Methods to prepare children for MRI have been investigated for decades and outcomes have shown appropriate preparation can reduce patient anxiety and the need for general anaesthetic (GA). For example, one study found that 40% fewer children required GA when preparation was used.\(^1\) Numerous methods have been applied to prepare children including mock scanners,\(^2\) play tunnels,\(^3\) and even therapy dogs to reduce anxiety.\(^4\) Given that an MRI under GA costs around an additional £600\(^5\) per patient there is clear financial incentive to help children achieve an awake MRI. More importantly, however, is the safety benefit to the patient. Although the risks of general anaesthesia and other forms of sedation are low, adverse reactions can still occur\(^6\) and professional bodies have highlighted that uncertainty remains regarding the long term effects of anaesthetics in children.\(^7\)

Virtual reality (VR) offers a novel method to prepare patients for MRI through creating a virtual MRI environment providing the experience of having a scan. This can be realised through a variety of technologies. Content creation can be achieved through 3D models of MRI scanners\(^8\) or photorealistic 360° footage.\(^8\) The quality of experience depends on the type of VR headset, which range from Google cardboard-style viewers (£5-£20), to fully immersive VR headsets such as the Oculus Rift/Quest (£300-£400). The work undertaken at our institutions involved creating a VR app based on 360° videos embedded within an animated, interactive interface designed for four to 12-year-olds (see mymri.org). The resource, deployed to both the Google Play Store and iOS App Store, can be downloaded free of charge onto any mobile device. When used in conjunction with a Google Cardboard VR headset the app allows patients and their parents to experience what it is like to have an MRI scan from the comfort of their own home. This work has won numerous national awards including the chief science officer’s Healthcare Science Awards: Innovation in Healthcare Delivery (2018) and the BIR Making it Better Award as highly commended (2017).

Individualised versions of the app are in use at four different hospitals and an initial pilot evaluation was undertaken with 44 patients aged four to 12 at King’s College Hospital and NHS Highland. Results from patient questionnaires on the app showed it was rated as nine out of 10 for being helpful, enjoyable and easy to use. There was unanimous agreement that it made children feel more positive about their MRI and all patients recommended it to other children needing an MRI. At the Royal Belfast Hospital for Sick Children the app was assessed on a cohort of 100 patients. Children aged four to 12 initially booked on a GA-MRI list were invited to attempt an awake MRI with the
app as preparation. The awake MRI was successful in 88% of patients with no additional needs and 42% in patients with additional needs (learning difficulties, ADHD, autism and Down’s syndrome).

A variety of methods have been used to deploy the VR resource across the different sites. Regina Cremin, Kirstie Still, Nina Mellor, Laura McShane and Anna Symons explore a series of questions discussing the implementation of VR for MRI preparation at their institution.

Regina Cremin and Kirstie Still
How have you been using the app and booklet to prepare children?

We send parents a letter with a set of customised cardboard VR goggles. Play specialists also have the VR goggles and a VR mirroring tablet on the ward so they can see what the child sees and talk them through the process.

After the success of the initial evaluation we have started offering potential GA cases an awake MRI appointment. If successful the GA slot can then be cancelled.

What impact do you feel it has had on helping children through their MRI?

Some children have come through without preparation and the stress has resulted in the scan being abandoned, with parents and consultants concerned over delays in care. Seeing these patients return after using the VR preparation led to a complete change. The stress was gone and anxiety was no longer there as both parent and child felt prepared for their scan. This was amazing to see and makes you proud to be able to help your patients. The app also helped the scan become a fun experience, usually resulting in us pretending the patients are astronauts and the MRI scanner is a rocket.

During COVID-19 the hospital has become an even more intimidating place but the preparation at home beforehand has really helped. By posting out cheap disposable VR headsets we have managed to avoid spreading infection.

Feedback from parents has also been great. We hadn’t considered this at the start but the app really helps them to understand their child’s upcoming MRI, reducing their own anxieties and enabling them to better prepare their child. We now realise how the app is preparing both child and parents.

Do you have any great success stories you would like to share?

We have had two cases where patients were so excited by the app that they took their VR goggles into school to show their teachers and school friends. This helped us realise how young people like to know what’s happening and feel involved in their care rather than just being told what to do by adults.

Nina Mellor
How have you been using the app and booklet to prepare children?

We have a link to the app in all of our outpatient letters and most parents download the app to prepare their child at home. This was very useful during the COVID-19 peak, as children could prepare at home without a play specialist in a non-contact approach. The app is also very useful when preparing children on the ward. Our imaging play specialist takes her smart device and disposable VR headset to the ward so patients can practise in the comfort of their own beds. The app allows radiographers to prepare children just before their scan in a timely manner if a child is feeling anxious.

Laura McShane
How have you been using the app and booklet to prepare children?

We show kids the app when they come for their MRI and tell parents about it over the phone. In some cases where it is thought kids initially require a GA, we ask the parents if they would like to try the app and attempt the scan awake. The play specialists use it a lot for kids who need additional support.

Unfortunately due to COVID-19 the headset has not been given out; however, parents and children can still view the app on their tablets and phones not in VR mode.
What impact do you feel it has had on helping children through their MRI?

We have found it reduces anxiety and because we can get kids laying down quicker it makes the majority of scans quicker. We also find kids are a lot more excited about coming in for their scans. My evaluation definitely showed an increase in the numbers of kids laying still for their MRI. The youngest child we got to lie awake for their scan by using the app was a three-year-old.

Do you have any great success stories you would like to share?

For us, children with Down’s syndrome are automatically assumed to require a GA. For one six-year-old boy we contacted his mother who from her own MRI experience also felt her son would not tolerate the scan. There was, however, a much longer wait for a GA-MRI and so when we highlighted that preparation using the VR app may help her son if she was willing to try, although still doubtful. Upon meeting the patient on the day of his scan, I could see that he was excited, he was looking forward to seeing the scanner, picking the colour of the room and watching a movie. He was well prepared for all aspects of imaging from the noise, to the use of a head coil, headphones, the location of his mum in the room and nothing came as a surprise. His scan was successful and his mum was exceptionally happy; she was still in shock that he lasted for his 20 minute scan.

Anna Symons

How have you been using the app and booklet to prepare children?

As a radiology department nurse I have been involved with using the app to prepare patients immediately prior to their MRI. I also undertake pre-assessment for GA-MRI and for some patients we will ask if they would like to attempt an awake MRI with the help of the app. The app was developed in combination with the play specialists and so they use it a lot on the ward too.

What impact do you feel it has had on helping children through their MRI?

Kids certainly seem to get excited when using the app and it really can completely change their view towards their upcoming MRI. We also gained some feedback from radiographers and they suggested the app was helpful for their job role and they felt it was saving time for some kids as they already knew what to do and that they had to lie still for their MRI.

Do you have any great success stories you would like to share?

I remember one four-year-old girl whose mum was really keen to avoid a GA. But being four we thought an awake MRI would be difficult. We used the app prior to her scan and spent a lot of time explaining and practising how she needed to lay still when the scanner was being noisy. She surprised us all, was so mature and really well behaved and the scan was a success. I think the app really helped her to practise just like practising in the actual scanner.

In a second case we had a child arrive for an MRI scan who we prepped with the VR goggles. After we left he started quarrelling with his sibling who also wanted a go with the VR. I think this highlights how excited kids are with this technology and how using VR really helps them engage with their own care.

For more information and for links to download the app go to www.mymri.org.

*representative value from the author’s institution.

References