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THE CLINICAL AND ECONOMIC BENEFITS OF SIMULATION –BASED MEDICAL EDUCATION TO THE BUDGET

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Abstract

Especially in the last two decades, there has been an increase in simulation-based training applications to increase the technical and non-technical skills of health care providers. In many scientific studies, thereare many studies on the effect of simulation education and research applications on theincrease of cost and clinical skills. In this study, we conducted a literature study on the clinical and economic benefits of simulation-based medical education on the budget. In this context, in order to determine the clinical and economic benefits of simulation-based medical education to the budget, a search was carried out on Google Schoolar, Pupmed and Science directs earch engines between 2010-2020 by entering the words "Simulation-basedmedical education, cost-effectiveness, budget effect". By using the word groups specified at theend of all these operations; Pubmed 75 Google Schoolar 162 and ScienceDirect 37 reached 274 results in total. All there sults obtained were reviewed and studies not directly related to the subject and the same articles that are duplicate of each other were excluded; A total of 21 results in the form of reviews, research articles, papers and reports were evaluated. The scientific studies evaluated within thescope of this study support the fact that simulation-based training practices provide clinical and economic benefits to the budget and that there is a positive relation ship between them.

Keywords: Simulation Education, Cost-Effectivenes, Budget Effect, Health Care.

Jel Codes: H51, H52, H53.

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SİMÜLASYON TEMELLİ TIP EĞİTİMİN BÜTÇEYE SAĞLADIĞI KLİNİK VE EKONOMİK FAYDALAR

Öz

Son yirmi yılda, sağlık hizmeti sağlayıcıları teknik ve teknik olmayan becerilerini artırmak için simülasyon temelli eğitim uygulamalarını sıkça kullanmaktadır. Birçok bilimsel çalışma da Simülasyon eğitimi ve araştırma uygulamalarının maliyet ve klinik becerilerin artması üzerinde etkisi konusunu ele almaktadır. Bu bağlamda çalışmada simülasyon temelli tıp eğitimin bütçeye sağladığı klinik ve ekonomik faydaları belirlemek için Google Schoolar, Pupmed ve Sciencedirect arama motorları üzerinde 2010-2020 yılları arasında 'Simülasyon temelli tıp eğitimi, maliyet-etkililik, bütçe etkisi' sözcük grupları girilerek tarama yapılmıştır. Tüm bu işlemlerin sonunda belirtilen sözcük grupları kullanılarak; pupmed 75 Google Schoolar 162 ve Sciencedirect 37 toplam 274 sonuca ulaşılmıştır. Elde edilen tüm sonuçlar gözden geçirilerek, konu ile doğrudan ilgisi olmayan çalışmalar ve birbirinin tekrarı olan aynı yazılar kapsam dışında tutulmuş; derleme, araştırma makalesi, bildiri ve rapor niteliğinde toplam 21 sonuç değerlendirmeye alınmıştır. Bu çalışma kapsamında değerlendirilen bilimsel çalışmalar, simülasyon temelli eğitim uygulamalarının bütçeye klinik ve ekonomik açıdan fayda sağladığı görülmüştür.

Anahtar Kelimeler: Simülasyon Eğitimi, Maliyet-Etkililik, Bütçe Etkisi, Sağlık Hizmeti.

JEL Kodu: H51, H52, H53.

1. INTRODUCTION

It may not be appropriate to apply some of the information taught theoretically during medical education directly on the patient, both in terms of ethics and in terms of possible inconveniences. Simulation lends a hand to the medical educators in order to minimize the problems that may occurs during health implementatitons. It is the duty of medical educators to provide students with both theoretical and practical skills and overcome the deficincies in the equipments to be used in all kinds of medical applications. In this context, one of the methods that reduces errors in practice and aids students in the application process is educational simulation. Simulation aids students to improve their hand skills by showing many treatments and implementations which are normally difficult and complex, in the computer environment or on the model to minimizing the problems that may occured.

Simulation practice in medical education is different from traditional practice, in which an artificial model takes place instead of the patient, or it is an educational process that enables the operations and processes to be carried out in the computer environment. (Gaba, 2007; Walter, Adler and Gaghie, 2006). The purpose of using simulation in medical education is to carry out these practices in a model or computer environment before all kinds of treatment and service to the patient, to prepare the students for the problems that may be encountered during the practice and to take precautions against the problems that may arise, thus positively affecting the course of the treatment process. The simulation based on the understanding of

learning by trial and error, gives students the opportunity to learn the same process more than once, this circumstance both increases their motivation and encourages them to learn. (Demirbilek, 2004).

