

2-2021

## Identifying the Roadblocks to Successful Pediatric Imaging Without Sedation or Anesthesia

Iman Soliman

Ammie M. White, MD

J. Christopher Edgar, PhD

Laura Cadge, CCLS

Margaret Hamel-Daymon, CRNP

*See next page for additional authors*

Follow this and additional works at: [https://jdc.jefferson.edu/si\\_ctr\\_2023\\_phase1](https://jdc.jefferson.edu/si_ctr_2023_phase1)



Part of the [Anesthesiology Commons](#), [Pediatrics Commons](#), and the [Translational Medical Research Commons](#)

### [Let us know how access to this document benefits you](#)

---

This Article is brought to you for free and open access by the Jefferson Digital Commons. The Jefferson Digital Commons is a service of Thomas Jefferson University's [Center for Teaching and Learning \(CTL\)](#). The Commons is a showcase for Jefferson books and journals, peer-reviewed scholarly publications, unique historical collections from the University archives, and teaching tools. The Jefferson Digital Commons allows researchers and interested readers anywhere in the world to learn about and keep up to date with Jefferson scholarship. This article has been accepted for inclusion in Phase 1 by an authorized administrator of the Jefferson Digital Commons. For more information, please contact: [JeffersonDigitalCommons@jefferson.edu](mailto:JeffersonDigitalCommons@jefferson.edu).

---

**Authors**

Iman Soliman; Ammie M. White, MD; J. Christopher Edgar, PhD; Laura Cadge, CCLS; Margaret Hamel-Daymon, CRNP; Sandra Saade-Lemus, MD; Rochelle Bagatell, MD; Elizabeth T. Drum, MD; and Lisa States, MD

---

# Identifying the Roadblocks to Successful Pediatric Imaging Without Sedation or Anesthesia

Iman Soliman, Lisa States, MD\*

**I have nothing to disclose.**

# Introduction and Objective

- Need for sedation/general anesthesia (GA) to promote scan success in young children
- Adverse events in hospital and outpatient setting associated with use of sedation/GA in children<sup>1</sup>
- Pre-clinical evidence suggesting that GA affects brain development<sup>2</sup>

**Objective:** To critically evaluate the use of sedation/GA in the diagnostic imaging setting

# Research Question & Hypothesis

- **Research Question:** What are the roadblocks to completing a successful MRI scan without sedation/GA in patients ages 5 to 9 in the outpatient setting?
- **Hypothesis:** Extended scan duration, lack of parental education, and insufficient patient preparation are the biggest barriers to non-sedated MRI scans in patients ages 5 to 9 in the outpatient setting.

# Methods

- **Study design:**

- Prospective data registry created via patient and parent/guardian surveys
- Medical record review

- **Population:**

- Patients ages 5 to 9 who are undergoing outpatient non-sedated MRI scans
- Parent/guardian of all patients ages 5 to 9 undergoing outpatient MRI scans, regardless of sedation status

- **Comparison groups:**

- CHOP Wood Center (Inpatient & Outpatient Setting - Philadelphia)
- CHOP Buerger Center (Outpatient Setting Only - Philadelphia)
- CHOP Specialty Care Center (Outpatient Setting Only - King of Prussia)

# Methods

- **Outcomes:**

- Closed-ended questions: frequencies of each survey response will be evaluated quantitatively
- Open-ended questions: each survey response will be evaluated qualitatively

- **Data Collection:** Both patient and parent/guardian surveys will be administered in person on REDCap via iPad

- **Analysis:**

- General: descriptive statistics
- Nominal & ordinal data: Chi-square test/Pearson correlation
- Scale data: Kolmogorov-Smirnov test/Shapiro-Wilk test
- Non-parametric distribution of data: Wilcoxon test/Mann-Whitney test



Category	Question	Outcome
Interest in Nonsedated MRI	<i>before</i> MRI was scheduled	<b>Likert scale</b> (1- definitely not interested, 5- very interested)
	<i>after</i> MRI was scheduled	
	<i>in the future</i> (if child was sedated today)	<b>Multiple choice</b> Yes, No, Unsure
Advantages & Disadvantages of Nonsedated MRI	Advantages	<b>Check all that apply</b> (less exposure to medications; decreased appointment time; reduced cost; routine; easier to schedule; no need for NPO; none; other - open ended)
	Disadvantages	<b>Check all that apply</b> (small space; scanner noise; anxiety/stress; movement during scan; change in routine; none; other - open ended)
Information About Present MRI	Purpose of MRI	<b>Likert scale</b> (1- not informed at all, 5- completely informed)
	MRI technology	
	Child preparation	
	Sedation/GA	
Child Life Support	Types of support	<b>Check all that apply</b> (storybook; video; mock scanner; prize; none; other - open ended)

