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Distraction of Children Undergoing Vaccination

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Abstract: Vaccination is a procedure considered painful for children; therefore, the healthcare team should provide conditions for adequate pain assessment and control. This study sought to evaluate whether behavioral distraction procedures contribute to reduce pain perception and anxiety indicators in children during vaccination. One hundred and four children between three and 12 years attending a Health Center in the Federal District participated in the study. Children were divided into four groups: baseline, groups with balloons, cards and tablets. Data were obtained by means of sociodemographic questionnaires, the *Monica and Friends Pain Scale* and the *Observational Scale of Distress Behavior*. The collected data were measured using the SPSS Statistics program. Results show that the intervention groups had lower averages, concerning pain levels, incidence of competing behaviors and duration of vaccine procedures, compared to baseline.

Keywords: immunization, distraction, pain, children, child psychology

Distração de Crianças Durante Vacinação

Resumo: A vacina é um procedimento considerado doloroso para crianças, portanto, a equipe de saúde deve fornecer condições para avaliação e controle adequados da dor. O objetivo deste estudo foi avaliar se procedimentos de distração comportamental contribuem para a redução da percepção de dor e de indicadores de ansiedade de crianças durante a vacinação. Participaram 104 crianças entre três e 12 anos em um Centro de Saúde do Distrito Federal. As crianças foram divididas em quatro grupos: linha de base, grupos com balões, cartões e tablet. Os dados foram obtidos através de: questionários sociodemográficos, Escala de Dor da Turma da Mônica e *Observational Scale of Distress Behavior*. Os dados coletados foram medidos por meio do programa SPSS Statistics. Os resultados revelaram que os grupos de intervenção apresentaram médias menores, em termos de níveis de dor, incidência de comportamentos concorrentes e duração dos procedimentos de vacina, em relação à linha de base.

Palavras-chave: imunização, distração, dor, crianças, psicologia da criança

Distracción de Niños durante la Vacunación

Resumen: La vacunación es un procedimiento considerado doloroso para los niños, por lo que el equipo de salud debe brindar las condiciones adecuadas para evaluación y control del dolor. El objetivo de este estudio fue evaluar si los procedimientos de distracción conductual contribuyen a disminuir la percepción del dolor y los indicadores de ansiedad en los niños durante la vacunación. En este estudio participaron 104 niños de entre 3 y 12 años de un Centro de Salud del Distrito Federal (Brasil). Los niños se dividieron en cuatro grupos: grupo de línea de base, grupo con globos, tarjeta y tableta. Los datos se obtuvieron a través de cuestionarios sociodemográficos, la Escala de Dolor de Mónica y sus Amigos y la *Observational Scale of Distress Behavior*. Los datos recopilados se midieron utilizando el programa SPSS Statistics. Los resultados revelaron que los grupos de intervención tenían medias más bajas, en cuanto a los niveles de dolor, incidencia de conductas concurrentes y duración de los procedimientos de vacunación, en comparación con el de línea de base.

Palabras clave: inmunización, distracción, dolor, niños, psicología infantil

Vaccination is one of the most effective public policy strategies for preventing known infections and epidemics. Currently, Brazil has decreased annual vaccination coverage and an immediate need to expand immunization against diseases that had already been eliminated or eradicated (Christ, 2020). According to data from the Brazilian Ministry of Health, the low coverage achieved recently for the main vaccines of the National Vaccination Calendar represents a real threat to the return of diseases common in the past, such as measles and polio (Christ, 2020).

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Up to the age of four, children undergo, on average, 25 vaccination procedures, while children and adolescents between the ages of seven and 15 undergo, on average, 10 procedures (Ministério da Saúde, 2019). Vaccination by intramuscular injection, for example, is one of the most widely adopted invasive techniques and is repeated several times during a person's lifetime, which can become a potentially stressful experience, especially for infants and children (Robabi, Askari, & Saeedinegad, 2016).

These invasive procedures can cause behavioral manifestations that indicate distress, such as crying, protests, aggression towards the agents administering the vaccine, and various forms of refusal to cooperate. Such behaviors can prevent, delay and or hinder the performance of the procedure, increasing perceived stress among caregivers and health care professionals (Talwar, Yadav, Deol, & Kaur, 2014).