In general, simulation implementations in medical education are utilized in two different ways. The first of these is the model used to improve the skills of students in medical education. The second one is computer aided simulation environments that provide visual representation of very complex physiological and anatomical features through various softwares. Nowadays, computer-based applications are common used in medical education. (Lane, Slavin and Ziv, 2001).

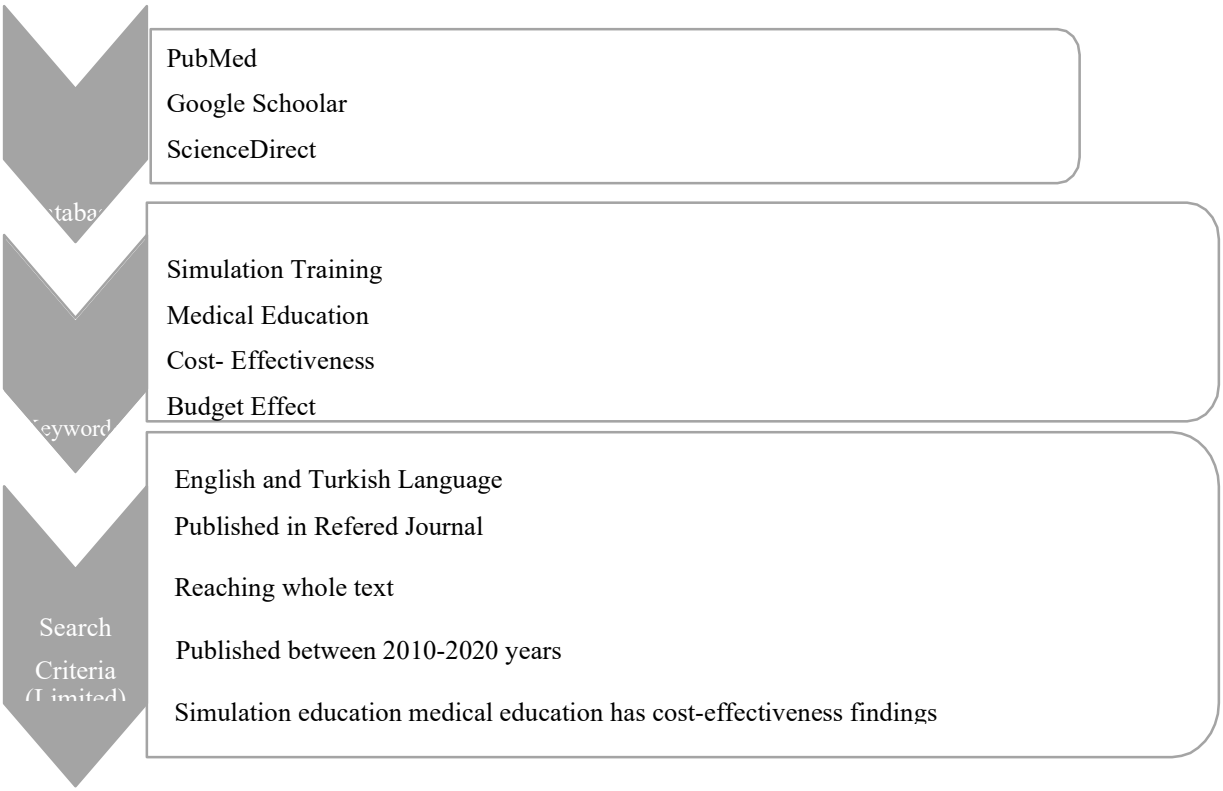
The development and change of technology in the world has shown itself in the field of education as in many areas. Simulation applications are used in medical education in the world. In recent years, rapid changes have been experienced in medical education. Increasing knowledge in the field of medicine and researches in this field make it difficult to continue medical education with conventional techniques and applications. Changes and transformations in the field of health with globalization have also changed the perspective on health services. With this changing paradigm, concepts such as quality, efficiency and effectiveness have come to the fore.

