

Managing Uncertainty in Paramedics' Decision Making

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ABSTRACT

Managing uncertainty is an important part of paramedic decision making. We conducted critical decision method interviews with 9 paramedics. As hypothesized, types of uncertainty differed according to the phase of the incident. More than half of the uncertainty cases were resolved by strategy of reduction. Types of strategies differed according to the types of uncertainty and phases of the incident. When compared to firefighting field, paramedics used less assumption-based reasoning and more forestalling than the firefighters. Uncertainty regarding situation was prevalent during second and third phase in both fields. Matching uncertainty types with strategies enables us to better understand the decision making process during the incident and can be also used for training purposes. So far, results suggest, that there are similar types of uncertainty and strategies used to manage the uncertainty across different fields. Further research is needed to validate these results and to extend the knowledge to other fields.

KEYWORDS

Uncertainty management; macrocognition; RAWFS heuristic; critical decision method; paramedics.

INTRODUCTION

Managing uncertainty vital for understanding the situation and it is one of the macrocognitive supporting processes. In this study we extended the research of RAWFS heuristic to the domain of emergency medicine. First study of Lipshitz and Strauss (1997) in students of military academy yield three main types of uncertainty and five coping strategies named RAWFS heuristic. Lipshitz, Omodei, McClellan, & Wearing (2007) then tested the RAWFS heuristic in fireground commanders and found, that both, uncertainty types as well as coping strategies, were influenced by the task structure, which is represented by the phase of the incident. They also found that strategies weighting pros and cons and suppression were lacking (or were not identified). Our study differs in two main points: The character of the situation and the field. We decided to focus solely on the non-routine challenging situations and we explored the character of uncertainty and coping strategies in paramedic field. Therefore, our aim is to identify what types of uncertainty do paramedics experience and which strategies do they use to manage uncertainty at different phases of the incident.

METHODS

Domain

Emergency medical service in Slovakia has two types of ambulances, ambulances with physician (MRS) and ambulances with paramedics (without physician) (ERS). In the MRS the doctor is responsible for the call. In the ERS, always one paramedic leads the action, usually the more experienced one, but it depends on agreement. Therefore, we decided to study the paramedics from ERS crews, because they are responsible for the decision making. Paramedic crews receive the calls from emergency dispatch centre and their goal is to arrive at scene as soon as possible, stabilize the patient and transport him/her to the hospital or call the MRS, if the patient requires physician's intervention on site.

Participants

Participants were nine paramedics from ERS crews ($\text{♂} = 5$, $\text{♀} = 4$), all of them from Slovak cities, aged between 26 and 49 years ($M = 35.22$; $SD = 7.032$), years of experience in the field varied from 4 to 22 years ($M = 8.78$; $SD = 5.869$). Data were collected by the critical decision method. The participants worked for one of the three biggest paramedic companies in Slovakia. The information about the research was presented to the company chief and he provided researcher with the contacts of the paramedics who wanted to participate. In this research we contacted five paramedics directly on the basis of the contacts provided by the chief and four other paramedics were recruited by a snowball by their colleagues.

Procedure

We conducted the critical decision method interviews (Hoffman, Crandall, & Shadbolt, 1998; Klein, Calderwood, & MacGregor, 1989), which were carried out at first aid stations in private quiet room or at home of the interviewees. Each interview lasted approximately 1,5 - 2 hours and all were recorded. After the interview

the participants were debriefed and received a monetary reward, four of them did not accept it. All interviews were transcribed and coded by two independent coders.

Coding the data and data structure

The data were coded along three themes: 1) phase of the incident, 2) uncertainty, 3) coping strategy and sub-strategy. In their study of fire fighters Lipshitz et al. (2007) divided the incident into three phases: on route to the incident, handling the incident and mopping up. To preserve the comparability of our results and also the logic of paramedic incident handling, we divided the situation respectively into three phases, preserving the first two phases but changing the third, into transport, which makes more sense in the context of paramedic work. The resulting three phases are thus as follows: 1. Phase - En route to the incident (starts by the call from the operational emergency dispatch centre and ends when paramedics find the patient); 2. Phase - Handling the incident (acquiring anamnestic information, examining the patient, delivering the treatment); 3. Phase - Transport (transporting the patient to the ambulance and then to hospital).

Based on previous research (Lipshitz et al., 2007; Lipshitz & Strauss, 1997), we coded the transcripts for different types of uncertainty owed to inadequate understanding, which was further divided to inadequate understanding of the situation (what is going on); action (which action to take); cause (what is the cause of the situation); and outcome (what will be the result of the action). Strategies used to manage the uncertainty were coded according to the RAWFS heuristic, as follows: reduction, assumption-based reasoning, weighting pros and cons, forestalling and suppression. Strategies of reduction and assumption based reasoning were further divided each to four coping strategies (Lipshitz et al., 2007).

