The Preferred Attributes of a Trauma Team Leader: Evidence From a Discrete Choice Experiment

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OBJECTIVE: Leaders of a pediatric trauma team are tasked with managing rapidly changing diagnostic and treatment challenges, while ensuring the entire team functions effectively to produce optimal patient outcomes. An effective trauma team leader is often thought to be self-evident, and there is little formal literature identifying the leadership characteristics and attributes associated with optimal trauma team performance. The purpose of this study was to elicit the trauma team leader traits and characteristics deemed of greatest utility by members of the pediatric trauma team.

DESIGN, SETTING, PARTICIPANTS: Members of the pediatric trauma team at British Columbia Children's Hospital were asked to participate in a semistructured interview to identify trauma team leader attributes associated with maximal team performance. Using the attributes, we constructed a discrete choice experiment (DCE). DCEs, developed in the economics and market research setting, allow participants to express preferences among finite alternatives, with subsequent statistical analysis that allows quantitative comparison of the utility of selected attributes.

RESULTS: After interviewing 21 trauma team practitioners, 6 themes were identified as being most important for trauma team leadership. The developed DCE was administered to 64 members of the trauma team. Analysis of the DCE revealed the most important attributes were collaboration, strong communication, and decisiveness. The attribute of least utility was experience. The specific leadership qualities that provided the most utility to the trauma team included "actively involves input for team" (mean utility [MU]: 0.70; standard error [SE]: 0.11) and "concise communication, at times closed-loop" (MU: 0.52; SE: 0.09). "Hesitant and unclear communication" (MU: −0.88; SE: 0.09) and "often indecisive" (MU: −0.68; SE: 0.10) were deemed most detrimental (negative utility) to the team's function.

CONCLUSIONS: This study is novel in applying a strategy to identify and quantify the relative value of trauma team leader attributes. When designing education initiatives for pediatric trauma care teams, defining trauma team quality metrics, and providing continuing medical education for the team leader, it is essential to incorporate preferred leadership characteristics. Crisis resource management skills benefit greatly from an understanding of the preferred attributes, as defined and evaluated by other trauma team members. (J Surg Ed 76:120−126. © 2018 Published by Elsevier Inc. on behalf of Association of Program Directors in Surgery.)

KEY WORDS: Discrete choice experiment, Trauma team, Leadership, Attributes, Preferences

BACKGROUND

The management of pediatric trauma involves high stakes care and is very susceptible to error.[1] Part of the challenge in providing trauma care relates to the nature of working in an ad hoc interdisciplinary team where team composition is frequently changing, and some members are often not familiar with one another. Pediatric trauma, because of the relative infrequency, the high stakes, and the sensitivity around the patients and their caregivers, creates anxiety in

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some medical teams, and this highlights the need for better simulation and training, with the goal of ameliorated crisis resource management.[1]

Given these challenges, it is important to have strong leadership in trauma teams. Human factors relating to teamwork, such as communication and collaboration, can influence patient outcomes.[2] Previous research has demonstrated an association between team leadership skills and quality of care in cardiac arrest simulation scores, underscoring the integral role of strong direction during the management of acute events.[3] Teams with large clinical caseloads, or frequent exposure to in situ simulation programs, can refine overall teamwork skills, and improve leadership training.[4] These studies suggest that frequent trauma exercises foster stronger teamwork and leadership, which in turn translates to favorable clinical outcomes. Furthermore, it is suggested trauma team leaders with frequent exposure are more likely to recognize factors that improve patient outcomes such as injuries and comorbidities.[5] Despite these correlations, there is a paucity of literature investigating the characteristics, or specific attributes that make up an effective trauma team leader.

In recent years, discrete choice experiments (DCE) have gained popularity as a useful tool and means of defining preferences for stakeholders in healthcare interventions.[6] Based on Lancaster's economic theory of value and random utility theory,[7,8] DCEs provide scientific rigor to determining the preferences of a particular population toward a given scenario. DCEs can describe possible scenarios using attributes and ask respondents to choose among a set of profiles—each with varying levels of the described attributes. An analysis of aggregate responses reveals the implicit weights respondents attached to each level of each attribute included in the study.[9,10] In our study, the DCE's ability to give a quantitative measurement for subjective preferences provides a unique understanding of the optimal characteristics of an effective trauma team leader.

The purpose of this study was first to define the key attributes of a successful pediatric trauma team leader and second, to determine the attributes that are of greatest utility to trauma team members. A final purpose of the study was to determine whether DCE (including the qualitative methodology utilized to determine potential important attributes) is a viable technique to quantitatively evaluate crisis resource management skills.