# Results: Demographics and Clinical Characteristics

	All Patients		Sedated Patients		Nonsedated Patients		p <sup>a</sup>
	M ± SD	Median	M ± SD	Median	M ± SD	Median	
<b>Age</b>	7.53 ± 1.33	7.58	6.90 ± 1.18	6.59	8.27 ± 1.10	8.42	0.001 <sup>b</sup>
<b># Total Scans</b>	3.78 ± 6.77	1.00	4.76 ± 7.89	1.00	2.62 ± 5.06	1.00	0.457
<b># Sedated Scans</b>	3.56 ± 6.63	1.00	4.74 ± 7.90	1.00	2.17 ± 4.49	0.00	0.310
<b># Nonsedated Scans</b>	0.22 ± 0.58	0.00	0.03 ± 0.17	0.00	0.45 ± 0.78	0.00	0.015 <sup>c</sup>

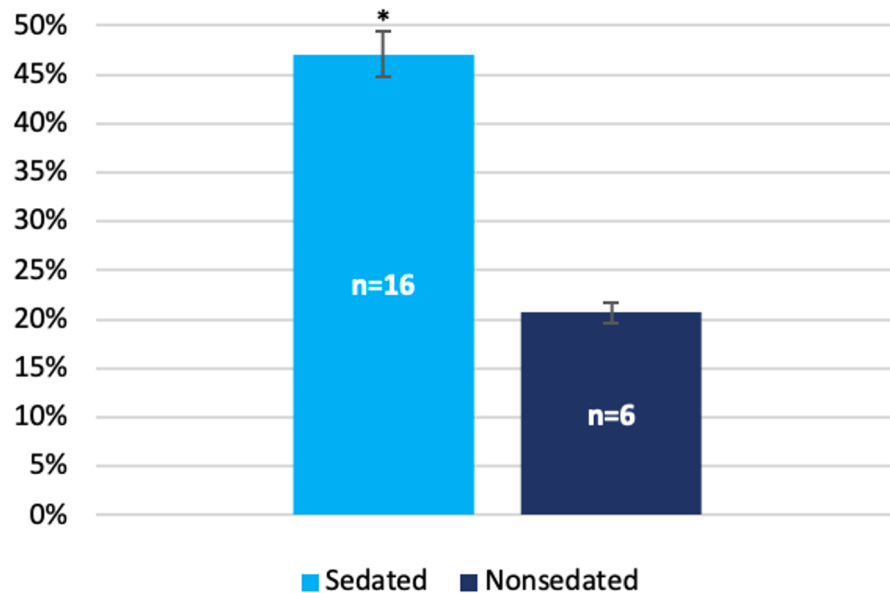
<sup>a</sup> two-sided p-value from one-way ANOVA

<sup>b</sup> planned comparisons show nonsedated > all > sedated

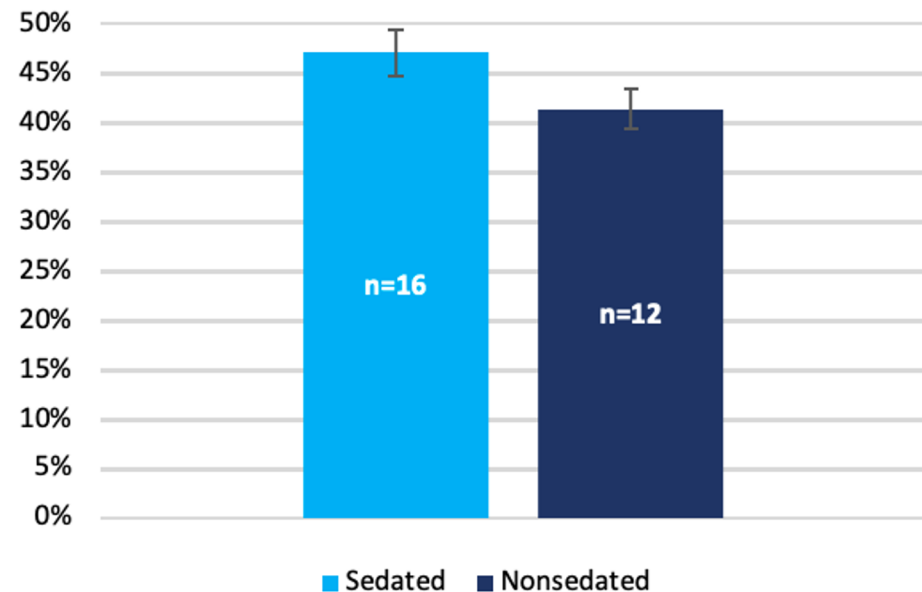
<sup>c</sup> planned comparisons show nonsedated > sedated

