for supervised practice in real environment but a complement to safe and effective practice. That is why Gaba (2004) believes that simulation is a strategy that must be taken in response to learning and health needs and that must be integrated consistently into resumes (D M Gaba, 2004).

Conclusion

The fundamental axis of medical training is clinical reasoning; in the student and in the doctor his learning represents a challenge, since traditionally education medicine has been based on the memorization of contents. The antecedent of a curriculum that includes clinical simulation scenarios favors the development of non-technical skills within which clinical reasoning stands out; the development of this must be one of the most important profile of the egress in medical schools, since it allows the doctor to analyze, reflect, evaluate and face situations that favor professional work. In other words, it promotes an orderly thought that until a few years ago was not considered within the university training of the doctor. Clinical simulation offers students the opportunity to approach real situations in which the should be of the physician is included, mimicking the context and generating a safe learning environment for the patient and the student, developing discipline competences, but also generic in an integrated way.

It is important to consider the simulation as one of this strategy that influences the development of clinical reasoning; whose importance lies in that it allows the improvement in the action and development of the personality of the doctor, which are determining elements. Many advances in the field of simulation in recent years have been the revised literature that the authors agree that simulation allows for higher ways of acting. After the analysis of the results we can say that participants who were trained under an academic program with clinical simulation not only develop specific clinical medical skills and skills, but also the application and development of the clinical reasoning, during the stage of building the medical history.

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