



Paramedic Clinical Decision Making

**A studentship Project
Funded in part by the Canadian Patient Safety Institute**

2009

Report Submitted: September 2010

Submitted by:
Jan L Jensen
Dr. Pat Croskerry
Dr. Andrew Travers

Dalhousie University

This project is
partially
funded by:



Paramedic Clinical Decision Making

Investigators:
Jan L Jensen
Dr. Pat Croskerry
Dr. Andrew H Travers



Table of Contents

Acknowledgement	3
Project Summary	4
Purpose / Objectives	4
Methodology	5
Results	6
Limitations	7
Recommendations (Gaps in Research, Next Steps)	9
Student Learning	11
References	12
Appendices	13

This project is partially funded by:



Paramedic Clinical Decision Making

Investigators:
Jan L Jensen
Dr. Pat Croskerry
Dr. Andrew H Travers



Acknowledgement

We acknowledge the paramedics and medical directors who participated in these two studies on paramedic clinical decision-making. Thank you for the time and thoughts you contributed to this research.

Thanks to the professors and coordinators of the Atlantic Research Training Centre (Dalhousie University) for their support and motivation throughout this program. Thank you to the Dalhousie University Division of EMS who supported Jan's completion of the masters' degree with a financial support. This studentship project was made possible by a financial contribution from the Canadian Patient Safety Institute.

This project is
partially
funded by:



Paramedic Clinical Decision Making

Jan L Jensen
Dr. Pat Croskerry
Dr. Andrew H Travers

Project Summary

Paramedics are responsible for the care of patients requiring emergency assistance in the out of hospital setting. These health care providers need to make many decisions during the course of an emergency call. This research on paramedic clinical decision making (CDM) includes two studies, intended to determine which decisions paramedics make that are most important for patient safety and clinical outcome, and what thinking strategies paramedics rely on to make decisions. Forty-two decisions were found to be most important for outcome and safety. The highest decision density of an emergency call is during the *on-scene treatment* phase. Paramedics use a mix of thinking strategies, including *rule out worst scenario*, *algorithmic*, and *exhaustive* thinking. The results of these studies have implications for future research, paramedic practice and training.

Purpose / Objectives

The first study on paramedic CDM is titled, “Consensus on paramedic clinical decisions during high acuity emergency calls: results of a Canadian Delphi study”. The objective of this study was to achieve consensus among a group of Canadian EMS experts on the most important decisions paramedics make during typical high acuity emergency calls, in terms of clinical outcome and patient safety. The decisions found to be most important were sorted into clinical categories and plotted on a process map.

The second study is titled, “Clinical decision making by advanced care paramedics: a think aloud study”. This objective of this exploratory study on paramedic clinical decision-making was to provide insight into the different thinking strategies used by advanced care paramedics during typical emergency calls.

These two studies provide data on *what* decisions paramedics make that are most important for clinical outcome and patient safety, and *how* these decisions are made.

Methodology

Study #1: “Consensus on paramedic clinical decisions during high acuity emergency calls: results of a Canadian Delphi study”

Participants in this multi-round survey study were paramedic leaders and emergency medical services medical directors/physicians from across Canada. In the first round, participants identified clinical decisions they felt are important for patient outcome and safety. In the second round, the panel scored each decision in terms of its importance. In the third and fourth round, participants had the opportunity to revise the score they assigned to each decision. Consensus was considered achieved for the most important decisions if 80% of the panel scored it as important or extremely important. The most important decisions were plotted on a process analysis map.

Study #2: “Clinical decision making by advanced care paramedics: a think aloud study”

A small sample of advanced care paramedics verbally worked through trauma and medical scenarios. The interviewer encouraged each participant to explain why he or she made each assessment, treatment and transport decision. Transcripts of interviews were analyzed by identifying each clinical decision and the thinking strategy used. Analysis included descriptive statistics of the sample, frequency of decisions and thinking strategies, and *t*-tests to detect differences in decisions and thinking strategies between novice and experienced participants and between scenario types by all participants.

Results

Study #1: “Consensus on paramedic clinical decisions during high acuity emergency calls: results of a Canadian Delphi study”

The panel (17 paramedics, 7 medical directors) had a mean 16.5 years experience. Response rates were: Round I: 96%; II: 92%; III: 83%; IV: 96%. Consensus was reached on 42 decisions, Grouped into 6 categories: *Airway management* (n = 13); *Assessment* (n = 3); *Cardiac management* (n = 7); *Drug administration* (n = 9); *Scene management* (n = 4); *General treatment* (n = 6). The highest level of consensus was the *Assessment* category (97% scored *Assessment* decisions important or extremely important). Paramedics scored four decisions higher than medical directors: *Decide on airway device* (p < 0.04); *Perform chest decompression* (p < 0.01); *Begin chest compressions on decompensated child* (p < 0.04); *Decide when to leave scene versus stay* (p < 0.02). Medical directors scored one decision higher than paramedics: *Give epinephrine for anaphylaxis* (p < 0.04). *On-scene treatment* was the phase of the process map with the highest decision density.