# Results: Demographics and Clinical Characteristics

## Cancer/Cancer Syndrome/Tumor



## Developmental/Motor Disability



# Results: Demographics and Clinical Characteristics

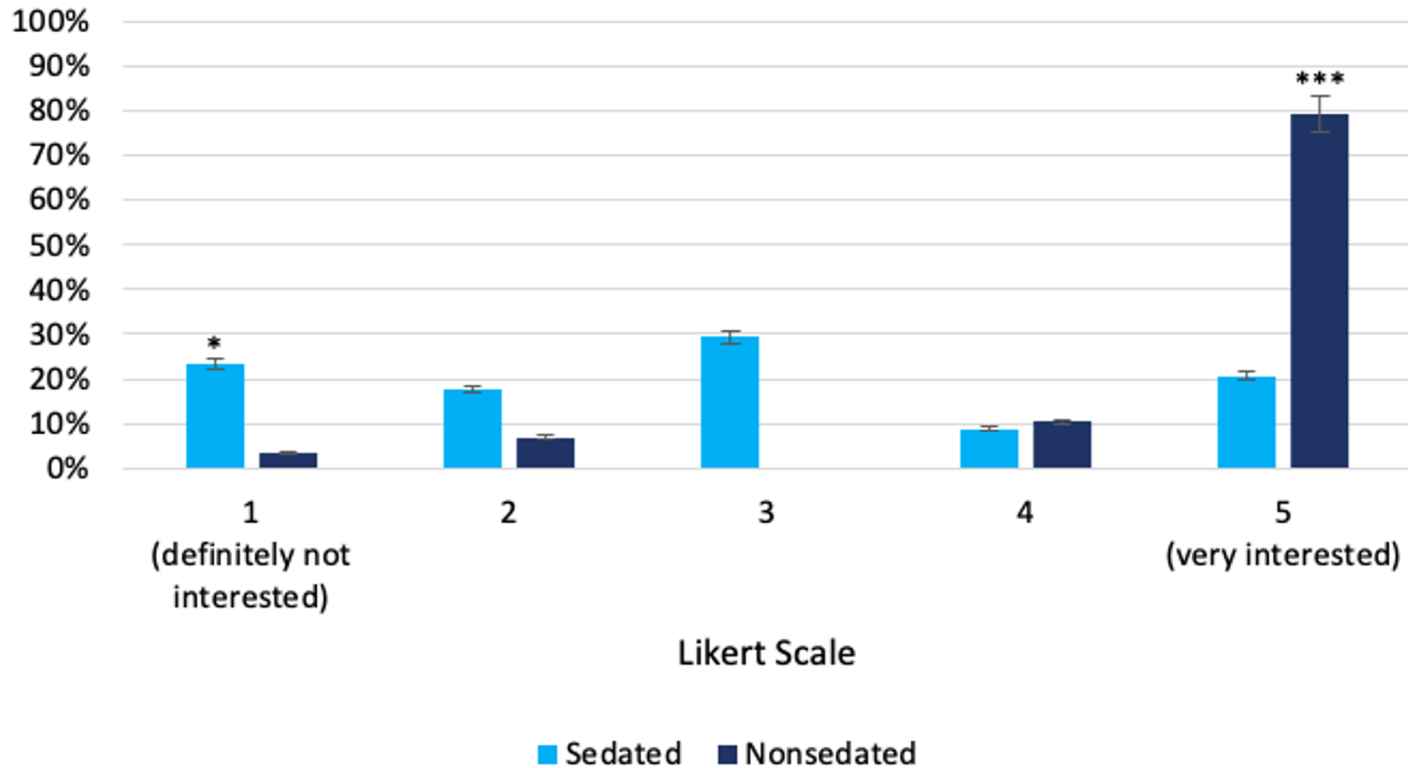
	Sedated Patients		Nonsedated Patients		p <sup>a</sup>
	M ± SD	Median	M ± SD	Median	
<b>Number of Studies Ordered (ACC #)</b>	1.44 ± 0.56	1.00	1.14 ± 0.44	1.00	0.019
<b>Scan Duration (mins)</b>	62.94 ± 29.94	56.50	49.97 ± 21.95	47.00	0.058