2. MATERIAL AND METHOD

In this study, in order to determine the clinical and economic benefits of simulation-based medical education to the budget, search engines were utilized on "Google Schoolar, "Pupmed" and "Sciencedirect" between 2010 and 2020 by entering the phrases "Simulation-based medical education, cost-effectiveness, budget effect" has been made. Due to there is a limitation in the Turkish literature that deals with simulation-based medical education and its economic relationship together, only studies published in foreign literature were determined and carried out. By using the specified word groups as a result of all these searches; A total of 274 results were obtained, including pubmed 75 Google Schoolar 162 and Sciencedirect 37. After similar publications reached in different databases were eliminated, the remaining 182 studies were evaluated during the screening phase. Scientific studies in the screening process; Abstracts were evaluated primarily in terms of keywords and screening criteria. At the end of this evaluation, 99 studies were excluded. 83 studies, which were thought to be suitable for the study, were examined on whole texts. As a result of this full-text review, 62 studies were excluded from the scope considered to be inappropriate. A total of 21 results in

the form of compilations, research articles, declarations and reports were evaluated. Among the criteria for inclusion in the study are that the research and reviews have been published in peer-reviewed journals; there are also criteria such as the scientific nature of the declarations and reports. The publishings included in the study are studies published between 2010 and 2020, scanned between 2010 and 2020, mostly scientific articles, compilations and declarations accessed from the internet. These publishings are studies on the economic benefits of simulation-based medical education. The results obtained were analyzed in the first phase by considering the subject of the study, namely the title.

Figure 1. Data Base, Keywords and Screening Criterias



3. SEARCHING PROCESS

The definition, screening, application and inclusion processes of the screening processes of this study, which was carried out with the PRISMA method used in systematic review studies, and the conclusions related to these processes are given in Figure 4. During the diagnostic process, a total of 274 studies were found as a output of the search for the keywords given in Figure 4 in three different databases. After similar publications reached in different databases were eliminated, the remaining 182 studies were evaluated during the screening phase. Scientific studies in the screening process; Abstracts were evaluated primarily in terms of keywords and screening criteria. At the end of this evaluation, 99

studies were excluded. 83 studies, which were thought to be suitable for the study, were examined on whole texts. As a result of this full-text review, 62 studies were excluded from the scope considered to be inappropriate. At the last stage of inclusion, a systematic review study was carried out with 21 scientific publishings that were considered fit for purpose.

Figure 2. Compilation Process According to PRISMA Method

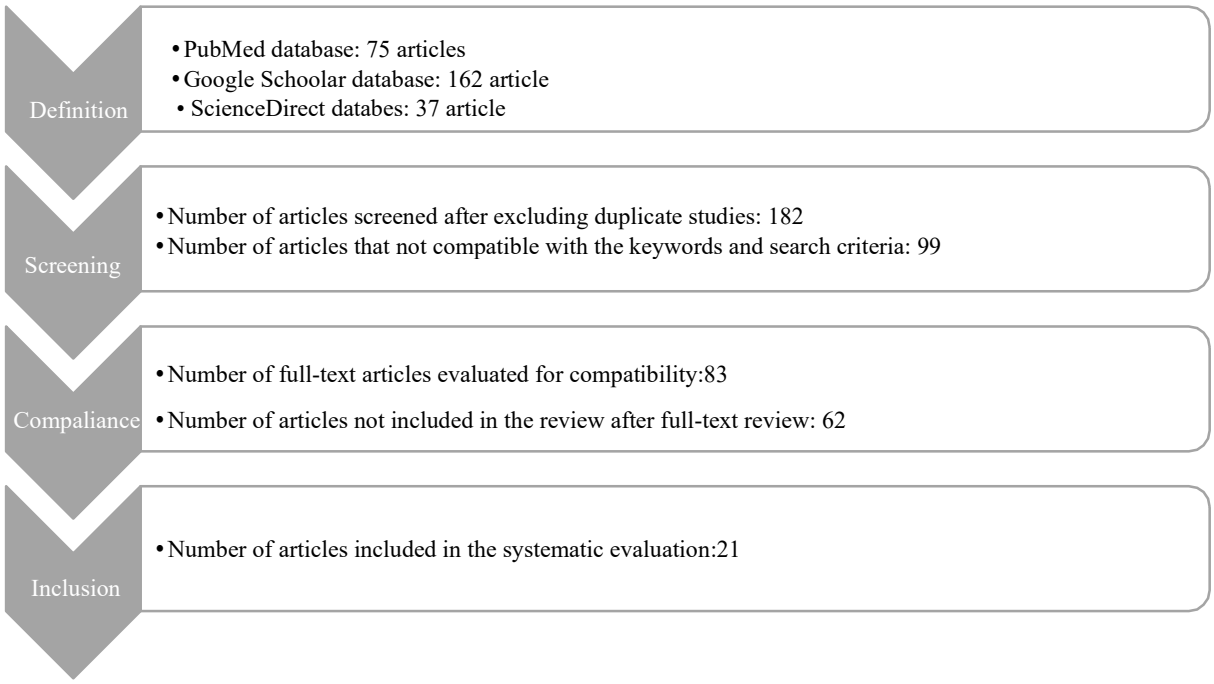


Table 1. The findings of the 21 scientific publishings included and examined in the study