Study #2: “Clinical decision making by advanced care paramedics: a think aloud study”

Eight ACPs with a mean 9.6 years of overall paramedic experience (SD 6.7) participated (novice group: mean 1.5 years ACP experience (SD 0.6); experienced group: 6.9 years ACP experience (SD 2.0)). Twenty-nine decisions were made in the trauma scenario. Eighteen decisions were made in the medical scenario. The most frequently used thinking strategies in both scenarios were *Rule Out the Worst Scenario* and *Exhaustive* thinking. In the trauma scenario, participants used *Event-driven* and *Algorithmic* thinking most frequently. In the medical scenario, *Algorithmic* and *Rule Out the Worst Scenario* were employed the most. *Event-driven* thinking was used more often in the trauma scenario compared to the medical scenario (p<0.001). Experienced participants made more decisions than novices (p<0.05).

Limitations

Study #1: “Consensus on paramedic clinical decisions during high acuity emergency calls: results of a Canadian Delphi study”

The results of this study should be considered along with the methodological limitations of a Delphi study. The researchers had to make decisions when designing this Delphi study that may have implications for the generalizability of the results. The researchers determined the composition of the panel (medical directors and paramedics). The decisions found to be important may have differed if the panel was entirely made up of paramedics or medical directors, rather than a mix of these groups. Only opinions submitted by panel members were scored, so some important decisions may be missing from this collection. The study was terminated at four rounds, regardless of the number of decisions in which consensus was achieved, to minimize sample fatigue and decreasing response rates. Potentially, additional decisions would have been found to be important if the panel had the opportunity to review their scores and the panel scores one more time. The Delphi technique calls for panel members to be given the opportunity to re-score items, after viewing the panel mean score and their individual previous score for each item. Viewing the group mean may have caused some panel members to score items closer to the group mean, while others may have inflated their score to a more extreme value, to contradict the group mean.

Decisions were categorized based on the judgment one of the authors (JLJ). Some items could have been placed in other categories, such as putting ‘Decide to use drugs to facilitate intubation (sedation, opiates, paralytics)’ in the *Airway management* or *Drug administration* category decision (it was placed in the *Drug administration* category). This could be improved with independent analysis by two authors, with third party adjudication.

Panel members may have scored some decisions in terms of perceived clinical importance, and not specifically in terms of patient safety and clinical outcome. Finally, and most importantly, the decisions selected as most important for patient safety and clinical outcome were determined by consensus, and are not verified by actual patient outcomes or safety data.

Study #2: “Clinical decision making by advanced care paramedics: a think aloud study”

The most obvious limitation with the Think Aloud technique is that participants cannot verbalize their intuitive thoughts, and decisions made this way could not be identified during analysis (Hogarth, 2001). Thinking aloud provides the conscious information held in working memory, not intuitive, subconscious thought. In essence, the TA method creates a Hawthorne effect; participants may report other thinking strategies, or state reasons why the decisions *should* be made, when in reality they might use intuitive thinking in clinical practice.

A second major limitation of this study is the lack of ecological validity of verbal scenarios. Some decisions are made at least partly as a result of the context of a situation. The context of an emergency call was re-produced in this study. It may be possible to improve the ecological validity with the use of high-fidelity simulation, in the natural setting, during real emergency calls.

The thinking strategies used in this study are largely based on emergency physician decision making (Sandhu & Carpenter, 2006). Physicians likely use different thinking strategies than paramedics, or use the same strategies in a different way. For example, it seems paramedics rarely use hypotheticodeductive reasoning. This may be due to a lack of clinical information available to them during emergency calls, or as a result of how paramedics are trained to make decisions. The thinking strategies used in this study may not be the most ideal for paramedics.

A single author identified the decisions and corresponding thinking strategies. This is a limitation of the analysis. This would be improved in a follow-up study with independent analysis by two authors with third party adjudication. A final limitation, particularly when interpreting the inferential statistics, is the small sample size. The purpose of this study was to explore this topic, describe thinking strategies used, and establish the study method. Significant differences between groups and scenario types may not have been found due to the low power. The study needs to be replicated with a larger sample size.

Recommendations (Gaps in Research, Next Steps)

Study #1: “Consensus on paramedic clinical decisions during high acuity emergency calls: results of a Canadian Delphi study”

The results of this Delphi study and this process map have implications for paramedic training and continuing education. Paramedics, especially those practicing at an advanced level, should be aware of these decisions and the time period in a typical call when they can expect to make most decisions that have high risk for patient safety and outcome. It also has implications for future research on paramedic CDM. Process mapping of specific interventions is valuable for determining the complexities and potential sources of error. This Delphi study has provided direction for similar studies on specific interventions, namely those that fall in the categories with the highest scoring important decisions (*Assessment, Airway management and Cardiac management*).

Study #2: “Clinical decision making by advanced care paramedics: a think aloud study”

This project was a preliminary study, to determine if the TA technique could be used to learn which thinking strategies paramedics rely on. The results of this study should be confirmed with a larger sample. Other variables could be included in a future TA study, including additional

paramedic levels, setting (air or ground ambulance, or emergency department paramedics), and training type.

