Effect of Virtual Reality Intervention on Labor Pain and Maternal Childbirth Satisfaction

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Abstract

Background: Labor pain is a highly distressing physical sensation that women experience during their lifetime. Maternal childbirth satisfaction is one of the important indicators of the quality of the care provided. The use of non-pharmacological therapies can make the childbirth process a pleasurable event for the mother. Virtual reality (VR) is a non-pharmacological approach utilized to alleviate pain. **Aim of the study**: to evaluate the effect of virtual reality intervention on labor pain and maternal childbirth satisfaction. **Design:** A quasi-experimental design was used. **Setting:** This study was conducted at the labor unit of Sohag University Hospital, Egypt. **Sample**: A convenient sample of 100 laboring women was equally divided into two groups (control group: 50 laboring women and intervention group: 50 laboring women). **Tools**: Data was collected through four tools, (I) A structured Interview Schedule, (II) A Numerical Pain Rating Scale (NPRS), and **(III) a** Virtual Reality Satisfaction questionnaire**. Results**: This study found no statistically significant difference regarding labor pain intensity before intervention among the virtual reality (VR) and the control group, while there was a highly statistically significant difference regarding labor pain intensity after the first intervention. Moreover, laboring women in the intervention group (VR) were more satisfied by using virtual reality. **Conclusion**: This study concluded that virtual reality intervention significantly reduced labor pain and also achieved satisfaction of laboring women with using it. **Recommendations**: Trials for including virtual reality as a one of routine hospital care during childbirth to reduce labor pain and improve maternal childbirth satisfaction.

Keywords: Labor pain, Maternal childbirth satisfaction, Virtual reality.

Introduction:

The process during which the viable products of conception are expelled from the uterus through the vagina is known as labor. According to **Sakala (2020**), labor is a clinical process that is characterized by the ejection of the fetus and placenta after 20 weeks and 500 g, as well as contractions that cause cervical dilatation and effacement and get progressively stronger. Labor can be broken down into four stages. Labor pain is the most severe pain experienced by humans, and it is a horrible feeling that is typically restricted to the back and abdomen. Behavioral, sensory, cognitive, and physiological reactions are all impacted by labor pain. In addition to physiological and anatomical aspects, pain is also influenced by psychological and sociocultural variables. The main objective of labor pain is to make the lady more cooperative with her own body during labor (**Graber, et al., 2020).**

One of a woman's greatest illnesses during her life is childbirth. **Akin et al., (2021; Carus et al., 2021; Ebrahimian & Bilandi, (2021)** describe it as a close-knit process with a physiological problem that is also greatly influenced by cultural norms and behaviors. Women in labor endure labor pain almost universally, while each woman's threshold for this pain is different. Many physiological and psychological variables interact in a complex way to determine this threshold **(Pratiwi et al., 2017; Wu et al., 2020).**

The three stages of labor (dilation of the uterus, delivery of the fetus, and delivery of the placenta) are associated with the highest pain level, which persists longer than acute pain. Extreme pain during labor can cause detrimental physiological changes, including

increased neuroendocrine stress, maternal acidemia, and protracted labor, even though labor pain is a normal part of the process. As a result, it's essential to reduce discomfort to a manageable level within safe bounds. While it has been demonstrated that epidural analgesia, the most popular type of pain treatment during labor, is safe and efficient, it is linked to longer labor durations and a higher need for surgical interventions (**Smith et al., 2021**). Furthermore, the cognitive and emotional aspects that greatly impact pain are not addressed by pharmaceutical analgesia. Therefore, using non-pharmaceutical pain treatment techniques is advised by the World Health Organisation (**WHO, 2018).**

Certain nonpharmacological approaches to pain management, such as aromatherapy and music, have been created to lessen the need for analgesic medications; nevertheless, they have drawbacks, including a steep learning curve and inconvenience. A popular technique used during medical operations is distraction, which effectively lowers pain (**Chow et al., 2021**). By combining computer technology and virtual reality (VR), which creates an inventive, dynamic, and immersive 3D virtual environment, people can be distracted from outside stimuli and encouraged to think positively. By separating attentional tasks to lower the intensity of attention to pain, virtual reality (VR) enables users to interact with a realistic 3D virtual environment while activating numerous perceptions **(Son et al., 2021).**

Virtual reality (VR) is proving to be a safe and effective alternative strategy for treating burns, acute pain, and adults, with growing evidence to support its efficacy as a distraction intervention. Acute pain, on the other hand, is not the same as labor pain, which is generally more intense and is linked to strong emotions. Whereas persistent pain is linked to widespread damage, intermittent discomfort occurs during uterine contractions (**Goodman et al., 2022**). Thus, while VR is a useful treatment for chronic pain as well, it is inappropriate to apply the results of meta-analyses that looked at VR's capacity to reduce overall pain to labor in women. To present, clinical trials have been small-scale due to the constraints of VR equipment and the quantity of research, and variations in experimental design have contributed to controversial findings **(Mallari et al., 2019).**

Non-pharmacological therapies such as virtual reality aid in ensuring a safe labor process and a favorable result. In place of analgesia during labor, non-pharmacological therapies such as birthing balls, reflexology, heat and cold therapy, transcutaneous electrical nerve stimulation (TENS), aromatherapy, hydrotherapy, and virtual reality (VR) can help the woman manage her pain complaints. Non-pharmacological therapies are applicable, affordable, safe, and reduce drug requirements in addition to relieving pain and reducing anxiety and panic. They also enhance the pace of labor (**McLaughlin & Lyons, 2020).** Through the use of a computer-stimulated approach that produces a visual image with accompanying audio, virtual reality (VR) is a non-pharmacological therapy and a distraction intervention to create a pleasant environment. Users wear a headset that is connected to a computer or smartphone. Through the ability to hear, feel, and interact with elements in a virtual environment as if they were real, this technology reduces pain and anxiety **(Linowes, 2020).**

Per the neuromatrix theory of pain, an individual's perception of pain can be altered, and ultimately, their response to it, by cognitive, sensory, and affective inputs as well as factors that influence those inputs, such as attention. Therefore, a person's limited capacity to process or attend to anything remains when they are using their cognitive resources to engage in a task such as watching or playing something through virtual reality (VR), providing them with visual and auditory sensory stimulation, or providing them with positive affective experiences through success or enjoyment (**Ahmadpour, et al., 2020**). One of the incredible medical applications of VR is pain alleviation. Virtual reality (VR) is entertaining, safe, and efficient, and it reduces anxiety while simplifying difficult circumstances and difficulties. Virtual reality technology has the potential to enhance patients' quality of life and satisfaction with their care (**Li et al., 2017**).

Virtual Reality (VR) is an innovative computer-simulated technique that involves the

utilization of a headset, which is connected to either a computer or a smartphone, to provide a visual image that is accompanied by sounds. This particular technology assuages both pain by incorporating a multitude of sensory distractions, including visual and auditory stimuli, as well as other sensory experiences. The employment of a head-mounted display (HMD), headphones, and a joystick for head tracking, music, manipulation, and navigation respectively, enables an individual to engage as an active participant within the simulated realm. This immersive experience enables the individual to perceiveand engage with stimuli in a manner that closely resembles the actual world, as well as communicate with them **(Linowes, 2020; Momenyan et al., 2021; Wu et al., 2020).** Viewing scenic imagery may also help to lessen pain perception because it elicits positive emotional responses **(Jahani Shoorab et al., 2015; Momenyan et al., 2021).**

The efficacy of pain relief is not necessarily associated with maternal satisfaction and many women strive for a natural birth, avoiding or delaying the use of pharmacological methods, such as epidural analgesia, and instead use nonpharmacological methods together with pharmacological methods (**Hodnett, 2019**). The use of non-pharmacological methods of pain relief in labor, designed to foster physiological birth, has a variety of benefits than purely the attenuation of pain (**Lindholm & Hildingsson, 2019**). To analyze women's perceptions of pain, nurses must record, appraise, and provide choices for pain control, including information regarding hospital-use pain relief techniques. Women's happiness with the therapy, the assessment of the treatment's adverse effects on the mother and fetus, and the adjustment of the care plan as necessary are also included.