<sup>a</sup> two-sided p-value from Student's t-test

Category	Question	Outcome
Interest in Nonsedated MRI	<i>before</i> MRI was scheduled	<b>Likert scale</b> (1- definitely not interested, 5- very interested)
	<i>after</i> MRI was scheduled	
	<i>in the future</i> (if child was sedated today)	<b>Multiple choice</b> Yes, No, Unsure
Advantages & Disadvantages of Nonsedated MRI	Advantages	<b>Check all that apply</b> (less exposure to medications; decreased appointment time; reduced cost; routine; easier to schedule; no need for NPO; none; other - open ended)
	Disadvantages	<b>Check all that apply</b> (small space; scanner noise; anxiety/stress; movement during scan; change in routine; none; other - open ended)
Information About Present MRI	Purpose of MRI	<b>Likert scale</b> (1- not informed at all, 5- completely informed)
	MRI technology	
	Child preparation	
	Sedation/GA	
Child Life Support	Types of support	<b>Check all that apply</b> (storybook; video; mock scanner; prize; none; other - open ended)

# Results: Parent/Guardian Survey Responses

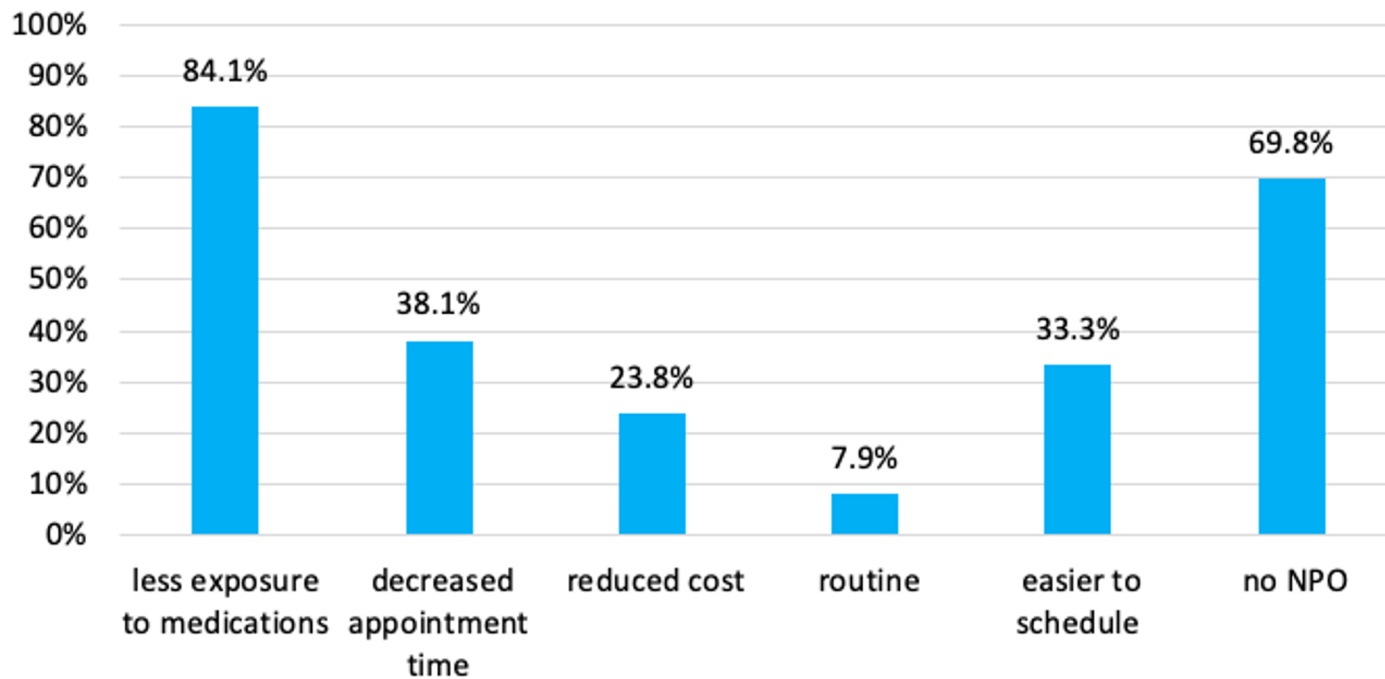
## Parental Interest in Nonsedated MRI Scan



