# Benefits of an On-Unit NICU MRI System

## Introduction

MRIs offer many benefits for newborns in the Neonatal Intensive Care Unit (NICU), but performing off-unit MRIs is incredibly complex and creates many risks for this vulnerable population. On-unit MRI options for NICU patients greatly reduce these risks and can lead to significant benefits that make them cost-effective and clinically superior to off-unit MRIs.

## Background

Magnetic resonance imaging (MRI) is one of the most thorough and in-depth forms of imaging technology, allowing high quality, three-dimensional visualization of internal structures. MRIs provide superior soft tissue contrast compared to computed tomography (CT) scans and are better at differentiating between different types of soft tissues (US Food and Drug Administration, 2017). MRI technology can provide valuable diagnostic information that can be used to predict neurodevelopmental outcomes in neonates and infants (Cheong & Miller, 2018).

## Difficulties of Utilizing MRI Technology with a NICU Population

While MRI technology provides an invaluable resource for treating neonates and infants in a NICU, there are several barriers that make use of this technology suboptimal for these fragile patient populations. The potential risks caused by transporting a NICU patient to the MRI and back is one of the most dangerous of these barriers.

NICU patients are more compromised and less adaptable to changes in their environment than adult patients. NICU patients almost never physically leave the controlled environment of the NICU, with travel


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for off-unit MRI scans being one of the most notable exceptions. The MRI room is often on another floor of the hospital, requiring the neonate, the neonate's equipment, and the neonate's nurse to transport this compromised patient through hospital hallways and elevators. In one study, the average time off the NICU for an MRI was 121 minutes, even though the scan only took 46 minutes on average, meaning that transporting the patient made the process three times longer than the scan itself. (Coughlin, 2020).

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## Negative Effects of MRI Transportation on NICU Patients

When compromised NICU patients are transported outside the unit there are several ways that they are likely to be negatively affected. These include:

- **Impaired Patient Safety**—NICU patients are more susceptible to hypothermia (Bastug et al., 2016); transporting the patient outside of the controlled NICU environment increases this risk due to decreased ability to control the ambient temperatures. While in the MRI scanner, monitoring the patient is also both more complex and less effective. Many of the monitoring and advanced treatment devices used in the NICU are not suited to use an MRI environment. MRI specific equipment is made for adult patients and therefore is inadequate or inappropriate for neonates. Patient safety is further affected by the limited resources in the MRI area and by the limited experience and knowledge of MRI staff in the care of critically-ill, newborn patients.
- **Infection Risk**—Infections are a great concern for NICU patients, especially central line-associated bloodstream infections (CLABSIs). Transporting a vulnerable neonate through a hospital and into the MRI environment exposes their underdeveloped immune systems to potential bacteria and viruses that thrive in hospitals (Ilyas et al., 2019). MRIs may also require line extensions to permit the use of IV medications while in an MRI. Accessing a central line outside of the controlled NICU environment can increase the risk of CLABSI.
- **Lack of Family-Centered Care**—Removing the patient from the NICU environment removes them from their family, which can cause distress for the patient and for the patient's family.
- **Staffing Strains**—The compromised condition of NICU patients often requires that they be accompanied by at least one RN and a respiratory therapist during transport. This causes staffing strains on the NICU for the duration of the time that the patient is off the floor, which can be three times longer than the time spent doing the scan itself (Coughlin, 2020). Having staff off the floor can lead to extra labor expenses to meet the regulated staffing needs of the floor or can lead to lower nurse-to-patient ratios, resulting in lower quality of care for the duration of the MRI, and increased stress for the staff.
- **Expense Considerations**—Many of the negative effects caused by transporting a NICU patient to an off-unit MRI result in increased costs. These include the costs incurred with complications from impairments to patient safety, infections such as CLABSIs, and in-creased staffing needs.

The numerous negative effects that can result from transporting NICU patients to off-unit MRIs factor into providers' risk-benefit considerations. This can result in fewer MRIs being ordered and performed, leading to potential delays in recognition of problems that could be treated to avoid permanent disability or other negative outcomes. MRIs that are ordered may also be delayed due to the logistical complications of obtaining one and the safety and staffing concerns outlined above.

## Embrace® Neonatal MRI System

The Embrace® Neonatal MRI System is a solution designed specifically for the neonatal population, tailored to meeting imaging needs specific to these patients. This unique MRI system is designed to be installed directly in the NICU, allowing on-unit NICU MRI imaging and eliminating the need for off-unit transportation. This system has cutting-edge shielding technology that prevents the magnetic field from reaching outside the scanner, making the scanner safer and easier to position in a small space.

The customized design of the Embrace® MRI provides special accommodations for the use of complex monitoring and treatment devices that most NICU patients depend on. This MRI system also allows for visualization of the patient, easy accessibility of the patient and on-unit resources, and control of the temperature of the patient's environment throughout the scan through the incorporated thermo-controlled patient bed.

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## Positive Effects of Implementing the Embrace® Neonatal MRI System in the NICU

The Embrace® Neonatal MRI System offers NICU patients many benefits compared to off-unit MRI systems. These benefits improve many components of care, including:

- **Patient safety**—The Embrace® Neonatal MRI provides continuous temperature control, reducing the likelihood of hypothermia. This system is also specifically designed to allow use of complex monitoring equipment and permits visualization of the newborn during the scan, further ensuring their well-being and reducing the need for sedation.
- **Infection Prevention**—Use of an on-unit MRI system reduces exposure of NICU patients to other parts of the hospital environment. This greatly reduces the likelihood of exposure to pathogens that could be encountered during transport and in the MRI environment (Shen et al., 2020). On-unit MRIs also reduce the exposure of newborn patients to staff who are not uniquely trained in the care of neonatal patients and who may not be familiar with the best practices for infection prevention for this patient population.
- **Patient & Family Centered Care**—The Embrace® Neonatal MRI allows for visualization of the newborn during the scan and allows them to stay on the unit. Both of these factors ensure the patient is not separated from their family for extended periods of time, reducing potential distress for the patient and their family.
- **Staffing Effectiveness**—Off-unit MRI transport is a personnel-intensive exercise. The on-unit capabilities of the Embrace® Neonatal MRI remove the additional staffing strains of having NICU staff off of the NICU floor for prolonged periods of time. An on-unit MRI also helps to alleviate some of staffing strain associated with off-hours imaging, when the NICU medical staff may not be as accessible as they would be during the day.
- **Cost Considerations**—The on-unit capabilities of the Embrace® Neonatal MRI avoid the many potential costs that may be incurred with the complications associated with off-unit MRIs. A NICU-specific MRI can also allow greater use of an existing MRI and the revenue it generates.

Overall, the primary benefit of adopting the Embrace® Neonatal MRI is the unparalled access to the critical data only available from MRI which can direct care with the goal of improving neurodevelopmental outcomes of neonatal patients, in a safe, patient-focused work-flow within the NICU. safety. With easy access to MRIs that represent less patient risks, less workflow complexity and are are more convenient, clinicians are more likely to take advantage of the benefits that MRIs can offer their patients and order MRIs more frequently. This can lead to quicker recognition and treatment of potential problems, ultimately leading to better outcomes and healthier lives for these vulnerable newborns.


# Embrace® Neonatal MRI System

Transforming Neonatal NeuroImaging *Inside* the NICU

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DOC10002392