Author	Aim	Scope	Conclusion
Daniel etc. (2020)	A systematic review of simulation-based implementation in healthcare in terms of cost-effectiveness	Analyzing 47 articles published in peer-reviewed journals on the subject	Health stakeholders and decision makers will benefit from more transparent, consistent, particular and gap assessments of the costs of developing and implementing simulation-based training programs in low- and high-income countries.
David etc. (2012)	Evaluating the effectiveness of instructional design features through a systematic review of studies comparing different simulation-based interventions.	Examining the studies published systematically in important journals such as MEDLINE, EMBASE, CINAHL, ERIC, PsycINFO, Scopus, until May 2011.	The Conclusions quantitatively validate the effectiveness of various instructional design features in simulation-based education.
Elaine and Galter(2010)	The aim of this study is to estimate hospital cost savings related to the reduction in Catheter-	A comparison of interventions estimating cost savings associated with a simulation-based	In the outputs obtained, simulation-based training intervention in central venous catheter (CVC) placement is very

	related bloodstream infections (CRBSI) after simulation training for residency.	intervention for central venous catheter (CVC) placement in the Medical Intensive Care Unit (MICU) in a city training and research hospital.	cost effective and these results show that investment in simulation training can provide significant savings in medical care costs.
Williams Bowles and Kiegaldie(2016)	This study aims to evaluate the effectiveness, cost-effectiveness, and student experience of healthcare professional students undertaking simulation training for decrease prevention among hospitalized patients with the simultaneous economic evaluation (cost-per-decrease avoided) trial and cross-random controlled trial.	In this study, students will be trained on how to provide the "Safe Recovery Program", which is the only intervention approach shown to reduce decreases in hospitals.	The result of this research was that overall satisfaction, including acute/rehabilitation care cost for each patient measured using simulation-based education (SBE) and ward-level practice change and clinical cost data, increased and inpatient falls decreased.
Donald etc. (2017)	The aim of this research is to characterize the clinical effectiveness and cost effectiveness of simulation training aimed at reducing cast saw injuries.	2.5 years Orthopedics workers were subjected to simulation-based instructions on distalradial fracture reduction, casting and casting removal using an oscillating saw. The analysis compared the incidences of cast saw injuries and associated costs before and after implementation of the simulation curriculum.	In the 2.5 years prior to simulation, cast saw injuries occurred in approximately 4.3 per 100 castings cut for orthopedic implementation. In the 2.5-year post-simulation period, the injury rate dropped significantly to approximately 0.7 per 100 cast cuts ($p = 0.002$) The total cost to implement the casting simulation was $2,465.31 per 6-month residency rotation. Based on historical data on cast saw burns ($n = 6$), total payments range from $2,995 to $25,000 per demand. The expected savings from averted cast saw injuries and related medicolegal payments within 2.5 years after simulation was $27,131. These conclusions support further investment in simulation-based training as a cost-effective way to improve patient safety and clinical outcomes.
Heather etc. (2013)	Comparing the cost-effectiveness of simulation methods: a case study applied to compare training in terms of outcomes.	Cost-effectiveness analysis of three simulation-based programs by using previously published data. Medical students skills are practiced in one of the	Analysis shows that a progressive program that strategically combines simulation methods provides a cost-effective solution. More generally, it indicates how cost-effectiveness analysis can be