Category	Question	Outcome
Interest in Nonsedated MRI	<i>before</i> MRI was scheduled	<b>Likert scale</b> (1- definitely not interested, 5- very interested)
	<i>after</i> MRI was scheduled	
	<i>in the future</i> (if child was sedated today)	<b>Multiple choice</b> Yes, No, Unsure
Advantages & Disadvantages of Nonsedated MRI	Advantages	<b>Check all that apply</b> (less exposure to medications; decreased appointment time; reduced cost; routine; easier to schedule; no need for NPO; none; other - open ended)
	Disadvantages	<b>Check all that apply</b> (small space; scanner noise; anxiety/stress; movement during scan; change in routine; none; other - open ended)
Information About Present MRI	Purpose of MRI	<b>Likert scale</b> (1- not informed at all, 5- completely informed)
	MRI technology	
	Child preparation	
	Sedation/GA	
Child Life Support	Types of support	<b>Check all that apply</b> (storybook; video; mock scanner; prize; none; other - open ended)

# Results: Parent/Guardian Survey Responses

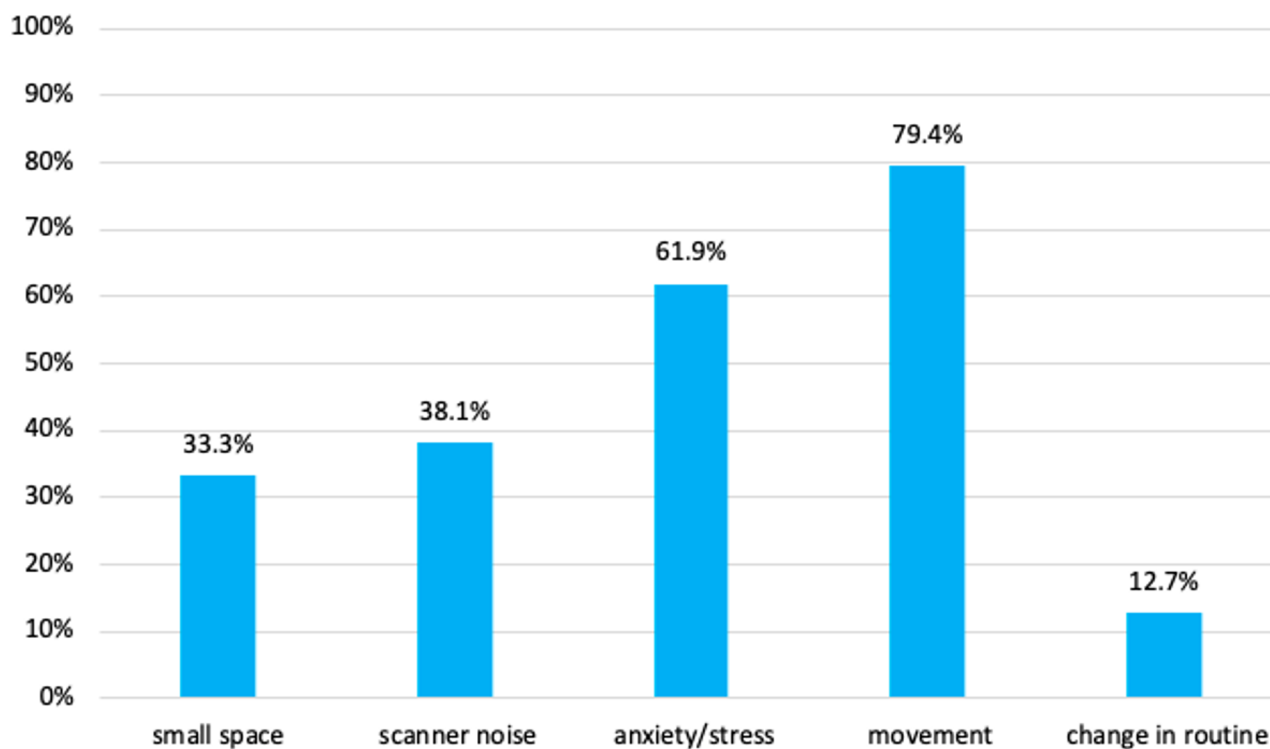
## Overall Advantages of Nonsedated MRI Scan