MATERIALS AND METHODOLOGY

The study used a 2-stage design. First, semistructured interviews were conducted with members of the trauma team at British Columbia (BC) Children's Hospital in Vancouver, Canada. The data from these interviews were used to identify the attributes and levels in our DCE questionnaire. In the second stage of the study, the DCE questionnaire was administered to members of the BC Children's Hospital trauma team to elicit preferences in attributes of a trauma team leader. Ethics approval was obtained from the University of British Columbia Behavioral Research Ethics Board, and from the institutional Research Ethics Board at Children's and Women's Health Centre of BC.

Questionnaire Development

To determine the key attributes of a trauma team leader, semistructured interviews were conducted with trauma team members. The sample consisted of members with different levels of training (resident, fellow, or attending) and professions (physicians, nurses, x-ray technologists, respiratory therapists, etc.). Our final sample size was based on the concept of theoretical saturation, which requires that no new themes are emerging from the interviews.[11] This concept facilitates study efficiency, as theoretical saturation helps determine the stopping point for recruitment. Interviews typically lasted 10 to 20 minutes and all interviews were audio recorded, transcribed, and analyzed for thematic analysis. Each of the identified attributes had 3 corresponding levels derived from situations and language seen in the semistructured interviews (Table 1).

TABLE 1. Attributes and Levels to Describe Potential Characteristics of a Trauma Team Leader

Attribute	Levels
Collaboration	Actively involves input from team
	Sometimes involves input from team
	Dismissive of differing opinions
Communication	Clear, closed-loop communication
	Concise communication, at times closed-loop
	Hesitant and unclear communication
Decisiveness	Capable of making decisions with expert guidance
	Decisive, based on available information
	Often indecisive
Organization	Delegates and prioritizes tasks; multiple tasks occur simultaneously
	Capable of delegation; tasks occur sequentially
	Does not clearly delegate or prioritize patient needs
Protocol	Strict on protocols/standards
	Deviates from protocols with team's feedback
	Deviates from protocols under own discretion
Experience	10 Years
	5 Years
	1 Year

With the attributes defined, the DCE questionnaire was developed using JMP Version 12 (SAS Institute Inc., Cary, North Carolina). Hypothetical combinations of the attribute level were created using a D-optimal design to maximize the variation of attribute levels presented in the DCE questionnaire. Four different versions of the questionnaire were utilized to optimize possible attribute level combinations. A random number generator was used to determine which version of the questionnaire would be administered. In the questionnaire, each participant was presented with 8 choice sets, plus 2 initial practice choice sets to familiarize themselves with the DCE design. Each choice set presented 2 possible trauma team scenarios and asked the respondent to select their preferred scenario. Prior to completing the DCE choice sets, the questionnaire explained the aim of the study and collected basic demographic information from the respondent. Convenience sampling was used to identify potential respondents. A research assistant administered the questionnaire at the study site using the tablet-based application, QuickTap Survey Tool (Toronto, Ontario).

Statistical Analysis

Multinomial logit modeling was used to analyze the DCE data. Data were coded using effects coding. The overall significance of the attributes was calculated using likelihood ratio (LR) tests. A maximum likelihood approach was used to estimate relative importance (or mean utility, MU) of the attributes and attribute levels included in the model. Multinomial logit modeling was used to estimate the MU of the respondents to each attribute level. Preference heterogeneity was assessed in a separate subgroup analysis by adding an interaction term in the model from the demographic variables determined to be of potential interest. All analyses were conducted using the Choice Modeling platform in JMP Version 12 (Cary, North Carolina).

RESULTS

Twenty-one members of the trauma team participated in the semistructured interview portion of the study. Thematic saturation occurred after 13 interviews; 8 more interviews were conducted to ensure no new themes occurred. The 6 recurring attributes that were identified and included in the DCE were collaboration, communication, decisiveness, organization, protocol adherence, and experience. Levels of each attributes were defined using language seen in the transcripts to create the DCE questionnaire (Table 1). A sample DCE choice set (respondent asked to select their preferred profile of a Trauma Leader, with 10 separate choice sets administered to each participant) is included in Table 2.

Among the 64 respondents to the DCE questionnaire, 47 (74%) were female, 23 (36%) were physicians, and 23 (36%) had been members of the trauma team for more than 10 years (Table 3). While 3 of the participants from the semistructured interview did participate in DCE questionnaire, an analysis for "dual participation" had shown there was no significant evidence of an interaction ($p = 0.99$) on the DCE results. Five of the 6 attributes included in the model were statistically significant characteristics of a trauma team leader. Attributes most strongly preferred by the respondents, based on the LR test, were collaboration (LR: 79.6; $p < 0.0001$), communication (LR: 62.9; $p < 0.0001$), and decisiveness (LR: 42.7; $p < 0.0001$). The years of experience of the trauma team leader were the least important attribute (LR: 3.8; $p = 0.15$). The specific leadership qualities that provided the greatest marginal utility to the trauma team were "actively involves input from team" (MU: 0.70; 95% confidence interval [CI]: 0.50-0.92) and "concise communications, at time closed-loop" (MU: 0.52; 95% CI: 0.34-0.71). "Hesitant and unclear communication" (MU: −0.88; 95% CI: −1.15 to −0.63) and "often indecisive" (MU: −0.68; 95% CI: −0.92 to −0.45) were deemed most detrimental to the team's function. Table 4 summarizes the results of this analysis.