		training programs: low fidelity (virtual reality), manikin, or progressive (virtual reality, consisting of task trainer and manikin simulator).	applied to simulation training and a method medical educators can use in investment decisions.
Maloney and Haines (2016)	It aims to inform about cost-benefit and cost-effectiveness issues for simulation in health professions education.	This article provides an overview of the costs and consequences associated with simulation in health education. It provides an outline of the benefits of using economic assessments to inform educators and clinicians' decision-making about the most appropriate educational approaches. It also provides guidance for education researchers who want to explore the cost and value of their innovations.	Cost and value measures in simulation indicate the necessity of providing information about the feasibility and sustainability of simulation education and to ensure that simulation education demonstrates its value in healthcare.
Yiqun etc. (2017)	It aims to provide an overview of the challenges and opportunities in the application of economic evaluation in simulation-based medical education.	As a path towards the meticulous state of the arts application of economic evaluation in medical education, it outlines the steps necessary to gather the information needed to conduct economic evaluation of simulation setting-based education programs and curricula, and to explain basic approaches to conducting economic evaluation.	A properly conducted economic evaluation can help stakeholders (i.e. program managers, policy makers, and curriculum designers) determine the most appropriate use of resources when choosing the method or method of evaluation in simulation. It also helps inform the allocation of scarce resources within an education program and broader decision-making between education and clinical care.
William etc. (2012)	This article presents a comparison of the effectiveness of traditional clinical education towards skill acquisition goals with simulation-based medical education (SBME) versus applied (DP).	This is a quantitative meta-analysis spanning two decades, from 1990 to 2010. A search strategy that included three literature databases, 12 search terms, and four inclusion criteria was used. Four authors independently obtained and reviewed the articles. The main outcome measures were extracted to calculate effect sizes.	The outputs show that SME's with DP (practical) are superior to traditional clinical medical education in achieving certain clinical skills acquisition goals. SBME is a complex educational intervention that must be carefully introduced and rigorously evaluated in educational fields. Further research on the inclusion of SBME in medical education with DP (practical) is needed to increase its strength, utility and cost-effectiveness.
Kamel etc.	It aims to uncover the	Program directors involved	Most urology program

2018)	current use of simulation in urological education in the United States and the barriers to incorporating a simulation-based training curriculum as the transition to competency-based medical education requires the introduction of simulation to assess both non-technical and technical skills.	in accredited urology training programs in the U.S. Accreditation Council for Graduate Medical Education (ACGME) were invited to respond to an anonymous electronic questionnaire. In the study, the experience and opinions of the program managers regarding the current use of current urology simulators were evaluated. The survey also revealed sensitivities and barriers to the inclusion of simulation-based education curriculum in urology education programs.	administrators agree that a simulation-based curriculum should be included in urology education; barriers to implementation include the cost burden, the need for continuous technology updates, the need for advanced planning, and the faculty's demand to participate in management.
Stefandis etc. (2015)	To review the current status of simulation use in surgery and to guide future research and implementation of evidence-based findings.	Surgical education simulation committee members, who are experts in surgical simulation, review and interpret the literature, explain the current state of the use of simulation in surgery, identify the challenges of its widespread adoption, and offer potential solutions to these problems. The review focuses on simulation research and implementations of current knowledge and researches possible future directions for the field.	Future research in surgical simulation should focus on demonstrating the cost-effectiveness and impact of SBT on patient outcomes. In addition, effective practice strategies need to be developed to more widely integrate surgical best practices and current simulation curriculum.
Ryall etc. (2016)	The purpose of this systematic review was to examine simulation as an assessment tool of technical skills in health vocational education.	A systematic review of the Nursing and Allied Health Literature (CINAHL), Educational Resources Information Center (ERIC), Medical Literature Analysis and Retrieval System (Medin), and Web of index was used to identify research studies published in English between 2000 and 2015.	Simulation has now göne into the health professional education and it is seen that simulation-based assessments can be used effectively. However, its effectiveness as a stand-alone assessment tool requires further research.
Khan etc. (2014)	This study seeks to identify and review	A literature review was done between 1999 and	Further research is needed to validate simulated environments,

