

# Use of virtual reality during venipuncture procedures in hospitalized children: a descriptive study

Uso da realidade virtual durante a punção venosa em crianças hospitalizadas: estudo descritivo

Uso de realidad virtual durante la venopunción en niños hospitalizados: estudio descriptivo

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## ABSTRACT

**Objective:** To describe the use of Virtual Reality during venipuncture procedures in hospitalized children. **Method:** A descriptive study with a quantitative approach, carried out through observation of venipuncture procedures in children using Virtual Reality glasses at a pediatric inpatient unit of a hospital in the Northwest region of Paraná. The data were collected from August to September 2019. **Results:** A total of 16 children were observed, aged between four and eight years old and who were subjected to the procedure along with use of the glasses. The pain scores were predominantly mild in both age groups and the most evident psychomotor behavior was minor discomfort. **Conclusion:** The study showed that the punctures performed using Virtual Reality presented mild pain scores and that, in terms of pain management, its use can be a beneficial alternative within pediatric care in the performance of painful procedures.

**Descriptors:** Pediatric Nursing; Pain Management; Virtual Reality.

## RESUMO

**Objetivo:** Descrever o uso da realidade virtual durante a punção venosa em crianças hospitalizadas. **Método:** Estudo descritivo, de abordagem quantitativa, realizado por meio de observação da punção venosa em crianças em uso de óculos de realidade virtual, em uma unidade de internação pediátrica de um hospital da região noroeste do Paraná. Os dados foram coletados no período de agosto a setembro de 2019.

**Resultados:** Foram observadas 16 crianças com idades entre quatro e oito anos que receberam o procedimento concomitante ao uso dos óculos. Os escores de dor foram predominantemente leves em ambas as faixas etárias e o comportamento psicomotor mais evidenciado foi um desconforto pequeno. **Conclusão:** O estudo demonstrou que as punções realizadas com o uso da realidade virtual apresentaram escores de dor leves e no tangente ao manejo da dor, seu uso pode ser uma alternativa benéfica dentro da assistência pediátrica na realização de procedimentos dolorosos.

**Descritores:** Enfermagem Pediátrica; Manejo da Dor; Realidade Virtual.

## RESUMEN

**Objetivo:** Describir el uso de la realidad virtual durante la venopunción en niños hospitalizados. **Método:** Estudio descriptivo, con enfoque cuantitativo, realizado mediante la observación de la venopunción en niños que usaban lentes de realidad virtual, en una unidad de hospitalización pediátrica de un hospital en la región noroeste de Paraná. Los datos se recolectaron de agosto a septiembre de 2019.

**Resultados:** se observaron 16 niños de cuatro a ocho años que recibieron el procedimiento concomitantemente con el uso de lentes. En ambas franjas etarias predominaron los puntajes de dolor leves y el comportamiento psicomotor más evidente fue el malestar leve. **Conclusión:** El estudio demostró que las punciones realizadas durante el uso de realidad virtual presentaron puntajes de dolor leve y en lo que respecta al manejo del dolor, su uso puede ser una alternativa beneficiosa dentro de la atención pediátrica en la realización de procedimientos dolorosos.

**Descritores:** Enfermería Pediátrica; Manejo del Dolor; Realidad Virtual.

## INTRODUCTION

Hospitalization of a child is a challenging time, as it can generate uncomfortable experiences, bring about feelings related to anxiety and trigger future traumas. Thus, it becomes necessary that the assistance provided during hospitalization aims, in addition to restoring children's physical and emotional health, at minimizing the deleterious effects of this period<sup>(1)</sup>.

Bonding with the child and his/her legal guardian during the interventions and procedures is one of the most important duties of the nurse who works directly in the pediatric area. Such a relationship is essential to alleviate the feeling of lack of control and fear arising from the interventions, in addition to serving as support during stressful situations<sup>(2)</sup>.

Another complex activity in pediatric hospitalization is pain assessment. It is known that it must be checked together with the vital signs, but it is still considered a laborious process, as pediatric patients can have difficulties describing their perceptions clearly, or even be unable to express their discomfort<sup>(3)</sup>.

One of the painful and frequent procedures is Intravenous Therapy (IVT). In this therapy, pain comes from the insertion of peripheral catheters in one of the blood vessels, in addition to the fixation, maintenance, drug administration and removal when their use is no longer indicated, or due to expiration date according to the institution's criteria and, also, due to accidental loss of the access<sup>(4)</sup>.

Although IVT is a crucial element in the arsenal of care measures for hospitalized children, its use generally culminates in a stressful, difficult and painful event, translated by this population into a feeling that refers to a constant state of alert, added to distrust, stress, fear, anxiety and physical pain<sup>(5)</sup>.