The child's behavioral repertoire given the invasive procedure for vaccine administration may vary according to age group, environment, the child's coping strategy, the presence of strangers in the room, and invasive procedures previously experienced by the children themselves, or observed in others. These factors contribute to the development of unpleasant psychophysiological processes, such as fear, anxiety, and behavioral resistance to procedures (Silva, Austregésilo, Ithamar, & Lima, 2017).

In recent years, there has been increasing recognition of the need to adequately control pain and suffering related to procedures involving needles. The WHO recommends adopting strategies that have been found to be effective, based on empirical evidence. Several methods to assess pain and anxiety associated with needle procedures have been proposed and tested, including psychological strategies to change the way children deal with such invasive procedure (Birnie, Noel, Chambers, Uman, & Parker, 2018).

The American Academy of Pediatrics (AAP) and the American Pain Society (APS) advise the use of specific strategies to assess, minimize, and relieve pain in children during potentially painful medical procedures, regardless of the level of severity and or complexity (Aydin, Sahiner, & Çiftçi, 2016). Various resources have been used for pain management, including pharmacological, psychological, procedural and physical measures – which are considered supplementary strategies to reduce the pain and suffering associated with vaccine injections (Birnie et al., 2015). But these strategies must be tailored to the child's pain intensity and age (Robabi et al., 2016), as well as their psychosocial needs, which must be assessed beforehand.

The most commonly used techniques are pharmacological methods, which use analgesics and produce satisfactory results, but are expensive. Non-pharmacological methods have become good options for health professionals, as they are non-invasive, easy to implement, require minimal training, and are cost-effective (Aydin & Sahiner, 2017; Pancekauskaitė & Jankauskaitė, 2018). Non-pharmacological methods can also include, among many classifications, supportive, physical, cognitive, behavioral and combined – which use more than one method (Aydin & Sahiner, 2017) – methods.

Supportive methods are techniques aimed at social support, such as the presence of family members during the procedure. Physical methods, in turn, include techniques such as contact/massage, skin stimulation by application of hot and cold objects, the use of vibration and pressure, among others (Aydin & Sahiner, 2017). The main cognitive strategies currently in use include: cognitive distraction, making information available, encouraging the use of imagination, positive self-instruction, and modifying memories about previous procedures (Pancekauskaitė & Jankauskaitė, 2018).

Behavioral strategies that can be used include behavioral distraction, breathing exercises, progressive muscle relaxation, systematic desensitization, use of reinforcement/incentives for adaptive behaviors, pre-testing of the procedure, and training in positive coping strategies (Birnie et al., 2018). One of the most adopted combined methods merge cognitive and behavioral strategies, which can influence the perception of pain and distress via cognitive (involving aspects of attention, motivation, expectations and suggestibility), learning, physiological, and neurobiological processes (Birnie et al., 2018).

Among all non-pharmacological methods, interventions using cognitive and behavioral distraction stand out in research as favorable alternatives for pain management in invasive procedures, but still require more confirmatory research and empirical evidence. Distraction can be defined as a cognitive technique to divert attention from a given stimulus to an alternative stimulus. It is often used as a strategy to redirect the child's attention to a (new) stimulus, or to actively involve the child in a task different from the original procedure, thus decreasing the child's ability to perceive painful stimuli and interrupting the affective component of pain (Aydin et al., 2016).

This study sought to evaluate whether behavioral distraction procedures contribute to reduce pain perception and anxiety indicators in children during vaccination.

Method

Participants

The study sample comprised 104 children who were attending a Health Center of the public health network of the Federal District, undergoing invasive (injectable) vaccination procedures and who met the following inclusion criteria: age between three and 12 years, having spontaneous verbal repertoire, and having the guardians' and the child's consent via the Informed Consent Form and Assent Form, respectively, to participate in the study. Exclusion criteria consisted of: children with a diagnosis of pathologies that compromised neuropsychomotor development and verbal skills.

Instruments

Eight balloons in different colors and *10 distraction cards*, developed by the researcher with themes related to cartoons, movies, and children's characters, were made available.

A *Tablet* was also used, via two applications "*My talking Tom*" and "*Subway Surfers*."