	available simulators for prostate surgery and the evidence supporting their validity for educational purposes.	2014. Research terms include urology, prostate surgery, robotic prostatectomy, simulation, virtual reality, animal model, human cadavers, training, assessment, technical skills, validation and a combination of learning curves.	determine which simulators are of greater importance than others, and evaluate the cost-effectiveness of simulators and the transferability of learned skills. With surgeons seeking for the new possibilities for easily reproducible and valid training methods, simulation training is of great importance for practice alongside traditional methods.
Ma etc. (2011)	The aim is that Central venous catheterization (CVC) is increasingly taught by simulation, with researchers aiming to review the literature on the effects of simulation training in CVC on learner and clinical outcomes.	Their work has been screened by using computerized databases, reference lists, and a control group (without simulation training intervention). Two independent evaluators reviewed the citations received. Independent data abstraction was made on study design, study quality score, student characteristics, sample size, components of the interventional curriculum, evaluated outputs, and evaluation method.	Despite some limitations in the reviewed literature, evidence indicates that simulation-based training for CVC has benefits in learning and selected clinical outcomes.
Walton etc.. (2016)	To evaluate the impact of a low-tech simulation-based training plan for obstetric and perinatal emergency management (PRONTO; on non-emergency delivery practices in primary care clinics in Programa de Guatemala).	A cross-sectional birth observation study was conducted with a matched sample from 18 clinics (nine couple intervention and control clinics) between 28 June and 7 August 2013. Conclusions included the implementation of practices It is known to reduce maternal and/or maternal and/or patient care.	The usage of PRONTO demonstrates that it improves non-emergency maternity care by increasing evidence-based practice, patient-centered care, and teamwork.
Rooney etc. (2016)	It is aimed to validate and evaluate performance measures from a new neurosurgery simulation model using the existing Standards framework.	After Institutional Review Board exemption, performance data were gathered from 11 trainee and 3 expert neurosurgeons. Participants used the Procedure Evaluation Tool, an 11-item graded device with a 5-point rating scale from 1 (unable to perform) to 5 (perform easily and smoothly).	Despite a small sample, positive evidence using existing Standards supports combining the new simulator and both tools for skills training and performance evaluation, but challenges (potential threats to validity) should be considered prior to implementation.

Gardner and Nepomnayshy (2016)	It aims to demonstrate the effects of simulation on trainee performances at the bedside and in the operating room.	Methods The American College of Surgeons - Accredited Institutes of Education (Simulation Centers) convened a multidisciplinary panel at the Consortium's 8th Annual Meeting in March 2015 to discuss the added value of simulation-based education, and Panelists shared ways in which the value of simulation was demonstrated in their institution.	The value of simulation-based education was evaluated and explained in terms of educational impact, patient care outcomes, and costs.
Ruder etc. (2017)	The aim of this study was to determine the effectiveness of the hands-on training session in reducing drill depth in an orthopedic drilling technique training model during a surgical simulation and to determine the effectiveness of elderly residents who gave a hands-on training session in orthopedic drilling.	A total of 13 participants (5 orthopedic trainees and 8 medical students) were drilled until the distal cortex of a synthetic bone model was penetrated, and the depth of penetration (PD) was measured. They were then randomized and had a training session with an attending Orthopedic surgeon or a senior resident. Further, subjects are punctured again while calculating PD. Pre- and post-training sessions were compared to determine if there was any improvement in PD and whether there was a difference between educators. The cost of the model was also determined.	This study demonstrated a significant reduction in drilling PD through the use of a low-cost training model and a formal didactics and skills session on proper drilling technique that can be effectively managed by older residents.
Ven etc. (2017)	Team training is frequently applied in obstetrics. It is aimed to evaluate the cost-effectiveness of obstetric multi-professional team training in a medical simulation center.	A model-based cost-effectiveness analysis was performed to evaluate four strategies for obstetric team training from a hospital perspective (no training, no onsite retraining, and 6 months or 3-6-9 months of retraining).	Multi-professional team training in a medical simulation center is cost effective in a scenario where repetitive training sessions are conducted in the field.
Barach(2017)	It is aimed to discuss the challenges and costs involved in developing a successful simulation and training centre, laboratory or onsite program, and the	Research is being conducted on the literature on the cost-effectiveness of simulation in education and growing evidence that SBME is evolving into	Hospitals must embrace simulation-based medical education and support the development of simulation centers for it to be an integral part of SBME's missine to provide the

	ROI of SBME as it relates to patient safety, cost savings and improved patient care.	improvements in communication, teamwork, and clinical care and overall health care improvement.	best possible care to patients.
Benjamin etc.(2010)	As the costs associated with technology-enhanced simulation are unknown, assessing the value of simulation-based medical education (SBME) requires exact cost calculation and reporting. An attempt is made to summarize the nature and quality of studies involving the economic analysis of SBME for the education of healthcare students.	A systematic search was conducted through MEDLINE, Scopus, major journals and previous review bibliographies up to May 2011. Articles reporting original research in any language assessing the cost of simulation, non-simulated instruction or other simulated intervention, practitioner training, and student physicians, nurses, and other health professionals were selected.	Because cost reporting in SBME studies is sparse and incomplete, a comprehensive model for accounting and reporting costs is recommended in SBME.