As a technological resource to help reduce discomfort and tensions, there is the possibility of using Virtual Reality (VR). VR consists of an innovative method, in which, with the aid of a helmet, glasses, gloves or a joystick and with voice or movement commands, it becomes possible to provide multisensory information, allowing the user to have a three-dimensional perception and a sensation of acting and living within that place in real time, providing distraction of the senses from the real environment<sup>(6)</sup>.

To the present day, VR has been applied within the pediatric population in the care of burn patients, especially during dressing exchanges.

In addition to helping reduce pain, its use also assists in the reduction of other physiological parameters, such as heart rate. VR can also minimize emotional discomfort, acting directly on anxiety and reducing the time the individual spends thinking about pain. At the same time, it also promotes fun in children, even with the possibility of reducing the hospitalization time<sup>(7)</sup>. In view of the difficulties that permeate pediatric care regarding adequate pain management from its evaluation and the fact that technological approaches are a promising strategy in this scenario, the current study set out the objective of describing the use of Virtual Reality during venipuncture procedures in hospitalized children.

## METHOD

### Study design and locus

This is a descriptive study with a quantitative approach, according to the recommendations set forth in the STROBE instrument<sup>(8)</sup> for observational studies, recommended by the Equator Network, developed at a pediatric inpatient unit of a medium-sized hospital in the Northwest region of Paraná.

### Inclusion and exclusion criteria

To define the sample, intentional non-probabilistic sampling was used, in which the researcher intentionally defined which children would be part of the study according to the previously determined inclusion and exclusion criteria. A pilot test was carried out in the same unit and with the same equipment to delimit the age group of the children to be chosen, and it was evidenced that those who were between four and eight years old showed better acceptance and identification with the equipment used when compared to those who were less than four years old. The children of this pilot test were excluded from the study. The following inclusion criteria were established: time since admission to the pediatric unit greater than 24 hours, indication of venipuncture for collection of exams and/or drug administration, and age between four and eight years old. The minimum hospitalization period was established with the objective of mitigating possible feelings and traumatic reactions related to the hospitalization need and moment, adaptation to the unit's routines and contact with the professionals. It is noted that, in some cases, it was the child's first puncture in the institution, as some children received only oral medications and, later on, re-

quired intravenous medications or serum therapy. Children who presented altered levels of consciousness as a result of the pathology that led to their hospitalization and/or instability of vital signs during the collection period were excluded.

### Instruments for data collection

VR BOX Virtual Reality glasses, model C-62 (Figure 1), and a Motorola cell phone, model Moto G6 Plus, were used, coupled directly to the glasses, and which presented the animation videos. The videos selected to be presented during the procedure were chosen from the YouTube platform and according to the child's age group. The cell phone coupled to the Virtual Reality glasses was used instead of using the tablet, as the latter is considered only as a screen, while the VR system has hardware, that is, headphones, glasses, gloves, mobile devices and, in some cases, computers; therefore, it is noted that this is more complex and sophisticated than a tablet. The environment reproduced by the VR glasses is holographic; even if it is to watch a video available online, it manages to provide interaction between the user and the image presented<sup>(9)</sup>. The glasses used can be seen in the figure below: The videos were chosen according to the child's personal taste; therefore, it was a random choice, as long as it was within the appropriate age group and there was parental consent. The four- and five-year-olds chose the video called "Children's songs from Joãozinho's Channel - Little Angel" and the six- to eight-year-olds selected "Multi-verse Voyage - Minecraft 360°".

The instrument used to assess the child's behavior during the procedure was the Face, Legs, Activity, Cry and Consolability (FLACC) scale. The scale was developed in 1997 and is intended to assess pain even in children with verbal difficul-

ties or speech impairments, although it is not a choice restricted to this population segment. In 2002, the scale was reviewed and started to be called FLACC<sub>r</sub>, with the letter "r" meaning "Revised". FLACC<sub>r</sub> presents five assessment categories with scores that, when added up, vary between zero and ten. Its classification consists in mild pain (from 0 to 3), moderate pain (from 4 to 6) and intense pain (from 7 to 10)<sup>(10)</sup>. The scale was translated into Portuguese and subjected to a transcultural adaptation process in 2015<sup>(11)</sup>.

### Data collection period and systematic procedure

Data collection took place from August to September 2019 according to the following systematic procedure: identification of the child according to the inclusion criteria; preparation of the material for the venipuncture procedure; referral and welcoming of the child and mother in a reserved room, aimed at carrying out medical and nursing procedures; provision of relevant and pertinent information to the study both to the child's legal guardian and to the child himself/herself about what would be performed; application of the Free and Informed Consent Form (FICF); survey of data related to the child's age, gender and reason for hospitalization; presentation of the VR goggles; and video selection according to the child's age group.

