Cast or Nail? Efficacy of a Preference-Based Decision Tool for Parents on Treatment Decisions for Pediatric Femoral Shaft Fractures
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INTRODUCTION:
Femoral shaft fractures are common pediatric injuries treated by orthopaedic surgeons. There are several treatment options, typically based on the age of the child. In the pre-school aged child (2-6 years), there are potential treatments ranging from reduction and casting to open reduction with flexible intramedullary nails (FIN). While each treatment has unique attributes with different risks, postoperative courses, and potential burden to caregivers, the reported union rates and function levels, regardless of treatment, are similar. Given equivalent outcomes, a shared-decision-making process can be used to assess individual patient and family situations to determine the best treatment for a particular patient. We hypothesized that a survey-based, decision tool using adaptive conjoint analysis would accurately elicit patient preferences and guide respondents toward a treatment for pediatric femoral shaft fractures that reflected those preferences. Such data will guide in providing advice to parents about treatments.

METHODS:
An interactive web survey was created, which included background information about pediatric femoral shaft fractures and the treatments of spica casting and FIN. Basic demographic information as well as family characteristics were collected. An adaptive conjoint analysis (ACA) exercise was included within the survey to elicit the preferences of individuals based on a fixed set of attributes relating to alternative treatment options, spica cast or flexible intramedullary nails (FIN), of femoral shaft fractures in the pediatric population. Each attribute was presented as a spectrum of possible clinical scenarios that represented a range of expected postoperative courses of either spica casting or FIN treatment (Table 1). A crowdsourcing marketplace was used to recruit survey respondents who simulated the at-risk population. ACA data was analyzed to generate relative importance values of each attribute based on utility weights. Logistic regression was performed to model choice of treatment casting or FIN. Included in the covariate analysis were demographic variables, family characteristics, and preference weights as determined by the ACA exercise (p-value = 0.05 for significance).

RESULTS:
Of 223 respondents, 186 were included in the final analysis, eliminating those who failed an attention check question and those who did not complete all ACA questions. A total of 79% of subjects chose casting as their ultimate treatment choice, while 21% chose FIN. The need for second surgery had the highest relative importance (42.00), followed by chance of serious complications (24.58), time away from school (12.89), effort required by caregivers (10.95), and least importantly, return to activities (9.58) (Figure 1). In total, 85% of respondents indicated the generated relative importance of attributes aligned “very well or well” with their preferences.

For those who chose casting, the need for secondary surgery and chance of serious complications were the most important factors. While those attributes were most important to those choosing surgery as well, they were significantly less important than in the casting cohort (43.9 vs. 34.8, p<0.001 and 25.9 vs.19.6, p<0.001, respectively). In addition, returning to activities, burden to caregivers, and time away from school were all significantly more important to those choosing surgery versus casting (12.6 vs. 8.7 p<0.001, 12.6 vs. 9.8 p=0.014, 16.6 vs. 11.7 p<0.001, respectively). Linear regression models revealed a quicker return to activities was more important to single caregivers (p=0.018), but no other covariates indicated a significant preference of treatment or importance of attributes.

DISCUSSION AND CONCLUSION:
Our decision-making tool was able to accurately identify the important treatment factors for subjects and also demonstrated the importance values of treatment attributes correlated with the ultimate treatment decision. In doing so, this tool aligned treatment decisions with individual preferences. This study supports further investigations of an ACA tool to allow for a shared decision-making model between families and surgeons. Such studies will investigate posttreatment family satisfaction of each treatment without the tool, as well as utilization of this tool in actual patient populations, assessing families’ satisfaction of being included in decision making, as well as their ultimate satisfaction of the treatment choice selected. A structured, decision tool that systematically elicits patient preferences may further improve shared decision making and family understanding, leading to improved satisfaction rates, which has previously been reported, as well as overall outcomes.
<table>
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<th>Attribute</th>
<th>Levels</th>
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| Timing of return to activities | 1 month  
2 months  
3 months          |
| Effort to caregivers      | Fully Dependent- child cannot walk and must be carried or use a wagon/wheelchair inside and outside the home for 4 weeks  
Partly Dependent- child will need an aide, such as crutches or a walker for short distances and may need to be carried or wheeled outside the home for 4 weeks |
| Chance of serious complications | 1% risk of serious complications  
6% risk of serious complications  
10% risk of serious complications |
| Time away from school/daycare | Miss school/daycare for 3 days  
Miss school/daycare for 1 week  
Miss school/daycare for 4 weeks |
| Need for a second surgery | 1% chance of needing a second surgery  
20% chance of needing a second surgery  
66% chance of needing a second surgery |

Relative Importance Weights (SE)  
(Scale 0-100)  
Pediatric Femur Fracture Treatment Characteristics