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FROM LAB TO BEDSIDE: ACCELERATING THE TRANSLATION OF RESEARCH INTO PRACTICE

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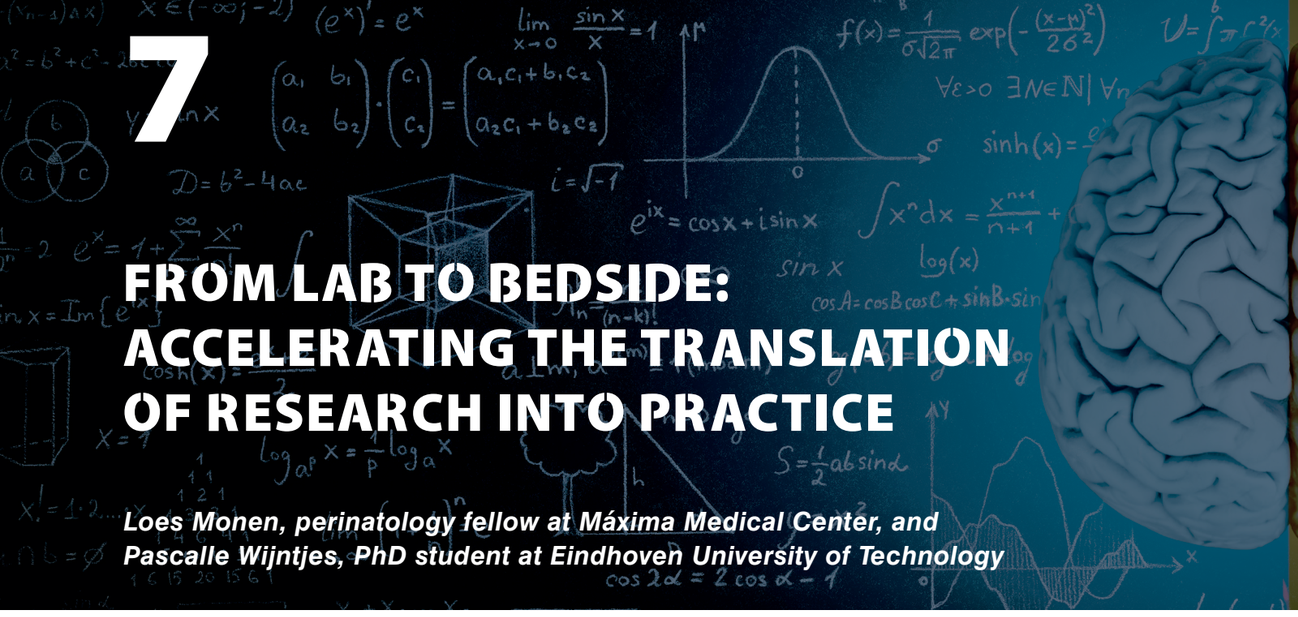

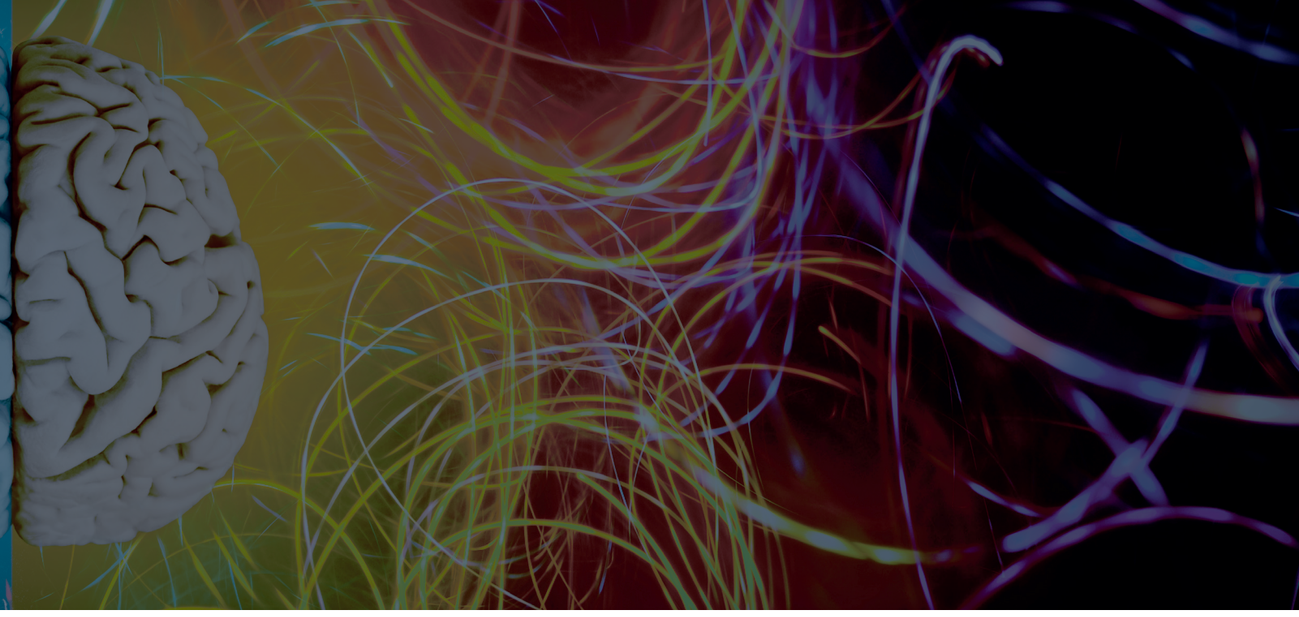

To accelerate the translation from research into practice, a multidisciplinary approach is essential. To aid multidisciplinary communication, different tools can be used. One tool popular for innovation in any kind of organization is Design Thinking. This complex thinking process leads to improved and accelerated creative processes, mainly in multidisciplinary teams.