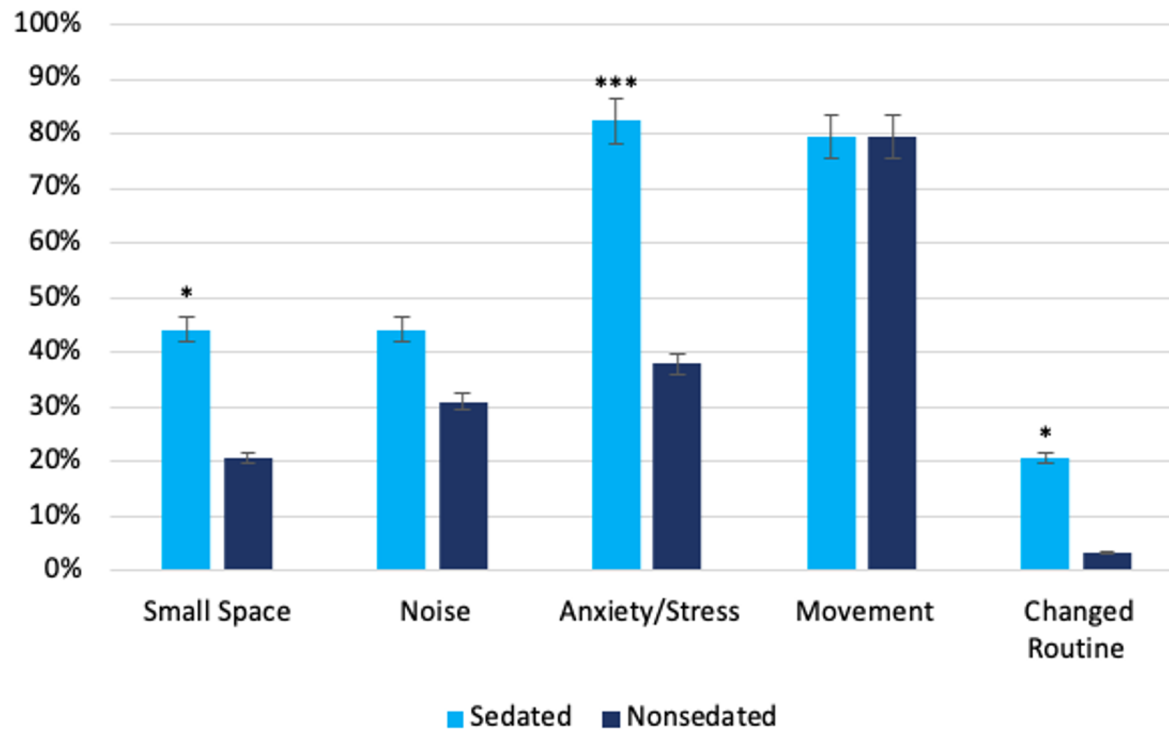
# Results: Parent/Guardian Survey Responses