Significance of the study

Many pregnant women are discouraged from choosing a vaginal delivery over a normal one by labor pain. According to the idea that pain is the primary factor driving the increased rate of cesarean sections (CS), both locally and globally (Lima, et al., 2019). One of the main objectives of intrapartum care and a crucial component of obstetric treatment is the management of labor pain. While it is not possible to completely suppress labor pain, several pain management techniques can be used to lessen the severity and duration of pain as well as its aftereffects. Numerous physiological and psychological changes associated with labor pain, such as tachycardia, elevated blood pressure, elevated anxiety and stress, decreased intestinal motility and urine output, mood swings, and noticeable agitation, are suggestive of maternal discomfort **(Lyons & McLaughlin, 2020).**

Users of virtual reality intervention can escape reality by submerging themselves in a computer-generated virtual environment. This type of therapy does not include the use of drugs. The goal of virtual reality (VR) is to better regulate pain by diverting the patient's attention from pain and toward other stimuli. **Rezai et al. (2016**) suggest that this approach may be beneficial for mitigating pain and alleviating any discomfort that may arise post-labor. VR can be utilized as a self-management tool for pain reduction and is an economical, safe, and efficient way to treat pain and anxiety (**Tacgin, 2020**). So, the study aimed to evaluate the effect of virtual reality intervention on labor pain and maternal childbirth satisfaction.

Aim of the study:

This study aimed to evaluate the effect of virtual reality intervention on labor pain and maternal childbirth satisfaction.

Study Hypotheses:

H1: Laboring women who use virtual reality experience less labor pain levels than those who don't use it.

H2: Laboring women who use virtual reality experience more satisfaction levels than those who don't use it.

Operation definition of virtual reality:

A computer-generated simulation known as virtual reality (VR) allows users to interact with an artificial three-dimensional environment through the use of electrical gear like gloves with sensors or special eyewear with a screen. The consumer can experience something realistic in an artificially created environment.

Materials and Method:

Study design:

A quasi-experimental design was used to achieve the aim of this study.

Study Setting:

This research was carried out in Egypt in the labor unit at Sohag University Hospital. This particular location was chosen because of its high turnover rate and ability to offer free and reasonably priced maternity care services to any woman, regardless of whether she lives in an urban or rural area.

Subjects:

Two equal groups of fifty laboring women each—a control group of fifty and an intervention group of fifty—were created from a suitable sample of one hundred laboring women.

Tools of Data **Collection**:

Three tools were used in data collection:

Tool I- Structured Interview Schedule: It consisted of two parts:

- **Part (1)** General characteristics of the studied sample such as demographic data of laboring women such as age, education, residence, and occupation.

- **Part (2)** Obstetrical history of women such as (last menstrual date, current gestational age, number of previous abortions, andestimated delivery date).

Tool II: Numerical Pain Rating Scale (NPRS):

It was adopted by (**Beilin et al., 2003**). The numerical rating scale enables the woman to rate their level of labor pain on a scale of 0 to 10 either orally or by marking a line. It is categorized into four distinct classifications: 0 (no pain), 1-3 (mild pain), 4-6 (moderate pain), and 7-10 (severe pain). The level of pain is recorded by using a dot or symbol on the pain continuum corresponding to the time at which the pain intensity was reported.

Tool III – Virtual Reality Satisfaction Questionnaire.

This was developed by the researcher following a comprehensive review of pertinent literature. to evaluate the degree of maternal satisfaction experienced by laboring women through the application of virtual reality **(Mohamed et al., 2022).** The questionnaire is comprised of eight items that serve to elicit information regarding a range of factors, including the application's ease of use; effectiveness in reducing labor pain, the extent to which the application has generated interest, its immersive qualities, the degree of discomfort experienced when wearing a head-mounted display (HMD), the absence of any side effects, the extent to which it would be recommended for use in the future, and as a component of routine hospital care.

A satisfaction Likert scale with three points was utilized, with agree scoring 2, uncertain scoring 1, and disagree scoring 0. The total scores for the questionnaire ranged from 8 to 24, with scores of >18 indicating satisfaction, scores of 13-<18 indicating moderate satisfaction, and scores of < 13 indicating dissatisfaction.

Field Work:

Pilot study:

The pilot study was completed. Ten percent of the whole sample, or ten laboring women, were involved in the process to test the produced tools' simplicity, feasibility, clarity, and application. It also aimed to identify potential issues and roadblocks that might arise for the researchers and impede data collection. women who were part of the study's pilot project.

Tools validity:

To test the content validity, a panel of five experts—three professors of obstetrics and gynecological health nursing and two from obstetrics and gynecological medicine—examined the data collection tools in detail. No changes were made based on the panel's recommendations.

Tools Reliability:

The Cronbach's alpha coefficient test was used to assess the reliability of the tools, and the results indicated that each instrument had a moderate to high level of reliability, indicating that

the tools were composed of generally homogeneous items. Tool II (0.80), Tool III (0.71), and Tool IV (0.91) all showed reliability.

Ethical considerations:

Ethical approval was obtained from the Committee of the Faculty of Nursing, Sohag University before conducting the research. Official permission to collect data was obtained from the responsible authority of the study setting after providing a thorough explanation regarding the objectives of the study. To earn each woman's confidence and trust, the study's aim state the goals and advantages of the research before using any instruments. For each woman to take part in the study and to withdraw at any time, oral consent was obtained. Participants in this study were not at risk in terms of their health, safety, or mental health. Women participating in the study were reassured that all data would be utilized solely for research purposes and that confidentiality would be maintained throughout. Throughout the investigation, time was communicated to every participant.

Field of work:

Four stages were used to get the data. To achieve the goal of the current study, the planning, assessment, implementation, and evaluation phases were used.

I. Preparatory Phase:

The preparatory stage of the study involved a survey of relevant local and international literature regarding the different facets of the research subject, which was done by the researchers. The researchers were able to build the necessary data collection methods thanks to this, which also helped them understand the scope and gravity of the issue. Aiming to verify its appropriateness, comprehensiveness, clarity, relevance, and applicability, five experts in the field—three professors of obstetrics and gynecological health nursing and two from obstetrics and gynecological medicine—were given the tools. The jury's decision was made. In this phase, official permission to conduct the research was obtained by submitting an official letter to the director of Sohag University Hospital from the dean of the faculty of nursing at Sohag University. The letter explained the purpose of the research and included statistics on the number of laboring women enrolled in the hospital each year.