Subsequently, the child was placed in the supine position on the procedure table, together with the materials for venipuncture (Abocath No. 22 or 24, polifix hydrated with physiological serum, syringe with serum attached to it, dry cotton, cotton soaked in 70% alcohol, micropore tape for fixation and tourniquet) without mechanical or physical restraints and with the mother at his/her side. The researcher selected the vessel to



**Figure 1** - VR BOX Virtual Reality glasses, model C-62.

Source: Google image bank, 2022.

**Table 1** – Pain scores during the venipuncture procedure (n=16). Paranavaí, PR, Brazil, 2019

Pain scores	4-8 years old		Use of VR	
	AF	RF	AF	RF
Minimum (from 0 to 3)	11	69%	11	69%
Moderate (from 4 to 6)	4	25%	4	25%
Intense (from 7 to 10)	1	6%	1	6%
Total	16	100%	16	100%

Source: Prepared by the authors, 2019.

AF: Absolute Frequency; RF: Relative Frequency; VR: Virtual Reality.

be punctured by means of a detailed examination of the upper limbs. Choice of the puncture site is based on technical experience and on the site, which ranged from the back of the hand to the antecubital fossa. Only this person was instructed to puncture the children during the study, and two attempts at inserting the venous access were made.

The glasses with the cell phone attached were then fitted to the child's face and the video began to be shown. After a mean of 30 seconds from starting the video, the researcher initiated the venipuncture procedure.

Immediately after the beginning of the procedure, an auxiliary researcher, previously instructed on the study objectives, the use of the instruments selected and the way to apply them, observed the child's behavior according to the FLACC<sup>(10)</sup> scale, recording the score in a printed document. The values referring to the scores were calculated and distributed in a table with the aid of descriptive statistics, and the behavior and other emotions shown by the children were recorded in a field diary at the end of the entire procedure, regardless of whether the child had undergone one or two puncture attempts, as the score was calculated based on the procedure as a whole and not in isolation by each puncture. For this study, the score referring to evaluation of the face was not assigned, that is, it was quantified as zero, as the glasses limited observation of facial expressions. Subtraction of the values related to the face score was an intentional decision by the authors themselves since, due to the use of the Virtual Reality glasses, it would not be possible to have reliable access to the expressions in the child's face. It is noted that this decision became a limitation in data analysis and exerted an impact on interpretation of the results, as the scale was not applied in full; however, since this is a pioneering study, it was decided to keep it, as the behavioral pattern could be assessed. It

is suggested that, at another time when using VR glasses, the numerical scale<sup>(12)</sup> is associated with the use of the FLACC<sup>(10)</sup> scale in order to better consolidate the results. At the end of the procedure, the children were taken back in their beds. There was no calculation of the Virtual Reality use time after the end of the procedure, as use of the equipment was restricted to the venipuncture observed in the study.

### Ethical aspects

The research was submitted to the Ethics Committee of the State University of Paraná, as recommended by Resolution 466/2012 of the National Health Council, being approved by opinion No. 3,448,684 on July 10<sup>th</sup>, 2019. All the legal guardians of the children present at the data collection moment signed the FICF.

### RESULTS

A total of 16 children participated in the study: five girls (31%) and 11 boys (69%) aged between four and eight years old. The reasons that led to hospitalization were divided into two: elective surgeries (56%) and unresolved pain (44%).

The pain records assessed by the FLACC<sup>(10)</sup> scale are described in the table below:

With the exception of one child, predominance of the minimum or moderate pain scores was noticed in the age group found. In the same sense, the VR analysis alone also showed that 69% of the venipuncture procedures presented minimum scores.

In relation to the children's psychomotor behavior during the procedure, it can be seen that it varied according to the age group. Younger children showed greater change in their crying behavior (RF: 100% and AF: 2) and needed to receive comfort from the family member; whereas in the older ones, the most evident alteration was restlessness in the legs (RF: 100% and AF: 14). Both the family members and the children spon-

taneously reported that the instrument was a new resource and that it might help minimize pain in painful procedures. Therefore, it can be inferred that VR was well accepted by both.

## DISCUSSION

Despite being positive, the results found in the study confirm the fact that pain management in pediatric patients is still a challenge. Despite elucidating the use of a new strategy such as VR to alleviate discomfort, it is understood that it is not yet a reality experienced in all services; therefore, it becomes relevant to discuss institutional strategies and within the team, in particular Nursing, which effectively help improve processes in terms of pain relief<sup>(13)</sup>.