Overall Disadvantages of Nonsedated MRI Scan



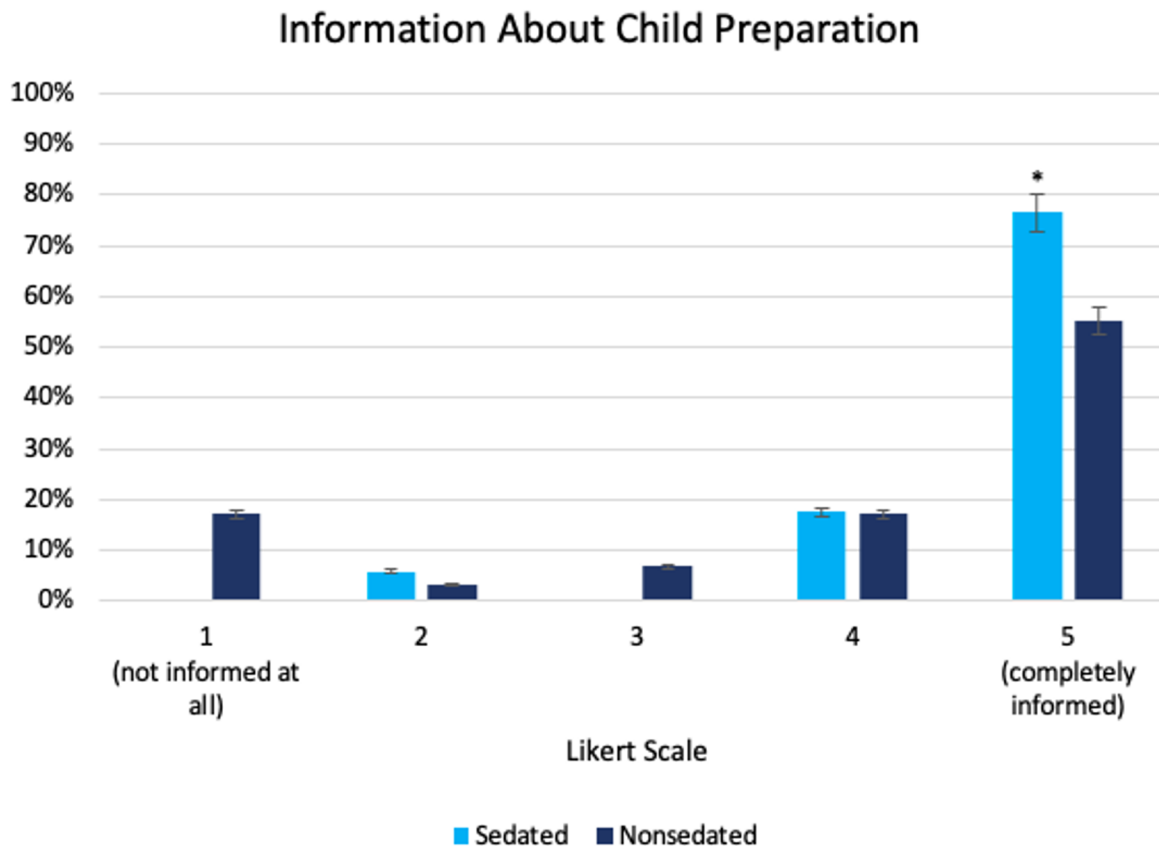
# Results: Parent/Guardian Survey Responses

## Disadvantages of Nonsedated MRI Scan



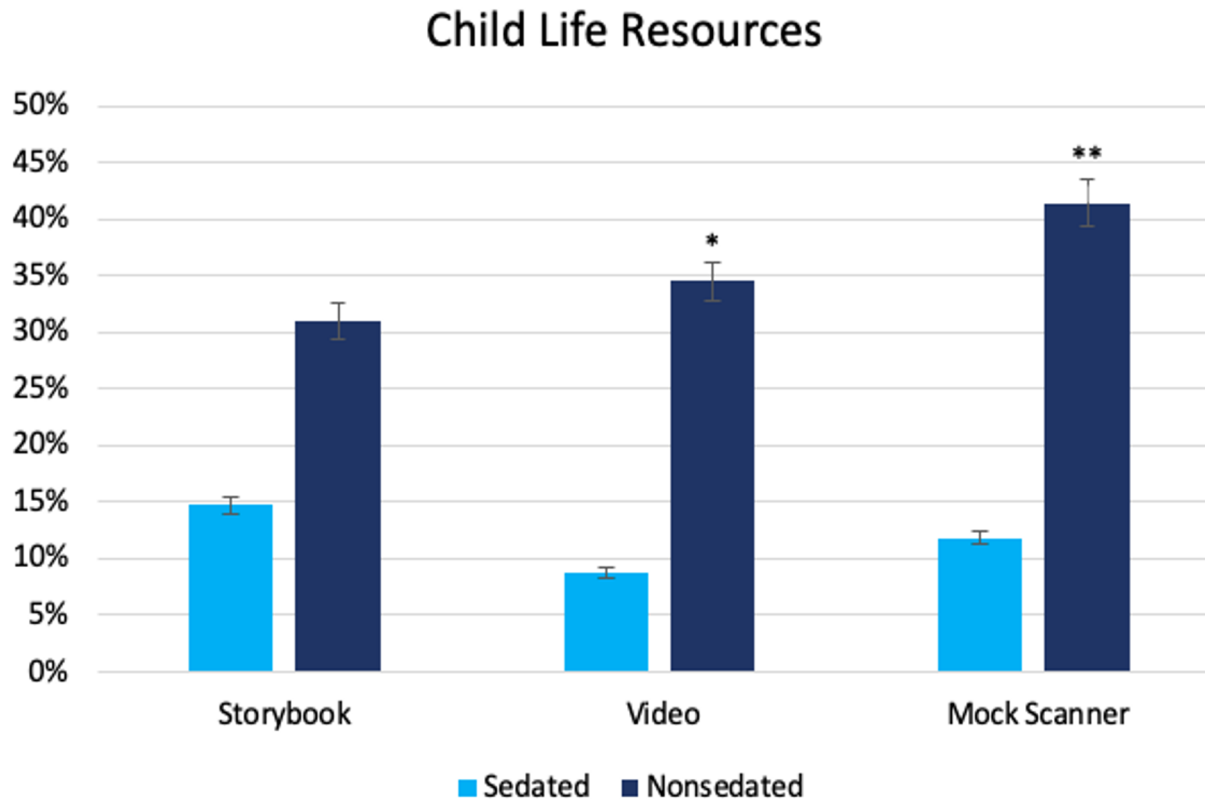
Category	Question	Outcome
Interest in Nonsedated MRI	<i>before</i> MRI was scheduled	<b>Likert scale</b> (1- definitely not interested, 5- very interested)
	<i>after</i> MRI was scheduled	
	<i>in the future</i> (if child was sedated today)	<b>Multiple choice</b> Yes, No, Unsure
Advantages & Disadvantages of Nonsedated MRI	Advantages	<b>Check all that apply</b> (less exposure to medications; decreased appointment time; reduced cost; routine; easier to schedule; no need for NPO; none; other - open ended)
	Disadvantages	<b>Check all that apply</b> (small space; scanner noise; anxiety/stress; movement during scan; change in routine; none; other - open ended)
Information About Present MRI	Purpose of MRI	<b>Likert scale</b> (1- not informed at all, 5- completely informed)
	MRI technology	
	Child preparation	
	Sedation/GA	
Child Life Support	Types of support	<b>Check all that apply</b> (storybook; video; mock scanner; prize; none; other - open ended)