II. Assessment Phase:

The researchers visited the labor unit three times a week (on Saturdays, Mondays, and Tuesdays) from 8 a.m. to 4 p.m. to interview pregnant women in the obstetrics and gynecology department (both in the intervention and control group) to gather baseline data. At the start of each interview, the researchers greeted the women, introduced themselves, and discussed the goal and duration of the study. The researched women gave their oral informed agreement to take part in the investigation. To investigate the usefulness of virtual reality for women experiencing labor pain relief and its impact on labor outcomes, data collected during this phase served as a baseline for subsequent comparisons. For ethical reasons and to prevent intervention contamination between the two groups, the control group was evaluated first.

III. Implementation Phase:

Two groups were created from the sample: the intervention group, which included 50 women, and the control group, which included 50 women. The control group initiated the study, and then the intervention group took over. From the beginning of July 2023 until the beginning of December 2023, data were gathered at the labor unit at the obstetrics and gynecological department of Mansoura University Hospital for six months.

Control group:

- The hospital personnel provided routine treatment to the control group.

- Gathering demographic information and obstetrical history with the use of (tool I: structured interviewing questionnaire). The replies were noted in the sheet by the researchers, who posed questions in Arabic. Every woman needed between five and ten minutes to do this stage.

- Both an initial and a follow-up examination were conducted to evaluate the pain.

- At a cervical dilation of 4 cm, the

initial examination measures the pain level utilizing (tool II). It took about five minutes for each woman to finish the initial exam.

- The same cervical dilatation of 4 cm was used for the pain assessment, which was repeated after 15 minutes. The repeated assessment took around 5 minutes to be completed for each woman. The control group was provided with routine care conforming to the guidelines of the Standard of Routine Hospital Care from the time of admission until delivery such as continuous observation of the progress of labor (cervical dilatation, condition of membrane, uterine contraction, and descent of fetal head). To prevent any possibility of sample contamination, the researcher initiated the study with the control group and concluded it before the intervention group.

Women allocated to the intervention group:

- The study group provided a concise explanation from the researchers about the objectives behind the utilization of virtual reality.

▪ - Two assessments of the pain were conducted: one before the intervention (pre-intervention) and other using tools II (post-intervention).

▪ Tool II was used for the initial assessment (pre-intervention) at the cervical dilatation 4 cm level of pain. It took each woman about five minutes to complete the initial exam.

▪ Repeated evaluation (post-intervention): Pain relief is the goal of each intervention, which lasts for ten to fifteen minutes. Following a 10-to-15-minute VR intervention, cervical dilatation at 9 cm was used to measure pain where the pain is considered server at this dilatation.

▪ The technique utilized by the researchers in presenting the VR headset (Figure 1) was the tell-show-do approach. This approach involved the provision of detailed explanations on the utilization of a headset in a virtual reality setting (tell), accompanied by a simultaneous demonstration of the process of selecting and displaying various virtual environments (show), and finally, allowing the laboring woman to apply it

- Each laboring woman in the VR group was presented with a variety of virtual environments to select from, which included options such as the blue ocean, blue deep, black beginning, green meadows, blue moon, red savannah, orange sunset, red fall, and white winter, that include different natural view with calm music sound. The Nature Trek application's photos were printed out to create cards that represented these innovative immersion alternatives, and these cards were given to the laboring women to assist them in selecting their chosen setting in advance. To conduct this study, VR distraction devices that let users navigate 360-degree video and offer full replacement were used. These devices allowed users to interact with VR as if it were the real world by using mobile VR, which displayed twin stereoscopic views on the phone's display (**Pratwi, et al, 2017**). It took each woman about five minutes to complete the repeated exam. Before being used by two women together, the VR glasses were sterilized with alcohol to stop the spread of infection.

- Upon adapting the VR device headset to the appropriate size for the woman's head and precisely aligning it in front of her eyes, the chosen virtual environment, namely the 3D Aquarium VR, was subsequently implemented.

- The researchers enhanced the women to be more relaxed, so they feel as if they live in or visiting novel environments. VR device used for 20 minutes during each intervention

Third phase (Evaluation phase):

- The researchers evaluate all study variables by measuring labor pain intensity for both groups after intervention at cervical dilations (4cm) and (9cm) using tool II.

- Before discharge, a woman's satisfaction level with the intervention was measured among the intervention group using Tool III.

- Finally, A comparison was performed between the two groups to ascertain

the effect of immersive virtual reality on labor pain and maternal satisfaction levels among laboring women

Figure (1) Virtual reality headset

Administrative design:

The dean of the nursing faculty, **Sohag University** wrote an official letter to the study setting administrator requesting the appropriate official approvals for data collection. The primary data item to be covered was illustrated along with the study's title and objectives.

Statistical design:

Data was verified before computerized entry. The statistical package for Social Sciences (SPSS version 20) was used for that purpose, followed by data tabulation and analysis. Descriptive statistics were applied (e.g., mean, standard deviation, frequency, and percentages). Test of significance (t-test, chi-square). A significant level value was considered when $p< 0.05$. In addition, a highly significant level value was considered when $p<0.01$.

Results:

According to **Table 1**, the mean age of the intervention and control groups in the 18–22 year age range is 25.03±3.55 and 24.33±2.78 years respectively, making up 66% and 40% of the groups, respectively. Sixty-two percent of the intervention group and sixty-six percent of the control group were rural residents. In terms of education, it was evident that over half of the study group and the control group (54% and 52%, respectively) had completed secondary school. 50.0% and 66, respectively, of the intervention and control groups were housewives in terms of occupation. In general, there was no statistically significant difference in socio-demographic features between the intervention and control groups. That is, the two research groups are identical.

Based on their obstetrics history, **Table (2)** shows that there were no statistically significant differences between the intervention and control groups ($p>0.05$). Given that 60% and 70% of the intervention and control groups, respectively, were 39 weeks or older during gestation. Furthermore, the majority of the intervention group (90%) and control group (88%) had never had an abortion.

Figure (1): Reveals that all (100%) the studied laboring women not had previous experience about virtual reality intervention**.**

Table (3) manifests the mean distribution of laboring women according to labor pain intensity using the Numerical Pain Rating Scale (NPRS). No statistically significant difference was found between the two groups before intervention (P=0.206). Nevertheless, a highly statistically significant difference was found between them after the 1^{st}& 2^{nd} interventions where the mean labor pain score was (3.98±0.44& 6.44±0.59) for the intervention group (VR), compared to (5.07±0.77& 8.45±9.65) for the control group respectively.

Figure (2) demonstrates that following VR intervention, (56%) of study group women experienced severe labor pain at cervical dilation of 9 cm, compared to (94%) in the control group women.

Table 4 revealed a significant difference between the two groups regarding satisfaction associated with the VR intervention ($P<0.001$) (**Table 4).**

Figure (3) illustrates the percent distribution of the VR group according to their satisfaction with the intervention using the virtual Reality Satisfaction questionnaire. Fortunately, the majority (85%) of the intervention group was completely satisfied, while only 3% of them were unsatisfied with virtual realityintervention during labor.