Design thinking is a non-linear, iterative process that teams use to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test. Involving five phases (Empathize, Define, Ideate, Prototype and Test), it is most useful to tackle problems that are ill-defined or unknown.

Many well-known companies have implemented Design Thinking in their daily practice. Examples are Oral-B, GE Healthcare and Netflix. Design Thinking has also found its way into education, where the concept is taught by Design or Challenge-Based Learning. Many universities, both nationally and internationally, are currently using Design-Based Learning as their main type of project-based learning.

Until now, Design Thinking has not been used on a large scale in healthcare. However, due to many technical innovations in healthcare, the increasing involvement of patients and the necessity to reduce costs, Design Thinking is increasingly valued as an interesting concept for healthcare.

In the field of fundamental perinatology, Design Thinking could aid in innovative ideas. In fundamental perinatology, research teams are generally multidisciplinary, where the people involved have different backgrounds. Also, the new concepts that are explored are suited to this process. In this article, the Design Thinking process is described using an example from our research group.

Before the concept of Design Thinking can be explained in detail, a brief summary of the example research proposal is given.

Research proposal summary

It is often assumed that many obstetric complications are caused by placenta dysfunction. Fetal growth restriction (FGR), hypertensive disorders in pregnancy and pregnancy loss are some of the complications that can be caused by placental insufficiency. For normal placental function, adaptations to blood vessels have to be made, both on the maternal and fetal side of the placenta. Therefore, it is important that the microvasculature of the placenta is studied. Hence, placenta imaging is discussed. So far, no satisfactory method for placenta function has been used in daily practice. One of the proposed methods is contrast-enhanced ultrasonography (CEUS).

Methods and Results

The Design Thinking process consists of five steps: Empathize, Define, Ideate, Prototype and Test. It is an iterative process, meaning that the process can (partly) be repeated after the fifth step. In this section, every step is explained based on the example of placenta microvasculature imaging.

Empathize - In this phase, the problem is explored. In a human-centered manner, all of the aspects of the problem are investigated. In this way, all of one's own assumptions are set aside and real insight is gained into the user's needs. A lot of information is gathered. Different stakeholders and experts in imaging, as well as obstetrics experts, were interviewed in this stage.

Define - The second phase is about defining the problem in a human-centered manner. For placenta vasculature imaging, it is important that the microvasculature of the placenta can be visualized, both on the maternal and fetal side. However, the safety of the mother and baby is most essential when using intravenous contrast agents.

Ideate - In this phase, ideas are generated. The problem is challenged from different directions and insights. The goal is to generate as many ideas as possible in order to eventually select the best ideas.

For visualization of the microvasculature of the placenta, many ideas were first generated. These included Doppler ultrasound, plasticizing the placenta or the use of CEUS. After investigating the pros and cons of each method, CEUS was chosen as the best idea to proceed with. CEUS was found to be easy to implement and enough knowledge was available. Above all, it can image both the macro and microvasculature of the placenta.

Prototype - In this phase, some of the ideas from the ideate phase are tested. Thereafter they can be improved, accepted, or rejected. At the end, in the ideal situation, the best possible solution to the defined problem should be found.

For CEUS, a feasibility study has been done to analyze whether it is possible to visualize the fetal circulation. As this was the 'prototype' phase, an in-vitro approach was used in which already-born placentas were investigated. In this way, it was not too expensive and there were no safety issues for the pregnant women and the fetus. During the execution of the prototype phase, many challenges may be faced. In this case, the right setting for the contrast was not available on the right ultrasound probe. Furthermore, adjustments had to be made to the set-up.

Test - This is the phase where the best solution from the prototype phase is tested. This is the last phase of the Design Thinking process, but one or more steps are usually repeated because of its iterative character.

At this stage, the vasculature of 16 cases has been shown using CEUS. Next, super localization techniques have been applied to the CEUS images. This led to the visualization of the feto-placental macro- and microvasculature of the cases.

At this point, the feasibility of CEUS for placenta imaging has thus been demonstrated. Now, the steps must be repeated to plan larger-scale research with CEUS to get from problem to idea to clinical use.

Discussion

Design Thinking has not been used in daily practice in healthcare. However, it is a concept that is very suitable for the implementation of innovations. It is an iterative process, although it is presented linearly in this report.

Within healthcare research, many steps of the Design Thinking process have already been taken unconsciously, but it helps to structure the brainstorming process. With previous unstructured brainstorm sessions, it is possible to miss out-of-the-box ideas. With the concept of Design Thinking, gathering as many ideas as possible in a human-centered model is key. In this way, input from all viewpoints is secured.

In our field of multidisciplinary and fundamental research in particular, this iterative process could aid in streamlining ideas.

Conclusion

Although still relatively unfamiliar, Design Thinking is a promising and valuable concept for innovations in healthcare. We would recommend implementing this process for future clinical problems with multidisciplinary teams.