The *Observational Scale of Behavioral Distress* (OSBD), with 11 behavioral categories indicating behavioral suffering (information seeking, emotional support, crying, nervous behavior, restraint, verbal pain, screaming, verbal fear, flailing, muscle stiffness and resistance), was applied.

The *Monica and Friends Pain Scale*, a pain scale containing the faces of Brazilian children's characters, was used with four facial expressions: no pain, mild pain, severe pain, and unbearable pain.

A *Sociodemographic questionnaire* was applied to the children's caregivers, including data such as age group, schooling level, and socioeconomic conditions. *Questionnaires* were also applied to health professionals to evaluate the intervention, verifying if the behavioral distraction techniques contributed to pain reduction during vaccination.

Procedures

Data collection. First, the intervention proposal was presented to the administration of a public health clinic in the Federal District. After approval of the research project by the health unit management, the project was submitted to the Research Ethics Committee of the State Health Department of the Federal District.

Data collection took place from August to December 2018. On vaccination day, the child and their caregiver were invited to participate and informed about the nature of the research, its objectives and methods, with emphasis on the confidentiality of names and any other potentially identifying information. Its voluntary nature was clarified, as well as the possibility of withdrawing at any stage of the study. Those who agreed to participate were asked to sign the Informed Consent and Assent Forms.

Participants were randomly divided into four groups, one baseline and three intervention groups. Baseline involved assessing the behavioral repertoire of those involved in the study setting, before any intervention was applied. Thus, the researcher accompanied the immunization process, making observations of the locations, procedures, and context variables that might be involved in vaccination scenarios.

In the baseline group, caregivers answered the sociodemographic questionnaire before entering the vaccination room. The OSBD was applied during the vaccination, and the Monica and Friends Pain Scale was answered by each child immediately after the procedure.

The remaining participants were randomly divided into three groups, using three different behavioral distraction methods: balloons, distraction cards, and tablets, during vaccine application, and the children's behaviors were assessed by the OSBD. After vaccination, the Monica and Friends Pain Scale was applied to all children.

In the balloon group, children were instructed to choose between the available colors and fill a balloon during the vaccination procedure. After completing the immunization, the children could take the balloons home.

In the group using distraction cards, children were instructed to look at the cards shown by the researcher during the vaccination procedure and verbally answer the questions asked about the characters.

In the tablet group, two applications were made available according to the child's age. Children aged three to seven used the "My talking Tom" app, which contains conversations and interactions with a character. Children aged eight to 12 played the game "Subway Surfers," in which the child assumes the role of a boy, whose goal is to run and perform quick movements to complete missions while dodging obstacles and collecting coins. The tablet was offered when they entered the vaccination room and returned after the procedure. After performing the vaccination procedures, all health professionals answered the respective questionnaires.

Data analysis. Data were measured qualitatively and quantitatively by means of descriptive and inferential statistics using IBM SPSS Statistics 20. Descriptive statistics analyzed frequencies, percentages, means and variance. Inferential statistics, in turn, used ANOVA considering a significance level set at 0.05 and 95% confidence interval.

Behaviors recorded by the OSDB were analyzed by dividing them into two categories: competing behaviors and non-competing behaviors. The former included responses from children that delayed, hindered or made it difficult to perform the vaccination procedure. The non-competing category included responses from children that neither hindered nor facilitated performing the vaccination procedure.

Ethical Considerations

As this scientific research involved human beings, the study complied with the National Health Council Resolution - CNS No. 466, dated December 12, 2012 (Ministry of Health, 2013), considering the development and ethical engagement inherent to scientific and technological development.

This research was approved by the Research Ethics Committee of the State Health Department of the Federal District (SES/DF/CEP/FEPECS) on May 22, 2018, under protocol number 2,667,264. We ensured the rights and duties of all research participants, respecting the principles of autonomy, non-maleficence, beneficence, justice and equity. The research participants signed the Informed Consent and Assent Forms containing clarifications about the nature of the research, its objectives, methods, benefits, risks and information confidentiality.