Table (1): Demographic characteristics of studied laboring women (n= 100)

Characteristics	Control groupn=50		intervention groupn=50		Chi square test	P value
	No	%	No	%		
Age (in years)						
18-22-	3317	66.0	2030	40.9	.879	>0.05
≥26		34.0		60.0		
Mean ±SD	25.03±3.55		24.33±2.78			
Residence						
Urban-Rural	17	34.0	19	38.0	.667	>0.05
	33	66.0	31	62.0		
Educational Qualification						
Primary education Secondary school	10	20.0	9	18.0	1.27	>0.05
University education	26	52.0	27	54.0		
	14	28.0	14	28.0		
Occupational status						
Housewife	17	34.0	25	50.0	1.75	>0.05
Working	33	66.0	25	50.0		

Table (2): Obstetrics history of studied laboring women (n= 100)

Obstetrics history	Control groupn=50		ıtervention groupn=50		Chi-square test	P value
	No	%	No	%		
Gestational age in weeks						
37-	15	30.0	20	40.0	.526	>0.05
39-	35	70.0	30	60.0		
Mean ±SD	39.56±1.35		39.40±1.44			
History of previous abortion						
No	44	88.0	45	90.0	1.23	>0.05
Yes	6	12.0	5	10.0		

No a Statistical significant p >0.05

Figure (1): Distribution of laboring women according to their previous experience about virtual reality intervention.

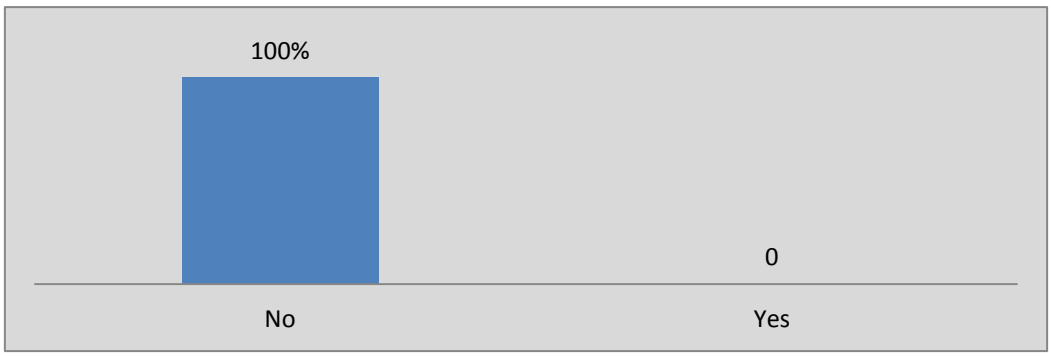


Table (3): Mean distribution of laboring women according to labor pain intensity usingthe Numerical Pain Rating Scale (NPRS)

Labor Pain	Control group (n=50)	Intervention group (VR) (n= 50)	t-test (P)
Before intervention	3.88±0.55	3.84 ±0.58	1.34 (0.206)
After the first intervention(4cm)	5.07±0.77	3.98±0.44	13.56 (0.000) **
After second intervention (9cm)	8.45±9.65	6.44±0.59	13.78 (0.001) **

t: Student t-test *: Significant at P ≤0.05 **: Highly Significant at P ≤0.05

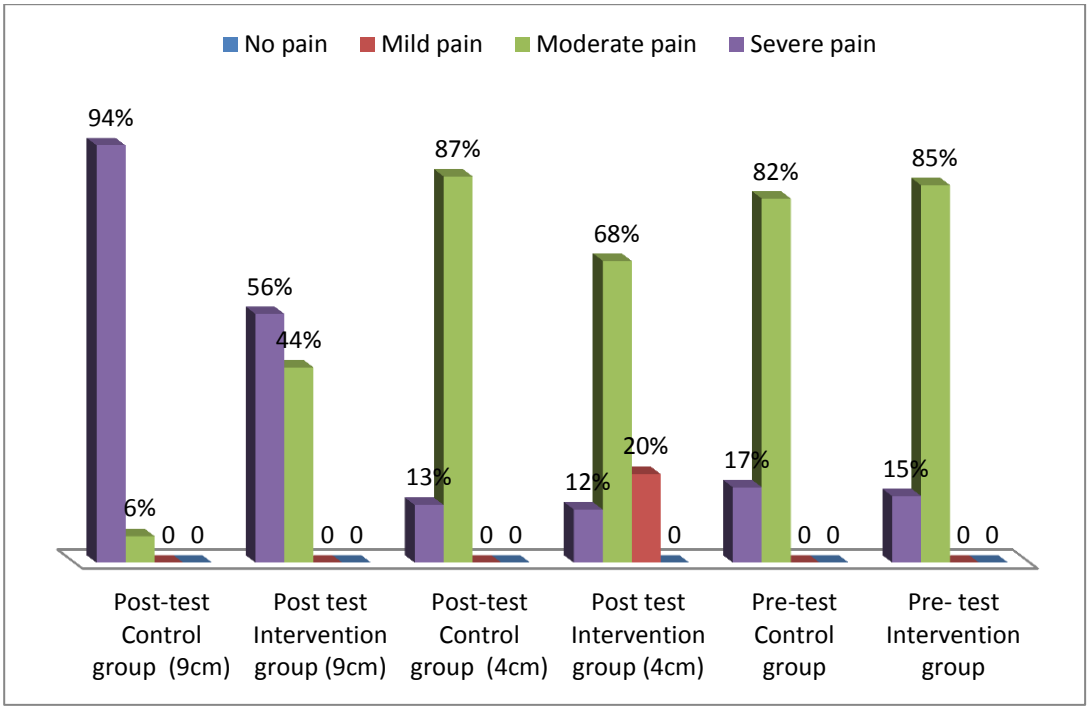


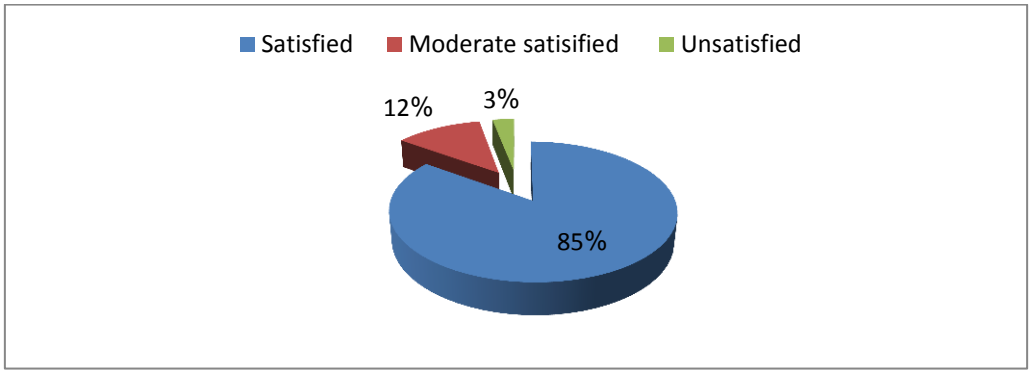
Figure (2): Level of labor pain among the studied sample after intervention (n=100)

Table (4): Mean distribution of laboring women according to their satisfaction level in both intervention and control group

Variable	Intervention group mean±SD	Control group mean±SD	P value
Satisfaction level	80.63±6.55	68.33±3.88	<0.001

t: Student t-test **: Significant at P ≤0.001

Figure (3): Intervention group distribution according to their satisfaction with virtual realityintervention.



Discussion

The physiological process of normal labor involves uterine contractions and increasing cervical dilation to remove the products of conception from the uterus (**London et al., 2021**). Labor pain has numerous physical origins and is a side effect of a regular procedure rather than an indication of harm or injury **Simkin (2020).** The use of pharmaceutical techniques to induce labor is limited by difficulties for the mother and fetus.

As a result, there is an increasing desire for less complicated, less expensive, and more easily available non-prescriptive treatments that also come with fewer problems **(Ebrahimian and RahmaniBilandi, 2021)**.