Teaching new paramedics how to make good quality clinical decisions is a difficult task (Kassirer, 1983; Sandhu & Carpenter, 2006). It is not, however, impossible. One participant in this study remarked after the interview that he had never actively thought about how he thinks before, that it is a worthwhile exercise that all paramedics should do. Thinking aloud causes one increase their own metacognition, or awareness about their thinking processes (Flavell, 1979). At the very least, paramedics should become more aware of how often and in which situations they make intuitive decisions, the best thinking strategies for particular decisions, and how heuristics and biases can help or hinder the quality of their clinical decisions. Currently, the document that guides Canadian paramedic training requirements, the Canadian National Occupational competency Profile, does not include competencies on CDM (Paramedic Association of Canada, 2001).

In practice, decision-making by paramedics during emergency calls may be improved with increased focus on reasoning processes. Paramedics need to become more aware of the limitations of memorization of algorithms, and engage alternate thinking tactics and cognitive forcing strategies, as described by Croskerry (2003). This awareness can be developed with cognitive autopsies, which are sessions of self-reflection, conducted after an episode when intense or difficult decision-making was required, or when it is known that patient outcome was adversely affected (Croskerry, 2005). The results of these cognitive autopsies should be openly shared among paramedic colleagues at mortality and morbidity sessions, to improve knowledge about how lapses in judgment can occur.

Student Learning

The following were key areas of learning and development for the student, Jan L Jensen:

1. Research project development, planning and execution
 - a. Jan, in collaboration with her master's thesis supervisors, developed the research idea, questions and subsequent research plans.
 - b. She led the recruitment, data collection, analysis and management of the research projects.
2. Obtaining research ethics board approval
 - a. Jan led the REB submissions for both research projects.
3. Quantitative and qualitative research analysis
 - a. Both quantitative and qualitative research methods were used in these two studies.
4. Writing
 - a. Jan wrote the thesis which included this research, and made edits based on her supervisors' and external reviewer's suggestions.
5. Presentation
 - a. Jan gave an oral presentation of Study #1 (the Delphi study) at the Canadian Association of Emergency Physicians annual meeting in Montreal in June 2010.
 - b. Jan has had a poster accepted for presentation of Study #2 (the Think Aloud Study) at the Canadian Patient Safety Symposium "Halifax10" in Halifax in October 2010.

References

Croskerry, P. (2003a). Cognitive forcing strategies in clinical decisionmaking. *Annals of Emergency Medicine*, 41(1), 110-120. doi:10.1067/mem.2003.22

Croskerry, P. (2005). Diagnostic failure: A cognitive and affective approach. In Agency for Healthcare Research and Quality (Ed.), *Advances in patient safety: From research to implementation* (pp. 1-14). Retrieved from: <http://www.ahrq.gov/qual/advances/>

Flavell, J. (1979). Metacognition and cognitive monitoring: A new area of cognitivedevelopmental inquiry. *American Psychologist*, 34(10), 906.

Hogarth, R. M. (2001). *Educating intuition*. Chicago: The University of Chicago Press.

Kassirer, J. P. (1983). Teaching clinical medicine by iterative hypothesis testing. Let's preach what we practice. *The New England Journal of Medicine*, 309(15), 921-923.

Paramedic Association of Canada. (2001). *National occupational competency profile*. Retrieved from: <http://www.paramedic.ca/Content.aspx?ContentID=4&ContentTypeID=2>

Sandhu, H., & Carpenter, C. (2006). Clinical decisionmaking: Opening the black box of cognitive reasoning. *Annals of Emergency Medicine*, 48(6), 713-719..

Appendices

Appendix 1 Thinking Strategies

Name	System	Details
Event driven	I	Treat symptoms and then re-evaluate with further evaluation, depending on response to therapy
Intuition	I	System I thinking. Decisions made without conscious thought.
Pattern Recognition	I	Combination of salient features establish likely diagnosis with corresponding evaluation and management plan
Exhaustive	II	Accumulate facts indiscriminately and then sift through them for diagnosis
Hypotheticodeductive	II	Inference based on preliminary findings, idea modification based on subsequent findings, response to therapy & exclusion of competing possibilities
Algorithmic	II by proxy	Preset diagnosis or treatment pathway, based on pre-established criteria
Rule out worse-case scenario	II by proxy	Consideration of pre-existing 'can't miss' list of diagnosis for presenting condition

Adapted from (Sandhu & Carpenter, 2006, p. 716)