Results

Participant Sociodemographic Data

Of the 104 children, 55 (52.8%) were girls and 49 (47.1%) were boys. Mean age was 6.43 years (range, 3 to 12 years), with 62 (59.6%) children aged three and four years,

four (3.9%) children aged five to seven years, and 38 (36.6%) children aged nine to 12 years.

Regarding schooling level, 13 (12.5%) children did not study, 51 (49%) were enrolled in early childhood education, and 40 (38.5%) were attending primary education. As for family income, three (2.9%) had less than one minimum wage, 14 (13.5%) had one to two minimum wages, 19 (18.3%) had three to four minimum wages, and 68 (65.4%) had more than four minimum wages.

Vaccines Administered Data

The health center performed 187 vaccination procedures with 13 types of vaccines: 50 (48.1%) children received POV, 43 (41.3%) received Triple Viral, 26 (25%) received HPV, 23 (22.1%) received Meningococcal C, 17 (16.3%) received DTP, 17 (16.3%) received chickenpox, three (2.9%) received anti-rabies1, 2 (1.9%) received Penta, two (1.9%) received Yellow Fever, one (1%) received Pneumococcal, one (1%) received Tetra Viral, one (1%) received Hepatitis, and one (1%) received Tetanus vaccine.

Group Comparison - Pain Levels

Pain levels, assessed by the Monica and Friends Pain Scale, showed no significant differences between the groups studied (p=0.168). The tablet group (2.20) showed the lowest pain levels, followed by the balloon group (2.24), distraction cards group (2.36) and baseline (2.88). In all distraction groups (balloons, distraction cards, and tablet), pain levels were lower than those recorded at baseline.

Group Comparison - Behavioral Observation

OSDB showed significant differences between the groups studied (p<0.05). Regarding competing behaviors, baseline showed the highest average (10.15), while the other groups showed a significant decrease (p=0.001) in such behaviors. The distraction cards group had the lowest mean (3.10), followed by the balloon group (4.10) and the tablet group (5.6).

As for non-competing behaviors, the tablet group had the highest average (7.80), followed by the distraction cards group (5.0) and the balloon group (1.86). The increase in these behaviors showed significant differences (p=0.000) from baseline (1.97).

All distraction groups (balloons, distraction cards, and tablet) showed a decrease in competing behaviors. Regarding non-competing behaviors, however, only the tablet and distraction cards groups showed a higher mean compared with the baseline. The balloon group had the lowest mean for non-competing behaviors.

Group Comparison - Duration of the procedure

Vaccination duration showed significant differences between the groups studied (p=0.05). The distraction cards group (2.23 minutes) had the shortest duration of the procedure, followed by the balloon group (2.31) and the tablet group (2.55). At baseline, mean time was 3.21.

Discussion

Participant Data

Our study sample consisted of 104 participants with a mean age 6.43 years, ranging from three to 12 years. These data were consistent with the number of participants and age ranges in other studies, such as Aydin et al. (2016), Aydin and Sahiner (2017), Bergomi et al. (2018), Gerçeker et al. (2018), Robabi et al. (2016), and Sahiner and Bal (2016).

Vaccines Administered

In this study, 41.3% of the children were vaccinated against measles (triple viral vaccine) and 48.1% against polio (POV vaccine). This higher percentage is due to the risk of reintroducing eradicated diseases in the country – such as polio, measles and rubella (Lisboa, 2020) – and concurs with Brazil's proposal (Lisboa, 2020) that vaccination is one of the most effective public policy strategies for preventing infections and known epidemics.

Research Group Design

Besides the growing concern about increasing outbreaks of preventable and infectious diseases, one possibility to increase adherence to future immunizations and collaborate positively with healthcare is to carry out psychological interventions that can minimize pain perception and anxiety concerning invasive procedures (Birnie et al., 2018). One must understand the need for non-pharmacological methods, such as adopting behavioral distraction strategies to reduce the behavioral impacts generated during vaccination (Ferreira, Cruz, Silveira, & Reis, 2015), besides the need for their dissemination among the various public health services and for health professionals to be trained to use them.