Using cognitive-behavioral strategies like virtual reality is one of the most successful non-pharmacological strategies for lowering sensitivity. To be more precise, this strategy entails shifting the person's attention from an uncomfortable stimulus to an outside stimulus. **Indovina et al. (2018**). Virtual reality (VR) is a safe and efficient non-pharmacological strategy used to reduce labor duration, manage pain and anxiety, and increase comfort (***Gur &Apay, 2020).*** As a result, the purpose of this study was to evaluate the effect of virtual reality intervention on labor pain and maternal childbirth satisfaction.

Regarding the demographics of the intervention and control groups, the current study's analysis of mother age revealed that over three-fifths and two-fifths, respectively, of the intervention and control groups belonged to the age group of 18 to 22 years, with mean ages of 23.55±4.33 and 24.05±4.81 years. Regarding educational attainment, the results of this study demonstrated that over half of the intervention group and half of the control group, respectively, had completed secondary school.

More than three-fifths of both the intervention group and the control group lived in rural areas, according to the study's findings on residency. About half and over three-fifths of the intervention and control groups, respectively, were housewives in terms of their occupation. Sociodemographic traits did not differ statistically significantly between the intervention and control groups in general. Regarding sociodemographic traits, there was consistency between the two groups. This could be a result of the examined sample being chosen via a purposeful random sample. This helped the current study since it guaranteed the homogeneity of the two study populations, allowed the study's findings to be generalized, and reduced the impact of confounding variables.

The current study's results were consistent with those of **Pratiw et al. (2017**), who investigated "The effect of virtual reality on pain in women" and found no discernible differences in age or educational attainment between the intervention and control groups. This could be because the age range of the examined sample (18–35 years old) corresponds to the typical marriage age in the studied group and culture.

The findings of this study were consistent with those of **Ebrahimian & Bilandi (2020**), who examined "Comparations of the effects of chewing gum and virtual reality videos on the length of delivery stages and maternal childbirth satisfaction" and showed that there was no statistically significant difference in the demographic traits of mother age, occupation, and education. Furthermore, there was no discernible difference in the sociodemographic traits of the two groups, according to **Amiri et al.'s (2019)** research on "The effect of distraction techniques on pain and stress during labor."

Furthermore, **Gur & Apay (2020**), who discussed "The effect of cognitive behavioral techniques using virtual reality on birth pain," found that the two groups were homogeneous and that there were no appreciable variations in any of the demographic characteristics (age, occupation, or educational attainment). **Sahin & Basak's (2020)** investigation on "The effects of intraoperative progressive muscle relaxation and virtual reality application on anxiety, vital signs, and satisfaction" corroborated the findings of the current study. The findings made it clear that there was no discernible age or educational difference between the groups.

The current study's findings on obstetric history showed that there were no statistically significant differences between the intervention and control groups in terms of birth history. With a gestational age ranging from (39-weeks), three-fifths, and over two-thirds of the intervention and control groups, respectively. Regarding prior abortions, the bulk of participants in the intervention and control groups had never had one. In terms of obstetrics history, the two groups were similar. This was advantageous for the current study since it guaranteed the homogeneity of the two intervention populations, allowed the study's findings to be generalized, and reduced the

impact of confounding variables.

The study's findings were consistent with those of **Ebrahimimani & Bilandi (2020**), who found no discernible variations in gestational age across the groups. Furthermore, Gur & Pay (2020) found that the two groups exhibited homogeneity and that there were no significant differences in obstetric factors.

In addition, the current study's results corroborated those of **Wong et al., (2020**) investigation, "Virtual reality reduces pain in laboring women," which found no discernible changes in the two groups' gestational ages (p=0.41). The reliability of the current study's results to previous research may be attributed to the sample's traits being similar.

The current study's findings revealed that all (100%) the studied laboring women not had previous experience about virtual reality intervention, from the researchers' point of view; it confirmed the need for virtual reality intervention**.**

The current study's findings regarding labor pain showed that after applying virtual reality following the first and second interventions, there was a highly statistically significant decrease in the mean scores of labor pain among the intervention group (VR) compared to the control group during labor. This could be explained by the way virtual reality goggles place women in unfamiliar settings that prevent the mind from processing pain signals. This cut the pain cycle probably because the wearer was distracted and the large amount of data introduced in the simulated setting occupied their brains, making it difficult for the mind to interpret pain sensations (**Carus et al., 2021**).

Similar to **Pratiw et al. (2017**), who found a significant difference between the women's VR group and the control group, the current study's results were obtained. Moreover, **Wong et al.'s (2019)** study, "Patient-reported outcomes on the use of virtual reality for pain management in labor," discovered that VR was a useful tool for easing laboring women's discomfort. Furthermore, the research conducted by **Cowles et al., (2019)** revealed that the average pain score decreased after using virtual reality (VR) compared to previously. The scores for pain varied statistically. Additionally, **Wong et al. (2020)** discovered that both the control and intervention groups' pain scores significantly decreased.

Furthermore, **Goodier, (2020**) demonstrated that the study group experienced lower pain levels than the control group, with an average decrease of 0.52 after the study period, compared to an average increase of 0.58 in the non-headset control group. Furthermore, a study by **David et al. (2019)** titled "Virtual reality analgesia in labor: The VRAIL pilot study- a preliminary randomized controlled trial suggesting benefit of immersive virtual reality analgesia in unmediated laboring women" corroborated these findings, with the VR group showing a significant reduction in pain.

Additionally, this study's findings were consistent with those of **Amiri et al. (2019**), who found that the intervention group's labor pain intensity differed significantly from that of the control group. Furthermore, **Gur & Pay (2020**) found that the intervention group experienced much less labor pain than the control group did during the active phase of labor. The stimulation of the visual brain while using other senses may be the cause of the improvement and progression in pain levels following VR intervention. Virtual reality modifies how a person processes nociceptive stimuli (**Wong et al., 2020**). Additionally, the ability to immerse the patient in a different environment via virtual reality can have the pain-reducing effect of slowing down the patient's reaction to pain signals (**Sikka et al., 2018).**

This result is consistent with research conducted by **Araby and Abou-Elazab (2022**), who found that using virtual reality applications to divert women during labor can effectively control their pain thresholds. Immersion in virtual reality lowers pain levels and improves the overall labor experience, according to a randomized controlled trial conducted by **Carus et al. (2021)**. Furthermore, it is in line with a study by **Wong et al. (2021**), who reported that participants in the VR group saw a notable reduction in pain while those in the control group experienced an

impressive spike in pain. Compared to the control group, which did not receive any VR treatment, the results show that the use of VR was effective in reducing pain among laboring women.

Virtual reality use has been shown to have a mitigating effect on the experience of labor pain during the active phase of the first stage. Furthermore, the current finding is consistent with a randomized controlled trial by **Gür and Apay (2020),** who found that posttest mean scores of labor pain were statistically significant as a result. Additionally, it harmonizes with **Momenyan et al. (2021),** who explained that a significant reduction in sensory pain was observed in the VR group exclusively during the first stage of labor in contrast to the control group. **Cowles et al. (2019)** also observed that the pre-existing mean pain score, before the implementation of virtual reality (VR) technology, was recorded to be 2.74±2.73. Subsequently, following the use of VR technology, the pain score exhibited a decrease, with an average score of 2.35±2.67.