4. FINDINGS AND DISCUSSION

The findings of the clinical and economic benefits of simulation-based medical education to the budget obtained as a result of the systematic review study are listed in Table 1. From these studies, 47 articles published in peer-reviewed journals on the subject Daniel etc.(2020) at the University of Washington were examined; In the study conducted for the purpose of systematic examination of simulation-based applications in health services in terms of cost-effectiveness; It has been concluded that the use of simulation-based education and practices in the medical education curriculum of low and high income countries will help in determining the costs more transparently, consistently and clearly. A systematic review of studies comparing different simulation-based interventions by Cook and others In the study in which studies published in important journals were examined; It has been concluded that quantitatively confirms the effectiveness of various instructional design features in simulation-based education. A central venous catheter (CVC) method used in a city teaching hospital by Galter et al. A study comparing interventions estimating cost savings associated with a simulation-based intervention for placement; A simulation-based training intervention in central venous catheter (CVC) placement is highly cost-effective and these results conclude that investment in simulation training can result in significant savings in medical care costs. Williams and Kiegaldie(2016) found that students were targeted within the undergraduate student placements established in Monash

University medicine, nursing, and peninsula Health acute and subacute inpatient wards, and simultaneous economic evaluation (cost-per-decrease prevented) through trial and cross-randomized controlled the aim of this study was to evaluate the student experience of healthcare professional students undertaking simulation training for trial effectiveness, cost-effectiveness, and decrease prevention among hospitalized patients.

As a consequence of this study, it was observed that overall satisfaction, including the cost of acute/rehabilitation care for each patient measured using simulation-based education (SBE) and ward-level practice change and clinical cost data, increased and inpatient falls decreased. Lync etc.(2017)'s scope of 2.5 years Orthopedics workers were subjected to simulation-based instructions on distalradial fracture reduction, casting, and casting removal using an oscillating saw. The analysis aimed to characterize the clinical effectiveness and cost-effectiveness of simulation training aimed at reducing cast saw injuries by comparing the incidences of cast saw injuries and related costs before and after the implementation of the simulation curriculum. This study concludes that it supports further investment in simulation-based education as a cost-effective way to improve patient safety and clinical outcomes.

In the study of Brydges (2013), he made a cost-effectiveness analysis of three simulation-based programs using previously published data as a method. Medical students (n = 15 per group) practiced in one of three 2-h intravenous catheterization skills training programs: low fidelity (virtual reality), highfidelity (manikin), or progressive (consisting of virtual reality, task trainer, and model simulator) and Simulation Comparing the cost-effectiveness of the methods: peripheral intravenous catheterization training was applied to compare the outcomes in terms of results. The analyzes of this study show that a progressive program that strategically combines simulation methods provides a cost-effective solution. More generally, it indicates how cost-effectiveness analysis can be implemented to simulation training and a method medical educators can use in investment decisions. Maloney and Haines (2016) aimed to provide information about cost-benefit and cost-effectiveness problems for simulation in health professions education. As a consequence of this study, cost and value measures in simulation show the necessity of providing information about the feasibility and sustainability of simulation education and to ensure that simulation education demonstrates its value in health services. In this study, which aims to provide general information about the challenges and opportunities in the implementation of economic evaluation in simulation-based medical education by Lin et al. It is concluded

that it can help them determine the most appropriate use of resources when choosing a training program, as well as inform the allocation of scarce resources within an education program and broader decision-making between education and clinical care. Dr. In a quantitative meta-analysis study William etc. (2012) spanning twenty years from 1990 to 2010, it was aimed to compare the effectiveness of traditional clinical education towards skill acquisition goals with simulation-based medical education (SBME) and practial (DP). As a consequence of this study, it was concluded that more research on the inclusion of SBME in medical education with DP (practical) is necessary to increase its power, benefit and cost-effectiveness. Kamel etc. (2018) evaluated the experience and opinions of program managers regarding the current use of current urology simulators, it was concluded that most of the urology program managers agreed to include a simulation-based curriculum in urology education.