Thus, we randomly divided the 104 participants into four groups: baseline (33), distraction cards group (22), balloon group (29), and tablet group (20). The use of distraction techniques to reduce pain and suffering during an invasive procedure was consistent with other studies, such as Aydin et al. (2016), Aydin and Sahiner (2017), Bergomi et al. (2018), Burns-Nader, Atencio, and Chavez (2016), Canbulat, İnal, and Sönmezer (2014), Ferreira et al. (2015), Gerçeker et al. (2018), Pancekauskaitė and Jankauskaitė (2018), Risaw et al. (2017), Robabi et al. (2016), Sahiner and Bal (2016) and Silva et al. (2017).

The three distraction groups (balloons, distraction cards, and tablets) can be described as active distraction, where children were encouraged to perform another action during the invasive procedure, being able to inflate a balloon (breathing exercise),

respond to stimuli (cards), or use an interactive game that included the participation of a digital character (Aydin et al., 2016).

The balloon technique sought to distract the child with an activity that could relax the body and muscles and decrease somatic and psychological tension, thus reducing pain perception (Burns-Nader et al., 2016). Such technique was consistent with other studies, such as Aydin et al. (2016), Burns-Nader et al. (2016), Eden, Macintosh, Luthy, and Beckstrand (2014), Robabi et al. (2016), and Sahiner and Bal (2016).

The distraction cards sought to contribute to the acquisition of collaborative behaviors, facilitating the adoption of active coping strategies, as well as to verify whether the children could concentrate and issue rational responses when facing the distraction stimulus while receiving an injectable vaccine. As pointed out by Aydin et al. (2016), we expected the instrument would contribute to reducing pain and anxiety levels during vaccination.

The use of this technique was also consistent with other studies, such as Aydin et al. (2016), Aydin and Sahiner (2017), Canbulat et al. (2014), Risaw et al. (2017), and Sahiner and Bal (2016). The use of distraction cards could be described as a cognitive distraction technique, for it involved a cognitive strategy that directed the child's attention to stimuli other than the procedure, such as an unrelated conversation (Barros, 2010).

Tablet games sought to contribute to the observation of emotional responses, creativity, communication and coping strategies before potentially painful stimuli, with the electronic stimulus acting as a behavioral distraction that would reduce pain perception, fear, and anxiety (Burns-Nader et al., 2016). The use of tablet-operated electronic games as a distraction technique was consistent with other studies, such as Burns-Nader et al. (2016), Ferreira et al. (2015), and Pancekauskaitė and Jankauskaitė (2018).

Effectiveness of Distraction Techniques

All distraction groups showed lower levels of pain perception, occurrence of competing behaviors, and duration of vaccination procedures than baseline. These data corroborate those by Aydin and Sahiner (2016), Birnie et al. (2018), Caprilli, Vagnoli, Basani, and Messeri (2012), Ferreira et al. (2015), and Sahiner and Bal (2016), who found that children showed less fear, pain and behavioral distress ($p<0.05$) when interacting with distraction interventions, with an expected reduction in pain and anxiety levels when compared with control groups and baselines.

Mean pain levels in the baseline group was 2.88, while it ranged from 2.20 ± 2.36 between distraction groups. These data are similar to the results obtained by Talwar et al. (2014), who found that the mean pain scores between the experimental and control groups were 4.02 ± 1.694 and 4.89 ± 1.503, respectively. In other words, experimental groups who used distraction also showed lower levels of pain perception than the group without intervention.

We assessed the effectiveness of distraction techniques by behavioral observation, self-reported pain level, and procedure duration. The best technique would have the lowest mean of competing behaviors, the highest mean of non-competing behaviors, the lowest self-reported pain level, and the shortest procedure duration (Aydin & Sahiner, 2017; Caprilli et al., 2012; Sahiner & Bal, 2016). The distraction cards and tablet techniques stood out in the present study: while the cards group had the lowest mean of competing behaviors and the shortest duration of the procedure, the tablet group had the highest incidence of non-competing behaviors and the lowest level of self-reported pain.

Distraction cards group

The distraction cards group had the lowest mean in two variables, that of competing behaviors (3.09) and duration of the vaccination procedure (2.23), thus corroborating the study by Sahiner and Bal (2016).