Furthermore, **Wong and Gregory's (2019**) study, which indicated that virtual reality (VR) is an effective strategy for reducing pain experienced by women during childbirth, is consistent with the results of the current study. The virtual reality group and the non-VR group showed statistically significant differences in pain scores during the latent and active periods of labor, according to **Pratiwi et al. (2017**). Furthermore, compared to the control group, the intervention group using the distraction strategy had a reduced average pain intensity score throughout labor, according to a study by **Amiri et al. (2019).** These study findings corroborate this finding.

The majority of women were satisfied with VR applications, according to the study's findings. Women communicated that they thought the intervention was a positive experience, easy to use, and free of any problems or negative effects. This could be explained by the effectiveness of VR applications, which have been shown to lessen discomfort.

The present results are in line with research by **El Sharkawy et al. (2022**), which shows that most women were content with virtual reality applications. The findings are consistent with those of **Ebrahimian and Bilandi (2021)**, who reported a significant difference in the degree of maternal satisfaction with the birthing process between the groups of participants exposed to virtual reality versus those who were not. The use of immersive virtual reality technology in the workplace has produced a notable degree of patient satisfaction, according to **Carus et al. (2021**). Additionally, most of the women in the VR group said that they wanted to keep utilizing this technology during labor in the future. Furthermore, the outcomes of this investigation corroborated a study by **Sridhar et al. (2020),** which demonstrated that participants generally displayed a positive experience with the VR intervention. Regarding this, **Rahman et al. (2021)** highlighted that the virtual reality group's mean score for maternal birthing satisfaction was found to be greater than that of the control group. This suggests that mother satisfaction with childbirth was positively improved by the usage of virtual reality.

Virtual Reality's Impact on Pain A total of four research investigated the impact of virtual reality (VR) on pain during childbirth (**Li et al., 2020; Liu & Wan, 2020**); three more investigated the impact of VR on pain reduction during the active period (dilated uterus, 3–10 cm) **(Akin et al., 2021; Wong et al., 2021; Gür & Apay, 2020).** Virtual reality's impact on labour pain A total of 405 patients were included in 4 trials that evaluated the impact of virtual reality on labour pain in mothers (**Li et al., 2020, Lin et al., 2021**). The research differences were quite substantial. Consequently, we separated the four investigations into two groups: a continuity VR group (in which VR was employed from the beginning of labor to the conclusion) (**Li et al., 2020)** and an intermittent VR group (where there were interruptions in the VR) (**Liu & Wan, 2020, Lin et al., 2021).**

Additionally, the current study's findings support those of **Wong and Gregory (2019**), who discovered that all laboring women prefer virtual reality intervention. In line with the current findings, **Wu et al. (2020**) also found that VR considerably increased women's overall happiness (P= 0.000).

Furthermore, the current study's findings are consistent with those of **Cowles et al. (2019**), who noted that a considerable number of women expressed a wish to use virtual reality technology for delivery experiences in the future.

These current study's findings are increasingly corroborated by **Frey et al. (2019**), who reported that the great majority of women expressed a deep appreciation for the use of virtual reality technology during labor. Virtual reality has also been shown by **Panel et al. (2022**) to be a useful method for lowering pain, raising satisfaction, and enhancing pain management during typical labor.

Satisfaction is a personal evaluation of healthcare services and providers. These assessments take into account the patient's expectations, preferences, and the actual conditions of the care they received. Increased satisfaction has been established as a goal for healthcare improvement. Satisfaction is one of the most commonly reported outcome metrics for quality of service. Administrators and healthcare professionals are becoming more and more concerned with how satisfied women are with maternity services, particularly with the care they receive during labor and delivery. According to **Sawyer et al. (2019**), a mother's and her child's health and well-being are factors that influence how satisfied a woman is with childbirth.

Expectations, desires, and the actual circumstances of the care the patient received are all taken into consideration during these evaluations. A goal for improving health care has been set, and that is increased satisfaction. One of the outcome metrics for service quality that is most frequently reported is satisfaction. The level of satisfaction that women have with maternity services, especially with the care they receive during labor and delivery, is a growing concern for administrators and healthcare professionals. A mother's and her child's health and well-being are factors that impact how satisfied a woman is with childbirth, according to **Sawyer et al. (2019).**

Additionally, the findings of our study are consistent with those of **Smith, et al. (2020**), who conducted "A randomized controlled trial to assess the feasibility of utilizing virtual reality to facilitate analgesia during external cephalic version." The study found that 88% of the women who received virtual reality (VR) said they would recommend it to a friend undergoing an external cephalic version (ECV), and 80% of the women indicated that they would use it again. This study's results, when compared to those of **Ebrahimian and Bilandi (2020**), showed a substantial difference between the control group's and the intervention group's levels of maternal birthing satisfaction. Given that non-pharmacologic therapies are non-invasive and have negligible side effects, these positive findings could be the consequence of increased interest in employing them.

Numerous research studies have shown that women's empowerment and self-control in selecting non-pharmacological ways to reduce the intensity of labor pain and the length of its phases can increase mother-birthing satisfaction **(Ganji et al., 2019 and Moghimi Hanjani et al., 2018**). Similarly, Hanjani et al. studied eighty primiparous women and found that by reducing labor pain, nonpharmacological therapies improved mothers' satisfaction. Rosen and colleagues found in their review study that greater maternal birthing pleasure was linked to lowering labor pain without having negative effects on the mother or the fetus (**Rosen, 2020**).

Our results regarding the effectiveness of watching virtual reality videos in shortening delivery length, likely due to reduced pain, are consistent with the findings of Frey and colleagues as well as Pratiw and colleagues, who demonstrated that watching virtual reality videos with 360° goggles during labor reduced pain (**Frey et al., 2019 and Pratiwi et al., 2017**).

Conclusion:

Based on the findings of the present study, it can be **that virtual reality intervention significantly reduced labor pain and also** the majority of women showed maternal satisfaction toward VR **intervention**.

Recommendations

In light of the current study findings, the following recommendations can be suggested:

- The research aims to investigate the potential benefits of integrating virtual reality into standard hospital treatment for reducing labor pain and enhancing maternal satisfaction during childbirth.
- Provide prenatal education on the advantages of virtual reality for expectant women and their infants.
- To enable a more comprehensive generalization of the findings, repeat the study with larger samples and in different environments.
- Future developments in virtual reality (VR) applications for laboring women, either as a stand-alone treatment or as an adjunct, should prioritize prehospital education, custom-tailored virtual environments that adjust to changing patient positions, and ease of use and intuitive design.

References:

Ahmadpour, N., Keep, M., Janssen, A.,Rouf, A. &Marthick, M. (2020): Designstrategies for virtual reality interventions for managing pain and anxiety in children and adolescents, JMIR, 8(1), Available at: https://preprints.jmir.org/preprint/14565. Accessed on May 1, 2019, 7 PM.

Akin, B., Yilmaz Kocak, M., Küçükaydın, Z., & Güzel, K. (2021). The effect of showing images of the fetus with the virtual reality glass during the labor process on labor pain, birth perception, and anxiety. Journal of Clinical Nursing, 30(15-16), 2301-2308.

Amiri, P., Mighafourvand, M., Esmaeilpour, K., Kamalifard, M. &Lvanbagha, R., (2019): The effect of distraction techniques on pain and stress during labor, 19:534, p; 1-9.Available at: https://doi.org/s12884-019-2683-y.