Appendix 2 Delphi Study Panel Characteristics

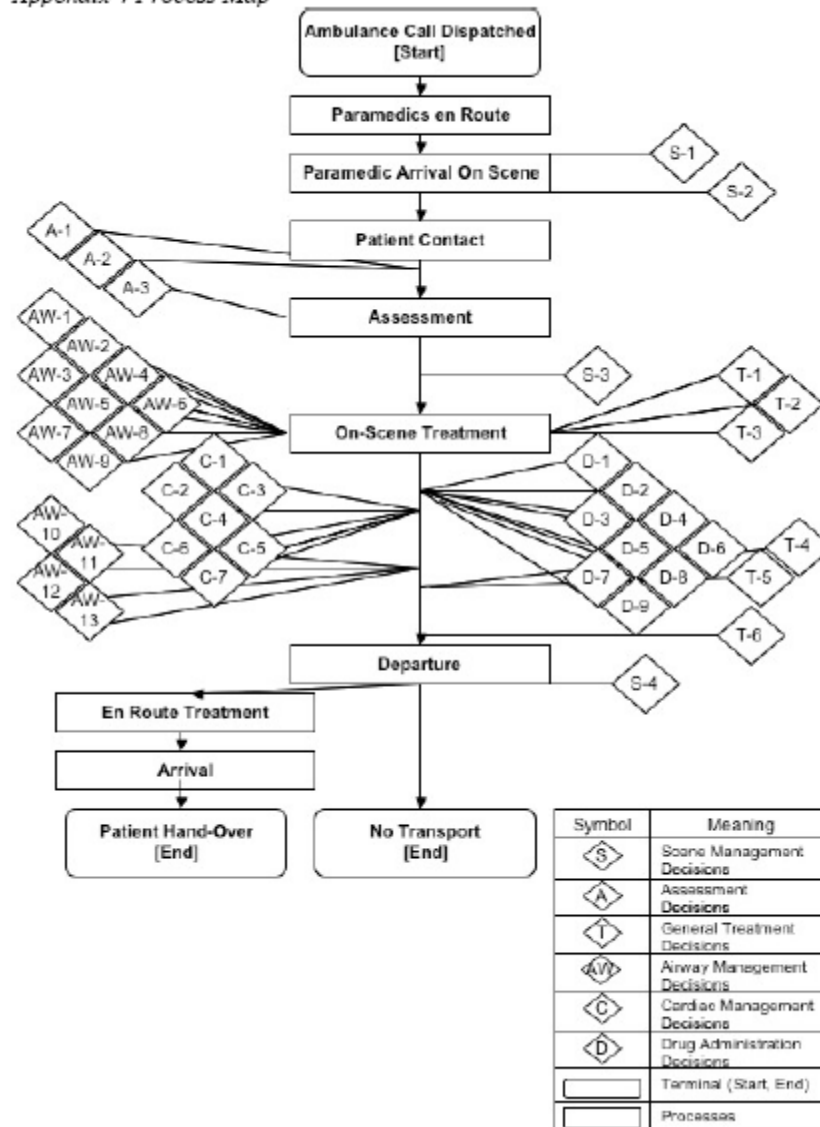
Panel	n = 24		
Paramedics	17		
Ground Ambulance Supervisor/Management	3		
Quality Assurance	2		
Clinical Development	4		
Educator	5		
Medical Directors	3		
Direct Oversight Regional/Provincial	4		
Experience	mean (years)	min (years)	max (years)
Panel	16.53	3	40
Paramedics	20.15	3	40
Medical Directors	10.62	4	18
Province	Panel	Paramedics	Medical Directors
Alberta	3	3	-
British Columbia	2	1	1
Manitoba	3	2	1
Nova Scotia	1	-	1
Ontario	13	9	4
Saskatchewan	2	2	-

Appendix 3 Included decisions, in order on Process Map

Code	Decision
S-1	Recognize potential hazards (e.g., people, animals, environment, chemical/radiological/biological risks) - Scene safety
S-2	Decide to check for/triage patients at scene with several patients
A-1	Initial assessment: is patient critical or not; level of distress/acuity, decide whether to start treatment right away, or complete assessment
A-2	Recognize signs of life-threatening trauma
A-3	Decide if patient has capacity to refuse or consent
S-3	Decide when to leave scene vs. manage/tx on scene (load & go vs. stay & play)
T-1	Deciding on appropriate treatment
T-2	Determine if patient requires immediate treatment or can wait til en route, arrival at ED
T-3	Recognize contraindications/reason to withhold therapy
T-4	Reassess patient after giving a treatment - decision on next action (stop drug, change, give another dose, etc)
T-5	Decision to change care plan (switch protocol/med directive) based on patient changes
T-6	Decide how to manage labour & delivery
D-1	Provide ASA
D-2	Give epinephrine for anaphylaxis
D-3	Give epinephrine for severe asthma
D-4	Give epinephrine for pediatric shock
D-5	Decide to give TNK for STEMI
D-6	Provide bronchodilators
D-7	Decide to use drugs to facilitate intubation (sedation, opiates, paralytics)
D-8	Decide on drug for tachycardia (amiodarone/lidocaine/adenosine)
D-9	Decide whether to administer vasopressor
AW-1	Decide on manual airway positioning - if necessary and how (head tilt, jaw thrust, etc)
AW-2	Decide to insert airway adjuncts (OPA, NPA)
AW-3	Decide to use supraglottic device (King LT, Combitube, LMA), ETI or BMV
AW-4	Provide positive pressure ventilation with BVM in respiratory distress
AW-5	Decide whether to attempt intubation in pediatric patient
AW-6	Decide whether to attempt intubation in major trauma patient
AW-7	Decide to use CPAP
AW-8	Decide to perform chest needle decompression
AW-9	How to clear obstructed airway (Heimlich maneuver, suction, forceps)
C-1	Start CPR
C-2	Begin chest compressions on decompensated child (shock)

