

# STATUS OF FETAL CMR TODAY

Latest advancements open a new era in prenatal diagnosis.

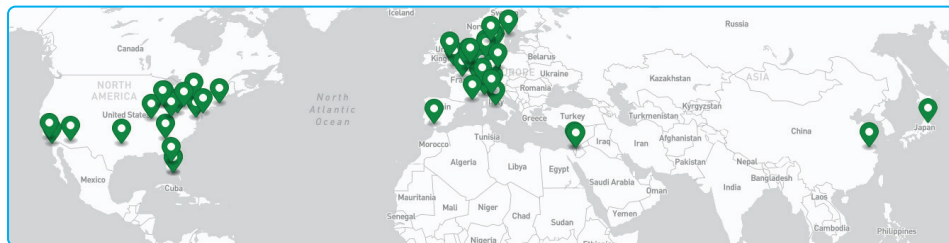
Fetal CMR has emerged as a new tool in prenatal diagnostics, helping in understanding of fetal heart development and CHD.

The journey of fetal heart imaging began with conventional methods like ultrasound, which, despite their utility, has limitations especially in the third trimester. The advent of fetal MRI can help to overcome such limitations as the strength of fetal MRI is dominant at the third trimester due to less fetal motion and larger size of cardiac structures. Initially used for neurological assessments, MRI's application in cardiac imaging was a leap forward, driven by technological advances such as the introduction of *smart-sync* and post-processing methods that allowed detailed imaging of the complex fetal heart structure.

To measure the impact and development of fetal CMR can mainly be done by evaluating the current scientific literature.

As Northh Medical we could see the development also by the increase of users, especially in the USA and Europe. The use of *smart-sync* increased within only two years to about 60 hospitals, the worldwide distribution is shown in *Figure 1*. We have also asked the users frequently if they perform fetal CMR for research, clinical application or both; the result is illustrated in *Figure 2*. It is very interesting to observe the increase in clinical use as it underlines the fast development of fetal CMR. Maybe one can say that the introduction of fetal CMR filled a critical gap in prenatal diagnostics, particularly for conditions challenging to diagnose through ultrasound and that this development is at its early stage.

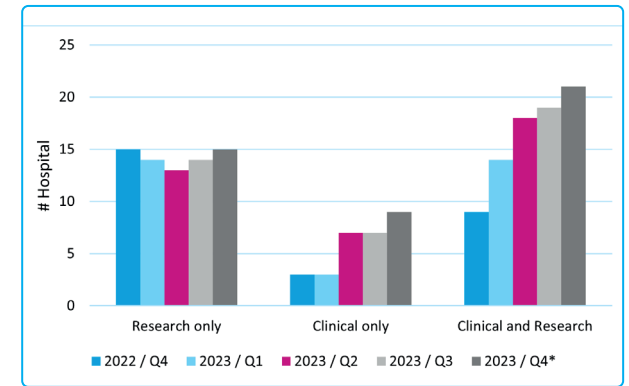
The current capability of fetal CMR is showcased by recent publications in 2023<sup>1-9</sup>. These advancements emphasize that fetal CMR can have an impact on diagnosis and management of CHDs. Desmond et al. highlighted the integration of prena-



**Figure 1:** Worldwide distribution of hospitals performing fetal CMR with *smart-sync*.

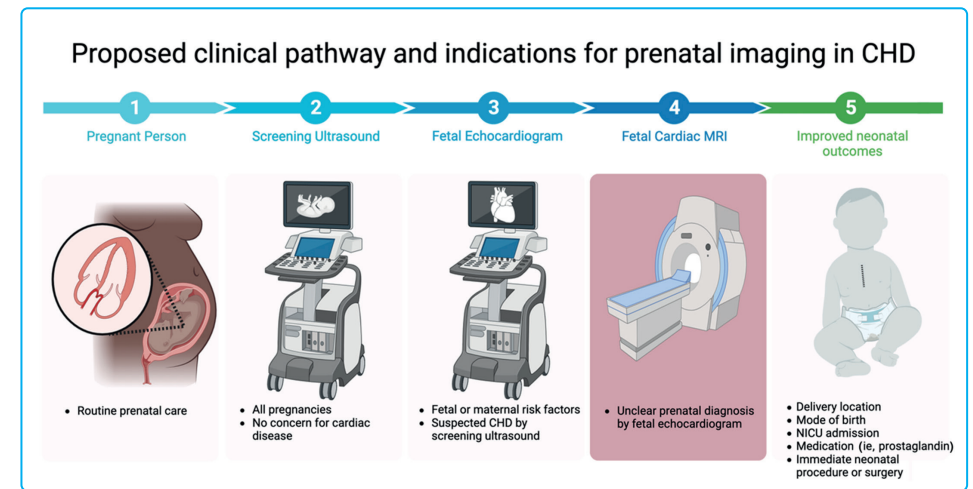
tal CMR in managing CHD, showing how it complements echocardiography, influences postnatal care strategies and how it can be integrated in the clinical pathway (*Figure 3*)<sup>7</sup>. Vollbrecht et al.'s study on Doppler US-gated fetal cardiac cine MRI further underscores the technology's diagnostic accuracy, comparing favorably with traditional echocardiography<sup>8</sup>. Minocha et al. provided valuable reference values for fetal cardiac dimensions, volumes, and function<sup>9</sup>. This work is an important advance, as establishing a range of normal structural and functional values allows more for effective diagnosis. It is particularly interesting as their results found a difference in volume compared to echocardiography by up to 48%. More studies are needed to understand these differences, but the results emphasize the