Araby, O. A.-W. A., & Abou-Elazab, R. A. (2022). Efficacy of Virtual Reality Application as a Distraction for Primiparity Women at 1st Stage of Labor on Pain and Anxiety Control.

Beilin, Y., Hossain, S., & Bodian, C. A. (2003). The numeric rating scale and labor epidural analgesia. Anesthesia & Analgesia, 96(6), 1794-1798.

Carus, E. G., Albayrak, N., Bildirici, H. M., & Ozmen, S. G. (2021). Immersive Virtual Reality Improves Labor and Delivery Experience for Women: A Randomized Controlled Trial.

Chow H, Hon J, Chua W, Chuan A. Effect of virtual reality therapy in reducing pain and anxiety for cancer-related medical procedures: a systematic narrative review. J Pain Symptom Manage 2021 Feb;61(2):384-394. [doi: 10.1016/j.jpainsymman.2020.08.016] [Medline: 32822755]

Cowles, S. D., Norton, T., Quiner, T., Hannaford, K., & Foley, M. (2019). 806: Virtual reality may decrease pain during labor. American Journal of Obstetrics & Gynecology, 220(1), S527-S528.

David, F., Melissa, B., Carrie, B., Kane, L., Afton, h., Ruth, C., Katherine, B. & Sam, S. (2019): Virtual reality analgesia in labor: The vrail pilot study- a preliminary randomized controlled trial suggesting benefit of immersive virtual reality analgesia in unmedicated laboring women, Anesthesia & Analgesia, 128(6), Available at: https:// journals. lww. com/ anesthesia-analgesia/Fulltext/2019/06000. Accessed on December 12, 2019, 7 AM.

Ebrahimian, A. &Bilandi, R., (2020): Comparisons of the effects of watching virtual reality videos and chewing gum on the length of delivery stages and maternal childbirth satisfaction, Iranian Journal of Medical Sciences, Available at: doi:10.30476/ijms.2019.82782.1119.

Ebrahimian, A., & Bilandi, R. R. (2021). Comparisons of the effects of watching virtual reality videos and chewing gum on the length of delivery stages and maternal childbirth satisfaction: A randomized controlled trial. Iranian Journal of Medical Sciences, 46(1), 15.

El Sharkawy, T. A. E.-W., Mohamed Abd-El Hady, R., Abdelhaliem Said, S., Abdel-Wahab Afifi Araby, O., & Taha Ahmed Abou-Elazab, R. (2022). Efficacy ofVirtual Reality Application as a Distraction for Primiparity Women at 1st Stage of Laboron Pain and Anxiety Control. Egyptian Journal of Health Care, 13(1), 1267-1284.

Frey, D. P., Bauer, M. E., Bell, C. L., Low, L.K., Hassett, A. L., Cassidy, R. B., Sharar, S. R. (2019). Virtual Reality Analgesia in Labor: The VRAIL Pilot Study-A Preliminary Randomized Controlled Trial Suggesting Benefit of Immersive Virtual Reality Analgesia in Unmedicated Laboring Women. Anesth Analg, 128(6), e93-e96. https://doi.org/10.1213/ane.0000000000003649

Ganji Z, Shirvani MA, Rezaei-Abhari F, Danesh M. The effect of intermittent local heat and cold on labor pain and childbirth outcome. Iran J Nurs Midwifery Res. 2019;18:298-303.

Goodier, R. (2020): Virtual reality may help relieve pain during childbirth, Reuters, Available at https:// www. Reuters. com/ article/us-health-childbirth-pain-vr/virtual-reality-may-help-relieve-pain-during-childbirth-idUSKBN2062T7. Accessed on August 24, 2019, 6 PM.

Goudman L, Jansen J, Billot M, Vets N, de Smedt A, Roulaud M, et al. Virtual reality applications in chronic pain management: systematic review and meta-analysis. JMIR Serious Games 2022 May 10;10(2):e34402 [FREE Full text] [doi: 10.2196/34402] [Medline: 35536641]

Graber, M., Jason, K. & Ray, B. (2020):Graber and Wilbur's Family Medicine Examination and Board Review, 5th, McGraw-Hill Education, Brigit Ray, p; 331.

Gur, E. &Apay, S., (2020): The effect of cognitive behavioral techniques using virtual reality on birth pain, Midwifery, 91. Available at: https:// doi. org/ 10. 1016/j.midw.2020.102856.

Hodnett E. (2019). Pain and women's satisfaction with the experience of childbirth: A systematic review. Am J Obstet Gynaecol; 186(5): S160–S173.

Indovina, P., Barone, D., Gallo, L., Chirico, A., De Pietro, G., & Giordano, A. (2018). Virtual reality as a distraction intervention to relieve pain and distress during medical procedures. The Clinical journal of pain, 34(9), 858-877.

JahaniShoorab, N., Zagami, S. E., Nahvi, A., Mazluom, S. R., Golmakani, N., Talebi, M., & Pabarja, F. (2015). The effect of virtual reality on pain in primiparity women during episiotomy repair: a randomized clinical trial. Iranian Journal of Medical Sciences, 40(3), 219.

Li ZR, Liu L, Yin YE. (2020): Effectiveness of VR glasses in primiparous delivery. Article in Chinese. China Modern Med Jun 30;27(15):246-249. [doi: 10.3969/j.issn.1674-4721.2020.15.072]

Li, L., Yu, F., Shi, D., Tian, Z., Yang, J., Wang, X. & Jiang, O. (2017): Application of virtual reality technology in clinical medicine, Am J Transl Res, 9 (9), p; 3867-3880.

Li, Y., Zheng, L., & Wang, X. (2019). Flexible and wearable healthcare sensors for visual reality health monitoring. Virtual Reality & Intelligent Hardware, 1(4), 411-427.

Lima, TR., Silva, FM., Negreiros, FD., Santos, JD., Moura, MA., Gouveia, MT., & Jorge, HM. (2019): Scientific evidence on non-pharmacological

Lin YY, Tao JJ, Ye XM, Sun XM, Hu SL. (2021): The value of virtual reality-based labor analgesia during labor. Article in Chinese. Maternal and Child Health Care of China;36(11):2483-2485. [doi: 10.19829/j.zgfybj.issn.1001-4411.2021.11.012]

Lindholm A, Hildingsson I. Women's preferences and received pain relief in childbirth – A prospective longitudinal study in a northern region of Sweden. Sex Reprod Healthc 2019; 6: 74–81.

Lindholm A, Hildingsson I. Women's preferences and received pain relief in

childbirth – A prospective longitudinal study in a northern region of Sweden. Sex Reprod Healthc 2019; 6: 74–81.

Linowes, J. (2020). Unity 2020 virtual reality projects: Learn VR development by building immersive applications and games with Unity 2019.4 and later versions. Packt Publishing Ltd.

Linowes, J. (2020): Unity 2020 Virtual Reality, 3rd, Packt Publishing, Birmingham, p; 10.

Liu X, Wan L. (2020): Effectiveness of virtual reality technology in reducing pain and anxiety during natural childbirth in primiparous women. Article in Chinese. Chinese General Practice Nursing Jul;18(21):2668-2670. [doi: 10.12104/j.issn.1674-4748.2020.21.011]

London. M, Galan. H, Jauniaux. E, Driscoll. D, Berghella. V, Grobman. W, Kilpatrick. S & Cahill. A, (2021): Gabbe's obstetrics Normal and problem pregnancies, 8th, ELSEIVER, Canada, p; 203.