Data were coded by two independent raters. During the first session, raters coded one selected incident together, to ensure common understanding of the previously mentioned categories. Afterwards raters independently coded remaining eight situations. To assess inter-rater reliability we used Krippendorff's α (Hayes & Krippendorff, 2007; Krippendorff, 2004) using irr package (Gamer, Lemon, Fellows, & Singh, 2012) in R (R Core Team, 2013). The Krippendorff's α for uncertainty, strategies and sub-strategies was 0.779, 0.693 and 0.876 respectively. According to Krippendorff (2004, in Krippendorff, 2004), values ≥ 0.617 are still acceptable. Therefore we conclude that the inter-rater agreement for all topics was satisfactory. All discrepancies in the data were resolved by discussion of both coders on final meeting until they reached an agreement. From further analysis we excluded one uncertainty owing to undifferentiated alternatives and one planning strategy, as they were the only cases.

RESULTS

Uncertainty in the Paramedic Field

Overall, most uncertainty cases were regarding situation and action, 44% and 34% respectively. In the first phase, 60% of uncertainty cases were due to inadequate understanding of the action. More than half (53%) of the uncertainty cases were identified in second phase, i.e. during the treatment of the patient. In second and third phase, 49% and 48% of uncertainty cases respectively were regarding the situation. Uncertainty regarding causes was present solely in the second phase. Distribution of types of uncertainty within incident phases is in the Table 1. Figure 1. shows the distribution of uncertainty types within incident phases.

Table 1. Distribution of types of uncertainty within incident phases

Uncertainty regarding:	Phases			Σ	
	First	Second	Third		
Situation	4	20	10	34	44%
Action	9	10	7	26	34%
Causes of incident	-	7	-	7	9%
Outcome	2	4	4	10	13%
Σ	15	41	21	77	
	19%	53%	27%		

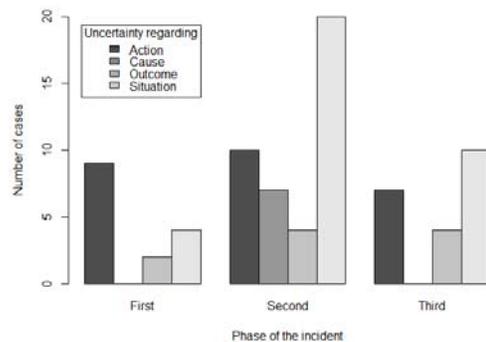


Figure 1. Distribution of uncertainty types within phases

RAWFS Strategies Used to Manage Uncertainty

Overall, most frequently used strategy was reduction (58%) and second most used strategy was forestalling (27%). Strategy of suppression was not identified. The distribution of coping strategies is showed in Table 2 and in the Figure 2. Uncertainty in the first phase was predominantly managed by reduction (47%) and forestalling (40%). Uncertainty in second phase was predominantly managed by reduction (81%). On the contrary, uncertainty in third phase was mostly resolved by forestalling (48%) followed by reduction (24%).

Next, we explored the strategies according to the uncertainty types. All cases of uncertainty regarding causes and 71% of uncertainty regarding situation were resolved by reduction. Assumption-based reasoning was applied just for uncertainty regarding situation and action. Most of uncertainty cases (80%) regarding outcomes were managed by forestalling. Strategy of weighting pros and cons was used just in the case of uncertainty regarding action (15%). The distribution of coping strategies within the uncertainty types is shown in Table 3 and Figure 3.

Table 2. Distribution of types of uncertainty within phases

Coping strategy	Phases			Σ
	First	Second	Third	
Reduction	7	33	5	45
	47%	81%	24%	58%
Assumption-based reasoning	2	2	3	7
	13%	5%	14%	9%
Forestalling	6	5	10	21
	40%	12%	48%	27%
Weighting pros and cons	-	1	3	4
		2%	14%	05%
Σ	15	41	21	77
	19%	53%	27%	

Table 3. Joint distribution of types of uncertainty and coping strategies

Coping strategy	Uncertainty regarding ...				Σ
	Situation	Action	Causes	Outcome	
Reduction	24	12	7	2	45
	71%	46%	100%	20%	58%
Assumption-based reasoning	2	5	-	-	7
	6%	19%	-	-	9%
Forestalling	8	5	-	8	21
	24%	19%	-	80%	27%
Weighting pros and cons	-	4	-	-	4
		15%	-	-	5%
Σ	34	26	7	10	77
	44%	34%	9%	13%	