In this context, especially for Nursing professionals who are constantly close to the patients, pain relief should aim not only at minimizing the unpleasant sensation in the physical (biological) field, but also at minimizing the psychological effects arising from this experience, such as anxiety, as it has the potential to change the perception of pain and can impair the treatment, in addition to reducing the child's cooperation in carrying out the procedures. Thus, it becomes strictly necessary that strategies aimed at such situations be studied and implemented, and one of them is using VR, as it is employed<sup>(14)</sup>.

Nurses working in a pediatric inpatient unit need to understand that, in addition to understanding their multiple needs and their family nucleus, pain management in hospitalized children demands an adequate interpersonal relationship since, in many situations, it is necessary to rearrange care in order to contemplate various instances or peculiarities of the care to be provided to pediatric patients and that will knowingly interfere with relief of the discomfort caused by hospitalization. In addition to that, it is essential that these professionals understand the strategies that are available to reduce discomfort and that, as team leaders, they put them into practice and positively influence their team members, in order to reduce the distress resulting from hospitalization<sup>(15)</sup>.

The use of behavioral indicators that employ facial expressions, body movements, crying and consolability, often associated with physiological parameters, can be used as an indication of the presence of pain and it is essential that such devices are incorporated into the care routine in order to improve care quality. Such findings should be considered in the management of pe-

diatric pain, as many children may not be able to communicate verbally or their vocabulary may be insufficient to describe the painful stimulus<sup>(16)</sup>. Also regarding pain management in the pediatric context, in situations where communication is impaired, the interaction between the health team and the family members is more than necessary. Such relationship facilitates decision-making and the course of action, and the parents' knowledge about their child and this view, together with the professionals, especially nurses, facilitates identification and relief of discomfort<sup>(12)</sup>.

Specifically in relation to the use of VR, the presence of uncomfortable situations arising from its use was not evidenced in the study. In other papers that addressed the same theme, the use of VR also did not exert negative effects on the patients studied, as both children and their families did not report side effects<sup>(17)</sup>.

VR has been used and, to the present day, has been a good alternative within the list of non-pharmacological strategies for pain relief. A number of studies have tested the device in burn patients and shown that there was a considerable decrease in pain among this clientele, due to the distraction and fun provided by the device during dressing exchanges<sup>(7)</sup>.

In addition to allowing pain reduction, some research studies show that VR can exert impacts on other variables, helping, for example, to reduce the heart rate and stabilize the vital signs<sup>(7)</sup>. In our study, such parameters were not measured, but the fact that we found mild to moderate pain scores in the vast majority of the punctures corroborates the other findings.

Another preliminary study addressing the theme showed that the effectiveness of VR did not decrease over the course of the treatment, unlike the medications that often require dose adjustments and even drug changes to achieve the result proposed<sup>(17)</sup>.

It is evidenced that such technology has been well accepted by the pediatric population, as well as among adult patients and even among health professionals<sup>(18)</sup>. It is known that we experience a reality within health institutions in which nurses are often overloaded and that, at first, the use of VR, as it is still preliminary, could cause some strangeness and even be overlooked, taking into account the adaptation time which, at the beginning, can make the procedure take longer than planned. However, it is found in the literature that, by applying this tool, children become more collaborative and that this exerts a positive

influences on the team since, as the child is exposed to less stress, it is possible for the team to perform the procedures with more ease<sup>(19)</sup>

Despite being a descriptive study, the positive results identified by the use of VR were evident, corroborating other findings in the literature regarding pain reduction during interventions. Such studies show the extent to which VR can assist in the treatment of pediatric patients, without any of the side effects, often present by the use of pharmacological pain control measures, ratifying its indication in the pediatric care setting<sup>(19)</sup>.

It is understood that the results found cannot be generalized, as it is an analysis of descriptive results, a fact that can be considered as a study limitation. However, it can be asserted that the use of VR during venipuncture procedures in children allowed reducing the pain scores, most of which were at minimum levels.

Furthermore, the findings refer to the need for more studies within the Brazilian context, with a greater number of participants, health professionals and data collection time. It is also important to know the professionals' opinion and clarify their care routines, so that the use of VR becomes a positive constant within the health services, in order to improve care for the pediatric

population. In addition to this, it is recommended to analyze more variables regarding the painful procedure, such as evaluation of the vital signs added to pre- and post-intervention assessments, in order to consolidate the indication for the use of VR in pediatric patients.

## CONCLUSION

The results found showed that the punctures performed with the use of Virtual Reality presented mild pain scores and that, in terms of pain management, its use can be a beneficial alternative within pediatric care in the performance of painful procedures.

It is suggested that more research studies be carried out focusing on the use of VR, especially in the sense of proposing strategies that ensure inclusion of this tool in the care practice.

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## CONFLICT OF INTERESTS

The authors have declared that there is no conflict of interests.

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