Lyons, P. & McLaughlin, N. (2020): Pain management in labor, Springer Link, p;173-176. Available at: https:// link. springer. com/chapter/10.1007/978-3-030- 39888. Accessed on October 2, 2020, 4 AM.

Mallari B, Spaeth EK, Goh H, Boyd BS. Virtual reality as an analgesic for acute and chronic pain in adults: a systematic review and meta-analysis. J Pain Res 2019 Jul 03;12:2053-2085 [FREE Full text] [doi: 10.2147/JPR.S200498] [Medline: 31308733]

McLaughlin, N. & Lyons, P. (2020): Obstetrics in Family Medicine, 3rd, Springer, Switzerland, p; 174.

Moghadam, A., Delpisheh, A., Rezaeian, M., Khosravi, A., (2020): Factors affecting the labor, Biomedical and Pharmacology journal, 6(2), p; 161-167.

Moghimi Hanjani S, Mehdizadeh Tourzani Z, Zeighami Mohammadi S, Nasrollahi S, Haghighi Khoshkho N, Tajvidi M. The Effectof Local Heat Therapy Method on Pain, Child- birth Outcomes, and Rate of Satisfaction in Primiparous Women: Randomized Clinical Trial. Qom University of Medical Sciences Journal. 2018;12:35-43. doi: 10.29252/ qums.12.5.35. Persian.

Mohamed, H. A. O., Sweelam, M. Y. M., Mohamed, S. H., Mohamed, A., Abuzaid, A.-A., Abd Elkhalek, N. K., & Mohamed, N. H. A. (2022). Effect of Virtual Reality Application on Pain and Anxiety among Primiparous Women with Episiotomy.

Momenyan, N., Safaei, A. A., & Hantoushzadeh, S. (2021). Immersive virtual reality analgesia in un-medicated laboring women (during stages 1 and 2): a randomized controlled trial. Clinical and Experimental Obstetrics & Gynecology, 48(1), 110-116.

Panel S., Khalid K., Ehab B., Waleed H., Ali A., Khaled M., Zainab S., Mohamed Abdelsattar Mohamed e, Hamdi Mohamed Ali e, Abd Elhalim M., & Mohamed S. (2022): The impact of virtual reality on pain management during normal labor: A systematic review and *meta*-analysis of randomized controlled trials, Sexual & Reproductive Healthcare, Volume 32, June 2022, https://doi.org/10.1016/j.srhc.2022.100720.

Pratiw, I., Husin, F., Ganeim, A., Susiarno, H., Arifin, A. &Wirahkusuma, F. (2017): The effect of virtual reality on pain in primiparity women, International Journal of Nursing and Health Science, 4(4), p; 64-50.

Rahman, W. K. S. A. E., Soliman, H. A. E., & Saber, N. M. (2021). Effect of virtual reality application on the delivery stages length and maternal satisfaction. International Journal of Health Sciences, 5(S1), 58 2-596. https://doi.org/10.53730/ijhs.v5nS1.13908

Rezai, MS., Goudarzian, AH., Koulaee, AJ. &Nesami, MB. (2016): The Effect of Distraction Techniques on the Pain of Venipuncture in Children, J Pediatr Rev, 5(1), p; 2.

Rosen MA. Nitrous oxide for relief of labor pain: a systematic review. Am J Obstet Gynecol. 2020;186:S110-26.

Sahin, G. &Basak, T. (2020): The effects of intraoperative progressive muscle relaxation and virtual reality application on anxiety, vital signs and satisfaction, Journal of Perianesthesia Nursing, 35(2020), available at https://doi. org/ 10.

Sahin, G., & Basak, T. (2020). The effects of intraoperative progressive muscle relaxation and virtual reality application on anxiety, vital signs, and satisfaction: A randomized controlled trial. Journal of PeriAnesthesia Nursing, 35(3), 269-276.

Sakala, E.P. (2020): Obstetrics and Gynecology, 1st, Kaplan Medical, New York, p; 1-4.

Sawyer, A., Ayers, S., Abbot, J., Gyte, G., Rabe, H. &Duley, L. (2019): Measures of satisfaction with care during labor andbirth, BMC Pregnancy and Childbirth, 13:108, Available at: https://www. Biomed central. com/1471-2393/13/108. Accessed on August, 52019, 7 PM.

Sikka, N., Shu, L., Ritchie, B. &Pourmand, A. (2018): Virtual Reality-Assisted Pain, Anxiety and Anger Management in the Emergency Department, Annals of Emergency Medicine, 72(4s), p; 117.

Simkin. P, (2020): The Birth Partner's Quick Reference Guide and Planner: Essential Labor and Childbirth Information for a New Mother's Partner and Helpers, 3rd, Harvard Common, USA, p; 54.

Smith A, Laflamme E, Komanecky C. (2021). Pain management in labor. Am Fam Physician Mar 15;103(6):355-364 [FREE Full text] [Medline: 33719377]

Smith, V., Warty, R., Kashyap, R., Neil, P., Adriaans, C., Nair, A., Krishan, S., Costa, F., Vollenhoven, B. & Wallace, E. (2020): A randomized controlled trial to assess the feasibility of utilizing virtual reality to facilitate analgesia duringexternal cephalic version, Scientific Reports, 10:3141, available at https:// doi.org/10.1038/s41598-020-60040-3. Accessed on September 2, 2019, 6 PM.

Son H, Ross A, Mendoza-Tirado E, Lee LJ. Virtual reality in clinical practice and research: viewpoint on novel applications for nursing. JMIR Nurs 2022 Mar 16;5(1):e34036 [FREE Full text] [doi: 10.2196/34036] [Medline: 35293870]

Sridhar, A., Shiliang, Z., Woodson, R., & Kwan, L. (2020). Non-pharmacological anxiety reduction with immersive virtual reality for first-trimester dilation and curettage: a pilot study. The European Journal of Contraception & Reproductive Health Care, 25(6), 480-483.

Tacgin, Z. (2020): Virtual and Augmented Reality, 1st, Cambridge Scholars Publishing, Newcastle, p; 16.

Wong, M. S., & Gregory, K. D. (2019). Patient-reported outcomes on the use of virtual reality for pain Management in Labor[17E]. Obstetrics & Gynecology, 133, 55S.

Wong, M. S., Spiegel, B. M., & Gregory, K.D. (2021). Virtual reality reduces pain in laboring women: a randomized controlled trial. American Journal of Perinatology, 38(S 01), e167-e172.

Wong, M., Spiegel, B. & Gregory, K. (2020): virtual reality reduces pain in laboring women, American Journal of Obstetrics & Gynecology, Available at: https://doi. org/10.1055/s-0040-1708851. Accessed on May 18, 2019, 6 AM.

Wong, Spring, M., Gregory & Kimberly, D. (2019): Patient-reported outcomes on the use of virtual reality for pain management in labor, The American College of Obstetricians and Gynecologists, Available at: https:// journals. www. com/ greenjournal/Abstract/2019/05001.

World Health Organization. WHO recommendations: Intrapartum care for a positive childbirth experience. Geneva; Switzerland: World Health Organization; 2018. methods for relief of labor pain, Scielo, 32(3).

Wu, H., Zhu, B., & Jiang, P. (2020). The Relationship between Virtual Reality Technology and Anxiety State of Parturient Women with Labor Pain. Science Insights, 35(5), 236-243.