In Stefanidis etc. (2015) study, which was conducted to review the current status of simulation use in surgery and to guide future research and application of evidence-based findings, Future research in surgical simulation should focus on demonstrating the cost-effectiveness of SBT and its impact on patient outcomes, it was also concluded that effective practice strategies need to be developed to more widely incorporate surgical best practices and current simulation curriculum. As a consquence, Ryall etc. (2016) examined the Nursing and Related Health Literature, simulation of technical skills in health vocational education to determine the scope of research studies published in English between 2000 and 2015; simulation has now entered health professional education and it is seen that simulation-based assessments can be used effectively. Rahej etc. (2014) conducted a literature review of the studies published between 1999-2014, to identify and review available simulators for prostate surgery and to search for evidence supporting their validity for educational purposes. It was concluded that more research is needed to determine the importance of the simulators than others and to evaluate the cost-effectiveness of the simulators and the transferability of the learned skills.

As a result of Brindle etc. (2011) study to review the literature on the effects of simulation training in CVC on learner and clinical outcomes, by increasingly teaching central venous catheterization (CVC) by simulation, the evidence suggests that simulation-based training for CVC may be beneficial, despite some limitations in the reviewed literature. Demonstrates benefits in learning and selected clinical outcomes. Dettinger etc. (2016) aimed to evaluate the impact of a low-tech simulation-based training plan for obstetric and

perinatal emergency management on non-emergency delivery practices in primary care clinics in Guatemala. For this, a cross-sectional birth observation study was conducted with a matched sample from 18 clinics (nine couple intervention and control clinics) between 28 June and 7 August 2013. The results of the study show that the use of a low-tech simulation-based training plan (PRONTO) improves non-emergency maternity care by increasing evidence-based practice, patient-centered care, and teamwork.

A review was conducted to validate and evaluate performance measures from a new neurosurgical simulation model using the Current Standards framework of Rooney, Sagher etc. (2016). Positive evidence using existing standards in this study supports combining the new simulator and both tools for skills training and performance evaluation, but it is concluded that challenges (potential threats to validity) need to be considered prior to implementation. Ruder etc. (2017) conducted a study to determine the effectiveness of a hands-on training session in reducing drill depth in an orthopedic drilling technique training model during a surgical simulation and to determine the effectiveness of elderly residents giving a hands-on training session in orthopedic drilling. In this review, a total of 13 participants (5 orthopedic trainees and 8 medical students) were drilled until the distal cortex of a synthetic bone model was penetrated, and the depth of penetration (PD) was measured. This study demonstrated a significant reduction in drilling PD through the use of a low-cost training model and a formal didactics and skills session on proper drilling technique that can be effectively managed by older residents. Ven etc. (2017) as a method; A model-based cost-effectiveness analysis was performed to evaluate four strategies for obstetric team training from a hospital perspective. This study is frequently carried out in team training obstetrics.

It is aimed to evaluate the cost-effectiveness of obstetric multi-professional team training in a medical simulation center. In the study, it was concluded that multi-professional team training in the Medical simulation center is cost effective in a scenario where repetitive training sessions are carried out in the field. Kothari etc. (2017) conducted a review that aims to discuss the challenges and costs involved in developing a successful simulation and training centre, laboratory, or onsite program, and the return on investment of SBME as it relates to patient safety, cost savings, and improved patient care. In this study, it was concluded that hospitals should adopt simulation-based medical education and support the development of simulation centers for SBME to be an integral part of its mission to provide the best possible care to patients. Zendejas etc. (2010) in a systematic search of MEDLINE,

EMBASE, CINAHL, ERIC, Psych INFO, Scopus, major journals, and previous review bibliographies up to May 2011 in scope quantified studies involving the economic analysis of SBME for education of healthcare students and trying to summarize its quality. In this study, it was concluded that a comprehensive model for accounting and reporting costs in SBME can be proposed, as cost reporting in SBME studies is sparse and incomplete.

5. CONCLUSION

Scientific studies evaluated within the scope of this study support that simulation-based education applications provide clinical and economic benefits to the budget and that there is a positive relationship between them. In addition, it is seen that simulation studies will continue to increase, as simulation applications have a positive effect on increasing patient satisfaction by providing significant savings in the costs of health enterprises thanks to the improvements made in hospital processes. On the other hand, although there are many studies abroad on both simulation-based education implementations and the economic and clinical benefits of simulation practices to the budget, it has been determined that there are very few studies in our country.

Particularly, the increase in the expectations of health service recipients from health institutions and the questioning of the quality of the service provided, as well as the medical errors that occur during treatment in health institutions, have led educators to new searches for the methods and technologies used in medical education. Thus, it is thought that educational simulation applications will be useful in creating the educational infrastructure that will eliminate the gap between the education given in schools and the practices in the clinical environment and provide interaction.

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