

Prevalence of Fear in Young Children Towards the MRI Environment

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Introduction

Medical imaging systems (including MRI) and their environments carry psychological risks for those being imaged. Strong transitory fear and claustrophobia have been reported. In children, this stress can be even greater due to poor communication or a lack of understanding, with the result that children are often excluded from MRI research and its benefits. Researchers and Ethics Boards require measures of the probability and severity of a child's response to an imaging environment in order to make accurate judgements of the risk/benefit ratio for prospective participants, and to help estimate the number of participants who must be recruited in order to have a final sample of desired size.

Methods

We determined the proportion of children aged 2 through 7 (n=45) unwilling to enter a non-clinical MRI situation. Each participant's response to a particular aspect of the imaging environment was measured in terms of progress through a brief series of approximations to normal patient treatment during MRI scans. Willingness to continue or anxiety level at each step was measured using a 5-point self-reported overt behaviour scale, where 1 means no fear/anxiety at all, 3 means "I'm ok" and 5 means something frightening that the child prefers to avoid. Ratings were collected using a visual analogue scale on a printed card (the numbers were supplemented by a series of line drawings of faces, from "upset red face" to "happy green face"). Each child was asked to point to the face that indicated how he or she was feeling at each step. Every effort was made to ensure that children never reached a very fearful situation (a measure of 5 on the scale) and if any child indicated a level of 4 or 5, they were immediately removed from the situation.

Children received a rating scale competency assessment prior to encountering the MRI environment and then progressed through the following hierarchy of potentially frightening situations: 1. Child asked to stand outside scanner room; 2. Child entered the room; 3. Child put in ear plugs and scanner noises started; 4. Child asked to stand beside the scanning bed, then the scanner noise was stopped; 5. Child asked to lie on the scanning bed, outside the main bore; 6. Head coil placed and mirror set; 7. Table positioned to align laser light for subject positioning in MRI and child asked if willing to enter into the bore, and 8. Bed moved into scanner bore. Participation was concluded when the child either indicated an unwillingness to proceed (rating of 4 or 5) or had completed the hierarchy. A parent was present with the child throughout the procedure.

Results

Forty-five children between the ages of two and seven participated in the study. Twenty-three children (51%) completed the hierarchy. Three subjects (7%; 5 yr M&F and 3 yr F) refused to enter the scanning room indicating they were not interested in what was on the other side of the closed door. Three children (7%; 3 yr F&M, 4yr M) indicated fear of scanner noises and stopped prior to the noises beginning. One child (2%, 3 yr M) would listen to the noises, but did not want to approach the MRI. Twelve children (27%) did not complete step 5 and three did not want to complete step 6 (7%; two 3 yr M, 6 yr F). An equal percentage of males and females completed the hierarchy. The percentages of children who completed the hierarchy based on age were: 35% aged 2-3 yrs, 50% aged 4-5 yrs and 75% aged 6-7 yrs (mean for all ages 53.43 \pm 0.20).

Age (Years)	2		3		4		5		6		7	
Sex	1M	0F	9M	7F	4M	1F	7M	4F	4M	6F	2M	0F
Completed Hierarchy	0	-	3	3	2	1	3	2	4	3	2	-

Discussion and Conclusions

A number of studies have reported proportions of people who show strong fear and refuse to receive an MRI scan unless sedated ¹. These data are inadequate for estimating the prevalence of fear in pediatric volunteers or their willingness to participate in MRI research studies. One reason is that the large majority of existing data were gathered in clinical settings from participants who were receiving the MRI to diagnose a potentially serious medical condition. These situations present additional stresses to patients and may exacerbate fearful reactions to the MRI environment. The difference, if any, between prevalence of fear under these conditions versus that in the MRI research contexts is unknown. To our knowledge there are no published data available to researchers and ethics boards regarding the prevalence of fearful reactions that pertain specifically to children, and especially to younger children in research studies.

We found that approximately 50% of children between the ages of two and seven would be willing to enter a MR imaging environment. Gender does not appear to be a significant factor as 52% of males and 50% of females completed the hierarchy. Successful completion of the hierarchy improved with age, with 75% of children aged 6 and 7 years completing all of the steps compared to only 35% between the ages of 2 and 4 and 50% between 4 and 5 years of age. The greatest stumbling block for cooperation in MRI research studies is the act of lying down on the patient table (steps 5 and 6). Of the children who did not complete the hierarchy, this position of vulnerability caused the most unease (68%). Only three subjects (18%) who did not complete the hierarchy indicated fear of the MRI system noises. We expect these numbers to be higher in developmentally delayed populations (such as autism spectrum disorders or fetal alcohol spectrum disorders) compared to the typical healthy controls enrolled in the current study.

In our experience, children are often excluded from MRI research and its potential benefits because of concerns about physical or psychological risks. In this study we gathered data that may help to prevent exclusion or inclusion based on inaccurate estimates of the risk of fear during MRI studies. Researchers who work with pediatric volunteers between the ages of 2 and 5 years should factor into their calculations for group size a failure rate of approximately 57% for children entering the imaging environment (this does not include experimental failure due to motion and other factors) and 25% for children aged 6 and 7 years. These numbers can likely be reduced if researchers commit the extra time, care and effort required to acclimatize the children to the MR environment by successive approximations to the requirements for the actual imaging study.

References

1. J. Marshall et al. A comprehensive analysis of MRI research risks: in support of full disclosure. Can J Neurol Sci. 2007, Feb **34**(1), 11-7.