Aydin and Sahiner (2017) found that the group using only distraction cards had the second lowest mean (2.60 ± 3.64), second only to the group who used music with the cards (2.36 ± 3.58). In Canbulat et al.'s (2014) research, both the distraction cards group (2.41 ± 2.49) and the kaleidoscope group (3.10 ± 2.16) had lower pain levels than the control groups (4.44 ± 3.64). Results obtained by Risaw et al. (2017) showed that distraction cards had a significant effect on the behavioral response to pain in children undergoing invasive procedures, evidenced by lower mean pain scores (2.75 ± 0.97) when compared with a control group (3.24 ± 0.85).

The cards group was second in the highest mean of non-competing behaviors (5.0) and the third in terms of the level of perceived pain (2.36), thus not showing the lowest level of pain and anxiety, contradicting the findings by Aydin et al. (2016) and Canbulat et al. (2014).

In the present study, the use of distraction cards showed a reduction in competing behaviors from a baseline mean of 10.15 to 3.09 (three times less), indicating that using such distraction technique can significantly alleviate pain associated with invasive procedures, as reported by Risaw et al. (2017).

Balloon group

The balloon group had the second lowest average in three variables: competing behaviors (4.1), pain level (2.24), and procedure duration (2.31). These data are similar to those obtained by Robabi et al. (2016) regarding pain intensity, which was lower in the balloon distraction group compared with the control group.

But this technique had the lowest mean of non-competing behaviors (1.86), second only to baseline. As the balloon technique did not show the lowest levels of pain, it was not the most efficient. This data contradicts the findings by Sahiner and Bal (2016), who propose that this technique would be the most efficient in reducing competing behaviors.

Tablet group

The tablet group had the best means on two variables: lowest mean level of self-reported pain (2.20) and highest mean of non-competing behaviors (7.80). These data contradict Burns-Nader et al.'s (2016) study, in which the tablet group had significantly more negative emotions than the control group, t (39) = 2.30. In the present research, the tablet group showed more collaborative behaviors, that is, more positive emotions, with the highest mean – 3.95 times greater than that obtained at baseline.

The group ranked third regarding the other two variables: mean competing behaviors (5.6) and procedure duration (2.55). Despite remaining in lower positions, the tablet group showed lower means relative to baseline, as highlighted by Burns-Nader et al. (2016).

Using a tablet as a distraction method proved effective in decreasing the level of perceived pain, competing behaviors and procedure duration, and in increasing collaborative behaviors when compared with baseline.

Baseline

Baseline data showed the highest mean regarding competing behaviors (10.15), pain level (2.88), and procedure duration (3.21). The only variable that baseline ranked as third best was non-competing behaviors (1.97), which corroborates the study by Robabi et al. (2016), in which the control group had a significantly higher mean pain score.

Ultimately, the objectives proposed for this study were achieved, showing that the behavioral distraction procedures contributed to reducing pain perception and anxiety indicators during invasive vaccination procedures. As for the most efficient behavioral distraction techniques, the distraction cards and tablet stood out. Regarding duration of the vaccination procedure, the intervention groups showed lower means than baseline.

The main contributions of this study refer to the interventions used during potentially painful vaccination procedures. Behavioral distraction techniques can increase possible adherence to future immunizations, contribute to the development of more appropriate coping strategies within healthcare settings, and also contribute positively to the care of the professional team.

Moreover, its main social contribution concerns the sharing of knowledge to health professionals on behavioral distraction techniques that can contribute to pain control in children during invasive medical procedures, which can positively influence these professionals' performance.

The study allowed to identify available evidence in the literature related to pain relief and control in children during vaccination, regarding the use of distraction practices such as balloons, distraction cards, and tablet applications. Most interventions are easy to program, considering their low cost, and useful to health professionals seeking to improve pediatric care regarding pain management.

Among its main limitations we can cite, first, the small number of participants, which prevented more robust conclusions. Second, limiting the study context to vaccination procedures in children hindered choosing types of distraction intervention that could be more effective in invasive medical procedures. Finally, the study could have addressed more specific age groups, as each child's developmental skills are very diverse and interaction and stress response strategies are different.

Future studies should apply behavioral distraction techniques in other health centers, covering more participants and other regions of Brazil, and measure the possible effectiveness of virtual reality-based distraction techniques.

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