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Improving Pediatric Radiography Patient Stress, Mood, and Parental Satisfaction Through Positive Environmental Distractions: A Randomized Control Trial

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Objective To evaluate how a positive environmental distraction intervention impacted pediatric radiography patient behavioral stress-responses, mood states, and parental satisfaction.
Methods: Behavioral observation, rating scales, surveys on 182 pediatric patients and their parents randomly assigned to three positive distraction levels (minimum, light, light and animation).
Results: Under interventional conditions, patients exhibited less low-stress coping behaviors (ps < 0.001–0.007) and more verbal behaviors indicating positive affect ($p = 0.003$); parents more favorably rated environmental pleasantness (ps < 0.001), sense of environmental control (ps = 0.002), and willingness to return and recommend the facility (ps = 0.001–0.005).
Conclusion: The intervention improved pediatric radiography experience but needs further investigation in more stressful settings.

PEDIATRIC PATIENTS OFTEN experience stress, fear, anxiety, and hopelessness in healthcare settings including radiology settings where the typical sterile-looking environment and large radiology machines appear intimidating to children (Alexander, 2012; Etzel-Hardman, Kapsin, Jones, & Churilla, 2009). Stress is an internal state of physiological or psychological tension caused by the imbalance between environmental demands and a person's capacity to respond or cope (Lazarus & Folkman, 1974; Stokols & Montero, 2002). In healthcare settings, stress may lead to a set of physiological, psychological, and behavioral responses (e.g., high blood pressure, sleeplessness) and cause disorders, diseases, and negative outcomes (Brannon & Feist, 2013; Porhomayon, Kolesnikov, & Nader, 2014; Ulrich, 1991; Ulrich, Zimring, Quan, & Joseph, 2006). Pediatric patients under stress often exhibit distress behaviors (e.g., crying, moving, and flailing) and other stress responses (e.g., talking) that distract radiology technologists (who operates imaging equipment to produce radiologic images for diagnosis and other healthcare purposes) from focusing on their core tasks

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and impede the process of radiology procedures (Bradford, 1990; Tyson, Bohl, & Blickman, 2014). The stressful nature of radiology procedures may result in short-term effects in pediatric patients including radiology procedure cancellations and backlogs, sedation use, and medical complications as well as long-term effects including post-traumatic stress syndrome and avoidance of healthcare (Alexander, 2012; Etzel-Hardman et al., 2009; Sanborn et al., 2005).

Many operational, behavioral, and environmental efforts (e.g., hypnosis, pre-procedural preparation) have been made to reduce pediatric patient stress level (Alexander, 2012; Kettwich et al., 2007). Among them, one highly effective measure is the provision of positive visual and audio distractions (e.g., artworks with nature scenes, music) which has been found to significantly reduce stress and improve healthcare outcomes (Mifflin, Hackmann, & Chorney, 2012; Pati & Nanda, 2011). Physical environment distractions include a set of environmental features that provide an appropriate level of sensory stimulation (e.g., artworks, nature scene video played in video goggles) for diverting patients' attention from stressors (e.g., noise, medical procedures), improving environmental aesthetics, and fostering psychological restoration in both adult and pediatric settings (DeLoach Walworth, 2005; Lee et al., 2004; Ulrich, 1991; Ulrich et al., 2008). For example, recent studies showed that pediatric patients distracted by music during invasive procedures (e.g., needle sticks) demonstrated lower observable distress than similar patients with no music (Caprilli et al., 2007; Hartling et al., 2013; Malone, 1996). Pati and Nanda (2011) found that visual distractions presented on a plasma screen had a calming effect on pediatric patients in outpatient waiting areas by reducing their fine and gross movements. In another recent study on ambulatory surgical pediatric patients undergoing inhalation anesthetics, lower anxiety level was found in the group exposed to video clips chosen by patients themselves than another group receiving traditional behavioral distraction techniques including humor and nonprocedural talk (Mifflin et al., 2012).

Research on positive environment distractions in pediatric radiology settings is very limited, even though findings from other similar pediatric settings (e.g., acute care procedure/treatment rooms, emergency care rooms, anesthesia induction areas, outpatient waiting areas) strongly suggest that the provision of positive environmental distractions for pediatric radiology patients may be effective in reducing patient stress and improving outcomes (e.g., Caprilli et al., 2007; Hartling et al., 2013; Malone, 1996 ; Mifflin et al., 2012; Pati & Nanda, 2011). Positive environmental distraction intervention refers to the utilization of physical environment distractions (such as artworks and gardens, as opposed to other non-environmental distraction methods such as hypnosis) for the purpose of reducing stress and improving patient experience. One example is a novel environmental intervention (Philips Ambient Experience) that integrates positive environment distractions and other healing environment features into an immersive environment, including: a) colorful ambient lighting, b) video animations projected on walls/ceilings, c) patient choice of lighting colors and animation themes (e.g., nature scenes, cartoons), d) integrated storage space hiding away medical equipment, and e) soft and rounded wall corners (Ensign, 2009). In addition, music is provided through headphones in certain cases of implementation. The intervention can be operated in two different modes providing two different levels of positive distractions (Ensign, 2009).

This integrated intervention has been anticipated to aggregate the effects of multiple stress-reducing mechanisms. First, the positive distraction elements of the intervention including lighting and artworks may improve the attractiveness of physical environment and reduce stress, according to well-documented research findings from pediatric care settings (Malone, 1996; Mifflin et al., 2012; Pati & Nanda, 2011) as well as adult care settings (Arneill & Devlin, 2002; Becker & Douglass, 2008; DeLoach Walworth, 2005; Diette, Lechtzin, Haponik, Devrotes, & Rubin, 2003; Lee et al., 2004; Nelson, West, & Goodman, 2005;; Ulrich, 1991; Ulrich et al., 2008). Second, the provision of personal choices of lighting and animation themes may lead to higher patient sense of environmental control, which may compensate for patient loss of privacy and control due to medical procedures thus lead to lower stress, better outcomes, and higher satisfaction (Williams, Dawson, & Kristjanson, 2008). Third, the intervention minimizes the existence of radiology equipment and devices in patients' visual fields by storing them away in the integrated storage spaces. Radiology equipment and devices often look unfamiliar and scary to pediatric patients, and therefore become stressors and contribute to discomfort and stress (Kettwich et al., 2007; Tanja-Dijkstra, 2011). A previous study evaluated the effectiveness of the intervention on adult patients in magnetic resonance imaging (MRI) and computed tomography (CT) rooms and found that it was associated with improvements in patient perception of radiology environment and satisfaction with radiology services (Quan, Joseph, & Ensign, 2012). To fully evaluate its effectiveness on different patient groups in different settings, this present study focused on pediatric radiography patients.

Objective

The purpose of this study was to evaluate whether the positive environmental distraction intervention improved behavioral stress responses and mood states in pediatric radiography patients, and increased parental satisfaction and compare three levels of positive distractions in radiography rooms: low—traditional sterile-looking environment without the intervention, medium—intervention operating mode with colorful lighting distraction only, and high—intervention operating mode with both colorful lighting and wall projection of child-friendly theme animations. Specifically, it was hypothesized that: when the level of positive distractions increased, the behavioral stress responses of pediatric radiography patients would decrease, their mood states