C-3	Remind/correct chest compressor on CPR quality; have chest compressors switch
C-4	Decision to defibrillate
C-5	Analyze cardiac rhythm (3 or 4 lead strip)
C-6	Interpreting 12 lead ECG
C-7	Decide on electrical cardioversion or medications for SVT
AW-10	Decide how to confirm intubation
AW-11	Decide to extubate if unsure of placement
AW-12	Failed attempt at intubation - try again for ETI or switch to supraglottic device or BVM
AW-13	Decide whether to perform cricothyroidotomy
S-4	Decide most appropriate destination (trauma, heart, stroke centre, community ED, other)

Appendix 4 Process Map



Appendix 5 Think Aloud Study Sample Characteristics

Entire Sample	Mean (SD)	Range (min – max)
Age	33 (6.7)	23 - 42
Years as ACP	4.2 (3.2)	8.0 (1.0 – 9.0)
Total Years Experience	9.6 (6.4)	20.0 (1.0 – 21.0)
	n	%
Gender (male)	8	100
Type of ACP Training (part-time)	3	37.5
Type of ACP Training (full-time)	5	62.5
Groups	Novice Participants	Experienced Participants
	Mean (SD)/ Range (min – max)	Mean (SD)/ Range (min – max)
Age	28.5 (5.8) / 13.0 (23.0 – 36.0)	37.8 (3.7) / 9.0 (33.0 – 42.0)
Years as ACP	1.5 (0.6) / 1.0 (1.0 – 2.0)	6.9 (2.0) / 4.5 (4.5 – 9.0)
Total Years Experience	4.9 (3.8) / 9.0 (1.0 – 10.0)	14.2 (4.7) / 11.0 (10.0 – 21.0)
	n (%)	n (%)
Gender (male)	4 (100)	4 (100)
Type of ACP Training (part-time)	0 (0)	3 (75.0)
Type of ACP Training (full-time)	4 (100)	1 (25.0)

SD = standard deviation; ACP = advanced care paramedic

Appendix 6 Thinking Strategies Used

Thinking Strategy	Both Scenarios (total n decisions = 376)	Trauma Scenario (total n decisions = 232)	Medical Scenario (total n decisions = 144)	SD Scenario Types	Experienced (total n decisions = 188)	Novice (total n decisions = 188)	SD Groups
	n (%)	n (%)	n (%)		n (%)	n (%)	
Decision Not Made	101 (26.9)	58 (25.0)	43 (29.9)	NS	33 (18.0)	68 (36.2)	*
Rule Out Worse-case Scenario	65 (17.3)	37 (15.9)	28 (19.4)	NS	28 (14.9)	27 (14.4)	NS
Exhaustive	59 (15.7)	33 (14.2)	26 (18.0)	NS	26 (13.8)	27 (14.4)	NS
Algorithmic	72 (14.1)	43 (18.5)	29 (20.1)	NS	29 (15.4)	32 (17.0)	NS
Event Driven	45 (12.0)	45 (19.4)	0 (0.0)	***	0 (0.0)	0 (0.0)	NS
Pattern Recognition	33 (8.8)	15 (6.5)	18 (12.5)	NS	18 (9.6)	11 (5.4)	NS
Hypothetico-deductive	1 (0.3)	1 (0.0)	0 (0.0)	NS	0 (0.0)	0 (0.0)	NS



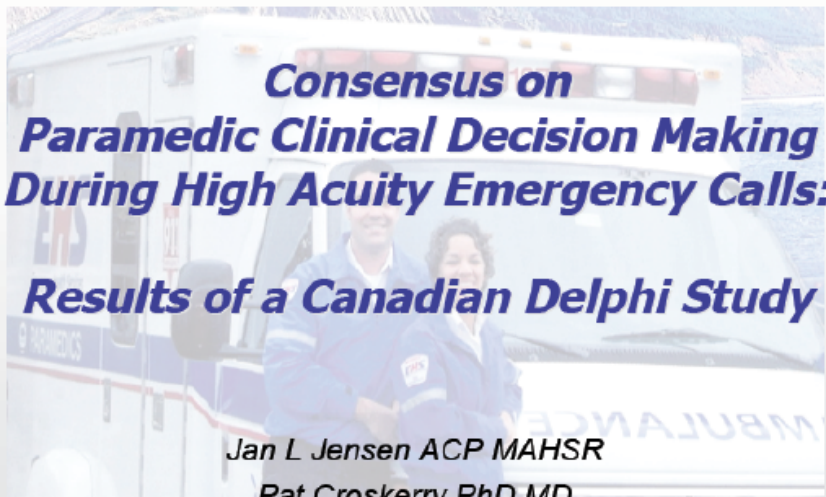
SD = significant difference; NS = no significant difference; *** = $p < 0.001$; * = $p < 0.05$