# Results: Parent/Guardian Survey Responses



Category	Question	Outcome
Interest in Nonsedated MRI	<i>before</i> MRI was scheduled	<b>Likert scale</b> (1- definitely not interested, 5- very interested)
	<i>after</i> MRI was scheduled	
	<i>in the future</i> (if child was sedated today)	<b>Multiple choice</b> Yes, No, Unsure
Advantages & Disadvantages of Nonsedated MRI	Advantages	<b>Check all that apply</b> (less exposure to medications; decreased appointment time; reduced cost; routine; easier to schedule; no need for NPO; none; other - open ended)
	Disadvantages	<b>Check all that apply</b> (small space; scanner noise; anxiety/stress; movement during scan; change in routine; none; other - open ended)
Information About Present MRI	Purpose of MRI	<b>Likert scale</b> (1- not informed at all, 5- completely informed)
	MRI technology	
	Child preparation	
	Sedation/GA	
Child Life Support	Types of support	<b>Check all that apply</b> (storybook; video; mock scanner; prize; none; other - open ended)

# Results: Parent/Guardian Survey Responses



# Results: Nonsedated Patient Survey Responses

- **Prior to MRI:**
  - Child Life resources received prior to the scan were confirmed with parents (as discussed)
- **During MRI:**
  - Majority of nonsedated patients (88.0%) reported watching a movie during their MRI scan
  - Slightly greater than a third of patients (36.0%) reported having their parent/guardian present in the room during their MRI scan
- **After MRI:**
  - Slightly more than half of patients (52.0%) reported receiving a prize after completing their MRI scan

# Conclusions

- The roadblocks to nonsedated pediatric imaging include:
  - Extended scan duration
  - Parental preference
  - Patient & parental anxiety
- These roadblocks can be overcome by
  - Decreasing scan duration
  - Increasing parental education
  - Increasing child preparation



# Future Directions

- Efforts focused on improving communication with parents
  - Nurse navigator role
- Using data to build foundation for QI initiative
  - Reduce use of sedation/GA by 25% in uncomplicated MRI scans for patients ages 5-8

# References

1. Malviya S, Voepel-Lewis T, Prochaska G, Tait AR. Prolonged recovery and delayed side effects of sedation for diagnostic imaging studies in children. *Pediatrics*. 2000;105(3):E42.
2. Sun L. Early childhood general anaesthesia exposure and neurocognitive development. *Br J Anaesth*. 2010;105 Suppl 1:i61-8.



**Jefferson**

**Philadelphia University +  
Thomas Jefferson University**

---

HOME OF SIDNEY KIMMEL MEDICAL COLLEGE