TABLE 2. Example of a Discrete Choice Experiment Choice Set

Attribute	Profile A	Profile B
Communication	Clear, closed-loop communication	Concise communication, at times closed-loop
Experience	5 years	10 years
Decisiveness	Capable of making decisions with expert guidance	Decisive, based on available information
Collaboration	Actively involves input from team	Dismissive of differing opinions
Organization	Delegates and prioritizes tasks; multiple tasks occur simultaneously	Capable of delegation; tasks occur sequentially
Protocol	Deviates from protocols with team's feedback	Deviates from protocols under own discretion
Choice: (please select your preferred scenario)	☐	☐

TABLE 3. Description of Respondent Characteristics

Characteristics	N = 64
Female, n (%)	47 (73.4)
Level of training, n (%)	
Staff	53 (82.8)
Trainee	11 (17.1)
Role on trauma team, n (%)	
Physician	23 (35.9)
Allied health*	22 (34.3)
Nurse	19 (29.7)
Duration on trauma team (years), n (%)	
<1 year	8 (12.5)
1-5 years	21 (32.8)
5-10 years	12 (18.8)
>10 years	23 (35.9)
Satisfaction level of trauma team members, n (%)	
Very satisfied	12 (18.8)
Satisfied	27 (42.1)
Neutral	18 (28.1)
Unsatisfied	6 (9.4)
Very unsatisfied	1 (1.7)

*Includes radiology technologists and respiratory therapists.

Our subgroup analysis found a potential interaction between the level of training of a trauma team member and their preferences for the leader attributes. The 17% of respondents who were trainees signaled a greater preference in favor of collaboration (p = 0.02). Additionally, nurses and allied professional groups demonstrated a preference toward protocol adherence, as compared with DCE-derived preferences among physicians (p = 0.02).

DISCUSSION

The objective of the study was to define the key characteristics of an effective trauma team leader through the analysis of a structured interview and a DCE. Using the validated results on team member leadership preferences provided by the DCE,[12] we had found collaboration, communication, and decisiveness as the most preferred attributes of a trauma team leader, whereas experience was determined to be an unimportant attribute. These results align with previously published positive attributes in trauma team leaders/crisis resource management.[13-15]

As expected, collaboration was found to be a highly rated attribute in a trauma leader. An effective leader should actively involve their team and establish common goals. It is unsurprising that the team members, who have defined roles and responsibilities, would value a team leader that engages their expertise for the patient's benefit. Furthermore, trainees emphasized the importance of collaborative effort more so than nontrainees. Collaboration

TABLE 4. Estimates of Coefficients in the MNL Model, their 95% CIs, and Overall Significances of the Attributes with p values Obtained From Likelihood Ratio Tests

Attribute	LR	p Value	Level	Mean Utility	95% CI
Collaboration	79.6	<0.0001	Actively involves input from team	0.70	0.50-0.92
			Sometimes involves input from team	−0.16	−0.37 to −0.06
			Dismissive of differing opinions	−0.55	−0.71 to −0.39
Communication	62.9	<0.0001	Clear, closed-loop communication	0.36	0.17-0.56
			Concise communication, at times closed-loop	0.52	0.34-0.71
			Hesitant and unclear communication	-0.88	−1.15 to −0.63
Decisiveness	42.7	<0.0001	Decisive, based on available information	0.43	0.26 to 0.60
			Capable of making decisions with expert guidance	0.25	0.05 to 0.45
			Often indecisive	−0.68	−0.92 to −0.45
Organization	25.8	<0.0001	Delegates and prioritizes tasks; multiple tasks occur simultaneously	0.37	0.21 to 0.54
			Capable of delegation; tasks occur sequentially	0.11	−0.09 to 0.32
			Does not clearly delegate or prioritize patient needs	−0.49	−0.73 to −0.25
Protocol	13.6	0.0011	Strict on protocols/standards	0.21	0.00 – 0.41
			Deviates from protocols with team's feedback	0.17	−0.02 to 0.35
			Deviates from protocols under own discretion	−0.37	−0.58 to −0.17
Experience (years)	3.8	0.15	10	0.11	−0.08 to 0.30
			5	0.16	−0.04 to 0.35
			1	−0.27	−0.56 to 0.01

MNL = Multinomial logit model; LR = likelihood ratio; CI = confidence interval.

allows for inexperienced trainees to listen and learn from the more experienced team members on how to resolve the situation.[16] Previous research has suggested that trainees are less likely to enjoy working in teams where their contributions are not explicitly sought or endorsed.[2] The trend toward a higher value on collaboration, among trainees, is somewhat expected in that light.