Appendix 7 Thinking Strategies Used

Thinking Strategy	Both Scenarios	Trauma Scenario	Medical Scenario	SD Scenario Types	Experienced	Novice	SD Groups
	(total n decisions = 376) n (%)	(total n decisions = 232) n (%)	(total n decisions = 144) n (%)		(total n decisions = 188) n (%)	(total n decisions = 188) n (%)	
Decision Not Made	101 (26.9)	58 (25.0)	43 (29.9)	NS	33 (18.0)	68 (36.2)	*
Rule Out Worse-case Scenario	65 (17.3)	37 (15.9)	28 (19.4)	NS	28 (14.9)	27 (14.4)	NS
Exhaustive	59 (15.7)	33 (14.2)	26 (18.0)	NS	26 (13.8)	27 (14.4)	NS
Algorithmic	72 (14.1)	43 (18.5)	29 (20.1)	NS	29 (15.4)	32 (17.0)	NS
Event Driven	45 (12.0)	45 (19.4)	0 (0.0)	***	0 (0.0)	0 (0.0)	NS
Pattern Recognition	33 (8.8)	15 (6.5)	18 (12.5)	NS	18 (9.6)	11 (5.4)	NS
Hypothetico-deductive	1 (0.3)	1 (0.0)	0 (0.0)	NS	0 (0.0)	0 (0.0)	NS

SD = significant difference; NS = no significant difference; *** = $p < 0.001$; * = $p < 0.05$



Appendix 8 Study #1 Oral Presentation June 2010 at the Canadian Association of Emergency Physicians Annual Meeting, Montreal

**Consensus on
Paramedic Clinical Decision Making
During High Acuity Emergency Calls:
Results of a Canadian Delphi Study**

Jan L Jensen ACP MAHSR
Pat Croskerry PhD MD
Andrew H Travers MD MSc

Dalhousie University
Emergency Health Services

This project is partially funded by:



Support

Project Funding:
Canadian Patient Safety Institute
Studentship Grant (2009 - 2010)



This project is partially funded by:



Paramedic Clinical Decision Making

Jan L Jensen
Dr. Pat Croskerry
Dr. Andrew H Travers

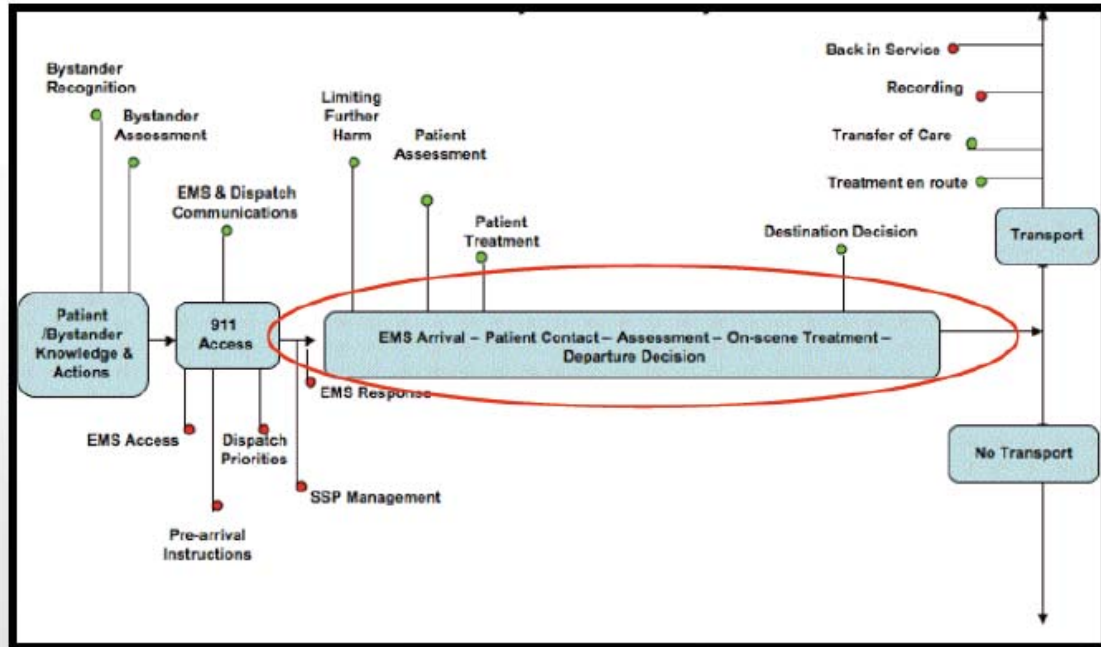
Background

- **Clinical Decision Making (CDM) has been studied in physicians** (Croskerry 2000, 02), **residents** (Young 2007), & **nurses** (Banning 2008)
- **CDM related to patient safety & clinical error** (Campbell 2007, Croskerry 2001, IOM 1999)
- **Paramedic scope of practice and autonomy has steadily increased over last two decades** (Paramedic Association of Canada 2002, IOM 2007)