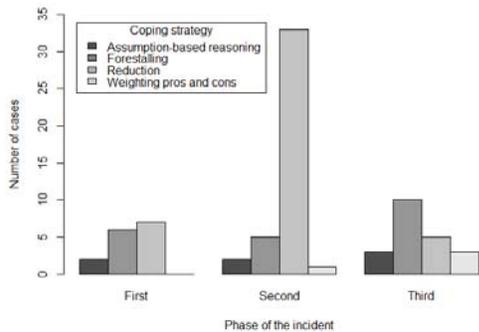


Figure 2. Distribution of strategies within phases

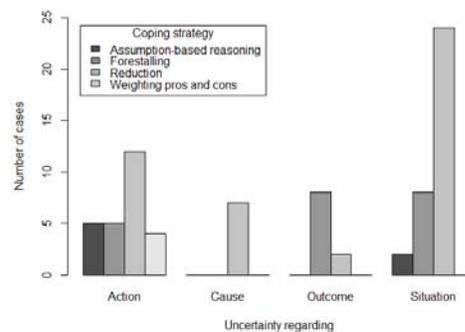


Figure 3. Distribution of strategies within phases

DISCUSSION

This study assessed the uncertainty and the strategies used to manage uncertainty in paramedic field. Unlike previous studies (Lipshitz et al., 2007; Lipshitz & Strauss, 1997) we studied uniquely non-routine situations. Overall, the results illustrated that different phases of the incident yield different types of uncertainty as well as coping strategies. These results are in line with findings of previous research (Heuvel, Alison, & Power, 2014; Lipshitz et al., 2007; Lipshitz & Shulimovitz, 2007). When we compare paramedic field with the firefighting one (Lipshitz et al., 2007), we conclude that uncertainty regarding situation was prevalent during second and third phase in both fields. Altogether, paramedics used less assumption-based reasoning and more forestalling than the firefighters. In the first phase, paramedics had to cope most frequently with uncertainty regarding action, while firefighters were mainly concerned with uncertainty regarding situation. In the second phase, uncertainty and coping strategies in firefighting and paramedic fields were similar. The third phase was generally different, both in uncertainty faced and in strategies used. Despite the fact that two studies (Heuvel et al., 2014; Lipshitz & Shulimovitz, 2007) were also examining the uncertainty, the results are reported just for the coping strategies.

The most salient finding is that the uncertainty types and coping strategies are predicted by the phase of the incident. Results also indicate, that relationships between the uncertainty types and strategies could be similar across different fields, but more research is needed to specify concrete relations as well as to describe the common and also the distinctive characteristics of different fields studied.

The least used strategy identified was weighting pros and cons. This finding is in line with general reasoning of naturalistic decision making paradigm and recognition primed decision model, that most decisions and actions are produced rather as a result of pattern matching than deliberation about different alternatives. Considering the time stress in situations, in is not surprising that weighting pros and cons strategy was mostly used in third phase, when paramedics decide about the possibilities of transport and the patient is usually stabilized. On the contrary, this strategy was absent during the first phase, where the main goal is to arrive to the patient as soon as possible. In our study the strategy of suppression was not identified. The original RAWFS heuristic was based on analysis of written descriptions of uncharacterised problems, but in emergency field suppression can have fatal consequences. This strategy was also absent in the firefighting field, as noted by Lipshitz et al. (2007). Absence of suppression strategy can be also due to use of retrospective interviews. Nevertheless, Heuvel et al., (2014) identified suppression just in minority of the cases.

In the study of police officers Heuvel et al. (2014) found, that most frequently used strategies during hostage negotiations were reduction and assumption-based reasoning. The negotiation problem was also divided on three phases: situation assessment, plan formulation and plan execution, but these phases have a different content than our phases and phases of Lipshitz et al. (2007). One main difference is the number of uncertainty/strategy pairs identified across different fields. Police officers coped with approximately same amount of uncertainty cases during first and second phase (Heuvel et al., 2014) while in paramedics' and firefighters' second phase was most demanding containing 53% and 67% of all uncertainty cases respectively. Lipshitz and Shulimovitz (2007) studied uncertainty in bank loan officers. The pattern of coping strategies was similar to paramedic and firefighting fields (reduction - 61.3%, assumption-based reasoning 22.6%, forestalling 14%, weighting pros and cons 1.1% and suppression 1.1.%).

It is important to acknowledge certain limits of presented study: limited sample and retrospective interviews. Despite 5-10 participants for the qualitative NDM studies is usual sample size, more studies are needed to confirm current findings and to broaden the scope of fields and situations within these fields studied. However, due to maintaining rigor in coding and further analysis we consider our study as highly reliable. Second limit can be use of the retrospective interviews. It was proven that CDM is reliable and effective method for study of decision making in naturalistic settings (Hoffman et al., 1998).

So far we could compare uncertainty in just two fields, the paramedic and firefighting one. Even though definitely more extensive research is needed to confirm actual findings, the results suggest that uncertainty that the task structure, the phase of the situation, is has an impact on the character of uncertainty professionals cope with. Next appealing finding is that reduction is mostly used strategy for dealing with uncertainty. Further research is needed to explore reduction into more detail using the sub-strategies classification. Despite the fact that sub-strategies are mentioned in the previous research the findings are not described.

CONCLUSION

Matching uncertainty types with strategies enables us to better understand the decision making process during the incident and can be also used for training purposes. So far, results suggest, that there are similar types of uncertainty and strategies used to cope with it across different fields. Further research is needed to validate current results and to extend the knowledge to other fields.

ACKNOWLEDGMENTS

The study was supported by following grants: APVV-0361-12 - Decision Making of Professionals: Process, Personality and Social Aspects; VEGA - 2/0080/14 - Decision making in emotionally demanding situations: Research of macrocognition and emotions in the naturalistic decision making paradigm.

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