potential impact of the MRI for quantitative measurements that can impact diagnosis. Moreover, a recent study by Dargahpour et al explored the utility of myocardial strain assessment for CHD<sup>10</sup>. They found a significant difference in strain parameters between fetuses with CHD and normal controls that indicates a new diagnostic approach to eval-

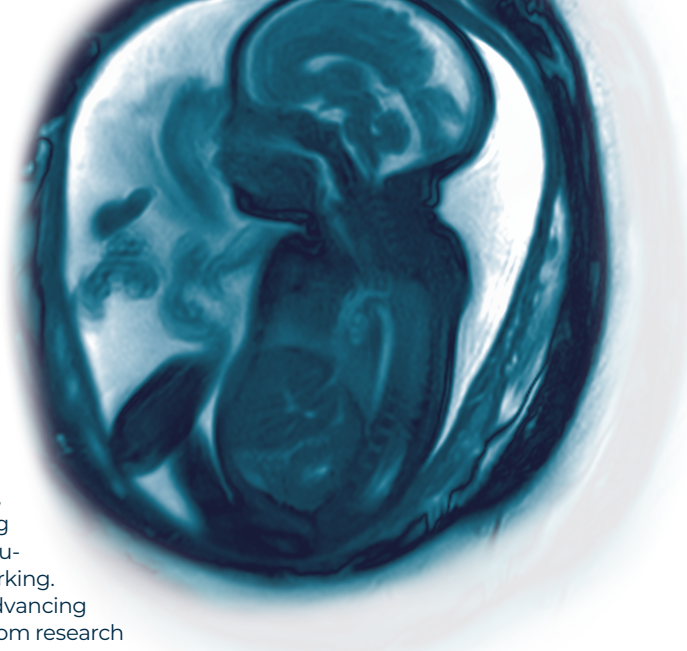


**Figure 2:** Overview of the temporal development of the clinical and/or research application of fetal CMR with *smart-sync*.

\*The information of 8 hospitals is missing.



**Figure 3:** Proposed clinical pathway and indications for prenatal imaging in congenital heart disease. CHD indicates congenital heart disease; MRI, magnetic resonance imaging; and NICU, neonatal intensive care unit. Image from Desmond et al.<sup>7</sup>



uate fetal cardiac function. Based on the strength of the MRI for quantitative imaging one future direction of fetal CMR will be complementing fetal echocardiography with functional cardiac information that supports in decision making. However, more studies are needed, and it is essential to foster a common platform for exchange, develop standardized MRI protocols, enhance post-processing techniques, and provide mutual support and networking. These efforts are key to advancing the transition of fetal CMR from research to clinical application.

Despite its advancements, fetal CMR is not without challenges and further developments are urgently needed. The primary hurdle remains fetal movement and small structures that prevents fetal CMR to be adopted as a standard clinical tool. To overcome this limitation, it is essential to be able to correct fetal motion in post-processing steps and to acquire a reliable gating signal even in cases of large movements. It will be one of the key goals of Northh Medical to support this development and to ensure seamless image acquisition of exceptional quality, making the process of imaging the fetal heart with MRI straightforward and efficient for the technician responsible for data capture.

**Do you want to stay up to date with the recent literature in the field of fetal CMR?**

Then simply scan this code and check out the list of recent literature on the Northh Medical Homepage:



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## REFERENCES

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