Related EMS Research:

- **Clinical error reporting by paramedics** (Hobgood 2006)
- **Paramedic scene management** (Campeau 2008)
- **Cognitive control of paramedic endotracheal intubation** (Wang 2007)
- **Paramedic decision-making to initiate IVs** (Pace 1999)
- **Process map of prehospital rapid sequence intubation** (Blanchard 2009)





Adapted from O'Connor 2002



This project is partially funded by:



Paramedic Clinical Decision Making

Jan L Jensen
Dr. Pat Croskerry
Dr. Andrew H Travers

Research Question

- During high acuity emergency calls in the ground ambulance setting...
 - *which clinical decisions made by paramedics are most important - in terms of clinical outcome and patient safety?*

Methods

Design

- **Delphi study: online, multi-round, iterative study with the goal to achieve group consensus among expert panel**

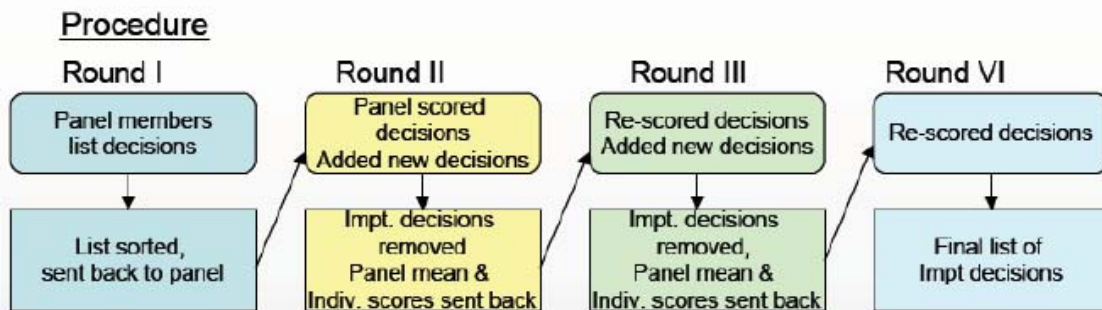
Sample

- **Paramedics & medical directors from across Canada**
- **Purposeful recruitment via 2 national organizations**
- **Research ethics approval from CDHA (written consent)**

Method of Measurement

- **Decisions ranked on Likert scale:**

1	Decision not important, very unlikely to impact patient clinical outcome or safety
2	Decision not very important, unlikely to impact patient clinical outcome or safety
3	Decision possibly important, may impact clinical outcome or safety
4	Decision important, in most instances will impact patient clinical outcome or safety
5	Extremely important, very likely these decisions will impact patient clinical outcome or safety



Analysis:

- Descriptive stats in Excel
- Consensus achieved for each decision if 80% or more of the panel ranked it a 4 or 5
- Inferential stats of scoring differences b/w paramedics & MDs in SPSS (t-tests for each decision and each decision category)

Creation of Paramedic CDM Process Map

- Phases of typical emergency call
- Decisions found to be important were plotted on map



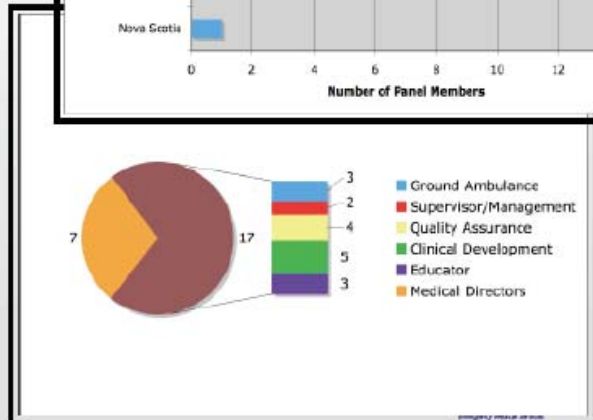
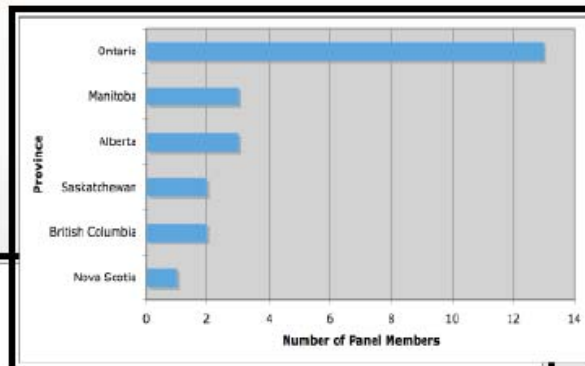
Results

Panel:

- N = 24
- Mean years experience: 16.5 (3 - 40)
- 17 paramedics
- 7 medical directors

Response Rates:

- Round I: 96%
- Round II: 92%
- Round III: 83%
- Round IV: 96%



Results

- The panel found 42 decisions to be important to patient safety and clinical outcome, sorted into 6 categories:

– Airway management:	13 decisions	(2nd highest consensus: 90%, 2nd highest mean score: 4.46/5)
– Drug administration:	9 decisions	
– Cardiac management:	7 decisions	
– General treatment:	6 decisions	(highest mean score: 4.60/5)
– Scene management:	4 decisions	
– Assessment:	3 decisions	(highest level of consensus: 97%)

Results

- Paramedics scored 4 decisions higher than MDs:
 - Decide on a/w device ($p < 0.05$)
 - Perform chest compressions ($p < 0.01$)
 - Begin compressions on decomp child ($p < 0.05$)
 - Decide when to leave scene or stay ($p < 0.05$)
- MDs scored 1 decision higher than paramedics:
 - Give epi for anaphylaxis ($p < 0.05$)

Discussion

- Many decisions made by paramedics were determined by the panel to be important for clinical outcome and patient safety
- Good agreement b/w paramedics & MDs
- Process map
 - Highest decision density identified to be *on-scene treatment* phase

Limitations

- Categories created by one author
- Process map plotted by one author
- Important decisions the opinion of panel, not verified with another panel or with clinical data

Implications

Paramedic Practice

- Decision density of the on-scene treatment phase likely has an effect on adverse events
- Important to increase paramedic metacognition of periods of decision density and clinical conditions found to be most important for safety and outcome (e.g., airway, assessment)


Future Research

- How paramedics make decisions - what thinking strategies do they rely on?
- Process map the specific clinical conditions which were found to be most important by the panel (assessment, airway)
- Conduct similar Delphi studies of CDM for comm and AMT

Acknowledgements

- Drs Croskerry, Travers and Campbell
- Paramedics and EMS medical directors from across Canada who participated
- The EMS Chiefs of Canada and the CAEP EMS committee
- Atlantic Regional Training Centre/Faculty of Health Admin, Dalhousie University







EHS
Emergency Health Services


Paramedic Clinical Decision Making: A Think Aloud Study

Jensen JL, Croskerry P, Travers AH
Emergency Health Services, Dalhousie University



DALHOUSIE
UNIVERSITY
Inspiring Minds
DEPARTMENT OF EMERGENCY MEDICINE
Division of EMS
Emergency Medical Services





Background

- As paramedics make many clinical decisions while caring for patients in the prehospital setting, it is essential to determine how paramedics make decisions.
- The Think Aloud technique was used to explore thinking strategies paramedics use to make decisions during emergency calls.

Methods

- A small sample of Canadian advanced care paramedics (ACPs) verbally worked through two scenarios (one medical call; one trauma call).
- Participants were encouraged to explain why they made each assessment, treatment and transport decision.
- Clinical decisions and thinking strategies were identified in interview transcripts.
- Analysis included descriptive sample statistics, frequency of decisions and thinking strategies, and t-tests to determine differences in thinking strategies used between novice and experienced participants, and between in the different scenarios types.

Results


- Eight ACPs with a mean 9.6 years of overall paramedic experience (SD 5.7) participated.
- Twenty-nine decisions were made in the trauma scenario. Eighteen decisions were made in the medical scenario.
- The most frequently used thinking strategies in both scenarios were *Rule Out the Worst Scenario* and *Exhaustive* thinking.
- In the trauma scenario, participants used *Event-driven* and *Algorithmic* thinking most frequently. In the medical scenario, *Algorithmic* and *Rule Out the Worst Scenario* were employed the most.
- Event-driven* thinking was used more in the trauma scenario than the medical scenario ($p < 0.001$).
- Experienced participants made more decisions than novices ($p < 0.05$). Thinking strategies did not differ between the experienced and novices.

Event-driven	Treat symptoms and then re-evaluate with further evaluation, depending on response to therapy
Intuition	Decisions made without conscious thought
Pattern Recognition	Combination of patient features establish likely diagnosis with corresponding evaluation and management plan
Exhaustive	Accumulate facts indiscriminately and then sift through them for diagnosis
Hypothesis-reductive	Inference based on preliminary findings, idea modification based on subsequent findings, response to therapy & exclusion of competing possibilities
Algorithmic	Preset diagnosis or treatment pathway, based on pre-established criteria
Rule out worst case scenario	Consideration of pre-existing 'can't miss' list of diagnosis for presenting condition

Thinking Strategies. Adapted from Gandy and Capenite 2006

Limitations

- Intuition cannot be evaluated with the think aloud method.
- There was a lack of ecological validity with these verbal scenarios.
- This pilot study is hypothesis-generating. A larger study is needed to confirm these results.



Conclusions

- The thinking strategies paramedics use in trauma and medical scenarios have been explored.
- The results of this study will be valuable for paramedic training, quality improvement and future research.

Acknowledgments

- The Canadian Patient Safety Institute funded this project with a studentship grant.
- Thanks to the paramedics who participated.