Good communication between trauma team leaders and their members is long believed to be a critical factor in a quality trauma team resuscitation. Our study confirmed the long held view of the importance of communication, and also provides language around defining effective communication. Clarity of communication, and closed-loop interactions are highly valued by the respondents to both the qualitative phase and DCE phase of our study. A decrease or lack in communication influences the performance of the team and can potentially affect the clinical outcome of the patient.[2,13,17] A recent study conducted by El-Shafy et al. demonstrates the value of closed-loop communication during pediatric trauma resuscitation. After reviewing 89 trauma activation videos, they had found there was a significant decrease in the time it takes to complete a task when closed-loop communication was utilized compared with open-loop communication.[18] This reinforces that good communication methods need to be a major focus during trauma team training.[13]

Trauma team leaders are critical in providing a plan for the team. Decisive leaders must be able to make clear decisions based on the information available and direct their team in an organized fashion.[17,19,20] This is especially true in emergent situations as trauma team leaders must make quick decisions, providing directed communication in order to ensure patient safety, and avoid further chaos.[13,21] Both the quantitative and DCE results of our study confirm decisiveness is an attribute that is sought after in trauma team leaders. Our results further validate the relationship between good communication, collaboration, and decisiveness in leaders.[13,15,17,22]

Although the attributes of a trauma leader are important, it is important to note the efficacy of their leadership is often dictated by the team's composition, as well as the severity of the case.[19] A directive leadership style was better suited for severe injuries with inexperienced team members. Patients with severe injuries require quick decisions to be made; inexperienced team members may not possess the knowledge or confidence necessary to make these decisions quickly. Directive leaders can help alleviate these issues by taking control of the situation. An empowering leadership style was more effective for less severe injuries with more experienced team members.[19] By empowering the experienced team members to make their own decisions, the leader is free to guide the overall plan. During less severe cases, this style of leadership provides more educational value as the trauma leader has more time to engage and discuss the situation more thoroughly with team members. Whatever the leadership style, an effective leader must be able to communicate, collaborate, adapt to each situation, and must take the team's ability into account.[15] The idea that different trauma leadership styles might be more effective in different trauma team situations (in this case level of acuity) should inform the results of our study. While our study has successfully identified and evaluated desired leadership attributes, team training and team leaders must keep in mind the unlikelihood of a one-size-fits-all leadership style that can be learned and relied upon. The attributes identified by our study rather form the framework for leadership development.

Negative attributes, such as "hesitant and unclear communication," "often indecisive," and "dismissive of differing opinions" were rated to be the most detrimental to team function, providing further evidence that trauma team members value communication, collaboration, and decisiveness. Together these attributes allow for a more constructive and collaborative environment. A study looking at the time it takes to decide on surgery in a trauma setting shows how unclear communication often results in delayed actions, which can be attributed to indecisiveness or a lack of leadership.[17]

Contrary to our expectations, results from the DCE-deemed experience a relatively unimportant attribute even though the vast majority of trauma members in the qualitative study voiced the importance of experience in a leader. Completing a DCE necessarily requires the respondents to make trade-offs, prioritizing certain attributes when confronted with complex choice sets. In the face of that methodology, it appears that experience is relatively less valued as compared with other crisis management skills. Some have argued leadership ability is not related to experience,[22] while others have suggested experience contributes to the confidence and decisiveness in an acute care setting.[23-25] However, when faced with the trade-off between an experienced leader or 1 with strong collaboration and communication skills, the respondents in this study clearly favored the latter.

There are several limitations to this study that should be discussed. While subjects were recruited by convenience sampling, the sample is representative of the population. The sample size limited the number of possible subgroup analyses. The data were obtained from this single pediatric center and may not be generalized to other hospital; however, similarities are expected. Leadership styles may also vary in different cultures.[6] We endeavored to phrase the attribute levels using the wording of the semistructured interview participants and were cautious to ensure the attribute levels were clear and mutually exclusive,

but we acknowledge that word choice may create bias in responses.

By identifying the most desired attributes in a pediatric trauma team leader, potential educational programs can be developed stressing the importance of communication, collaboration, and/or decisiveness. Knowing which skills are most highly valued by team members assists education efforts, in initial training as well as ongoing professional development. With trauma simulation increasingly having a focus on specific crisis resource management aspects—for example, a simulation with a communication style emphasis—it is very helpful to know which attributes to highlight and also which attributes might receive less educational weighting.

CONCLUSIONS

Our study is the first to characterize trauma team attributes with quantification of provider preferences with regards to strong leadership and crisis resource management skills. Identifying and ranking provider attributes is essential in evaluating performance, improving quality of care and team performance, and education of the next generation of clinical leaders.

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