RESEARCH

Desirable non-technical skills for paramedicine: A Delphi study

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Abstract

Introduction: Non-technical skills (NTS) are a causative factor in many adverse events in healthcare. Although this is the case, NTS have been explored in the paramedic literature in isolation, with no current list of desirable paramedic NTS within the literature. This study aims to gather consensus opinions on which NTS are considered important for an operational paramedic.

Methods: A modified Delphi technique was utilised to achieve the study aim. Participants were required to rate each NTS on a 10-point Likert scale. For an NTS to reach a consensus, it was required to be rated within two Likert scale points of the mode score by 80% of participants.

Results: There were 17 participants in the Delphi study (n=17). The study ran for a total of three rounds, and 33 of 35 NTS reached consensus. The top five NTS were communication, problem-solving, situational awareness, professionalism, and interpersonal skills. Two NTS did not reach consensus; these were empathy and cognitive offloading, which did not reach consensus despite being rated six or higher by all participants.

Conclusion: The results of this Delphi study have created the first expert-based list of important NTS for paramedics. This will have significant implications for paramedicine as we now have a foundation of which NTS is vital for a paramedic to complete their duties. These results can begin to form the foundation of future paramedic behavioural marker systems that will improve paramedic performance and ultimately lead to improved patient safety.

Keywords

allied health personnel; non-technical skills; paramedicine; patient safety

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INTRODUCTION

Non-technical skills (NTS) have been defined as the "the cognitive, social, and personal resource skills that complement technical skills, and contribute to safe and efficient task performance".(1) They can be broken into two groups: cognitive and mental, and social and interpersonal.(2) Common NTS include situation awareness, decision making, leadership and teamwork.(3)

Non-technical skills can be originated back to 1979; it is from that time that a link between aviation incidents and NTS error became stronger and an emphasis was placed on the identification and training of NTS in aviation.(4) The application of NTS to healthcare occurred when it was recognised that there were similarities between human errors in the operating room and those in aviation.(2,5) Similarly, medical research over 10 years later still supports these findings with 44% of adverse medical events in orthopaedic surgery associated with a

breakdown of NTS, situational awareness accounting for more than half of these.(6) Furthermore, research from Japan between 2010 and 2013 identified that 46% of fatalities were secondary to an NTS breakdown; this was opposed to only 5% that occurred as a result of technical skill errors.(7) This highlights that technical skills alone are insufficient for maintaining patient safety or practitioner performance.(8)

Anaesthetists and surgeons − like experts in aviation − have recognised that improvement in NTS is imperative to improve performance and ultimately improve patient safety. As such, these professions have created behavioural marker systems in their respective fields to enhance individual NTS.(9,10) Behavioural marker systems (which are created from an empirically based taxonomy of NTS for a particular profession) provide an observation-based system for assessing the effectiveness of NTS in the given environment.(11) Each profession

must develop its own NTS taxonomy to create behavioural marker systems. This is so that each element, along with good and poor behaviours, are specified, as they can vary significantly from one technical setting to another.(3) Behavioural marker systems are specific to each domain and thus are required to be developed individually for the domain in which they are used.(8)

Paramedics have recognised that there is a place for NTS and further behavioural marker systems in their field.(12) However, with the emerging introduction, application and knowledge of NTS in the field of paramedicine, there is currently little evidence to support which NTS is important to the role of a paramedic.(13) The governing bodies of numerous ambulance services worldwide refer to the importance of attributes that would be considered NTS.(14-17) These share similarities to those in anaesthetics and surgery with an emphasis on communication, teamwork, leadership and situational awareness.(9,10) However, paramedics differ from these other professions as they are required, due to the nature of the job, to operate in uncontrolled and often unpredictable environments. Furthermore, paramedics are in a unique position in which they are required to elicit information while controlling these environments that often involve multiple people and other emergency services.(18)

With such a strong link of NTS breakdowns to adverse events in the medical literature, assumptions can be made that similar errors would also result in adverse events in the out-of-hospital environment. It is for this reason that we must begin to identify which NTS are important for an operational paramedic. This is so that paramedicine can begin to make inroads into creating their behavioural marker systems to improve paramedic performance and, ultimately, patient safety (12). A previously conducted scoping review of NTS in paramedicine identified that there is a significant amount of literature exploring individual NTS in the paramedic field (13). However, the majority of this work is on specific NTS in isolation, with little literature supporting a NTS taxonomy for paramedics. The findings from this scoping review provided a foundation of empirically-based NTS for paramedics. This study will build on that list by determining whether the empirically-based NTS are important to the role of a paramedic. This study aims to gather consensus opinions on which NTS are considered important for an operational paramedic.

METHODS

Design

First introduced in 1950, the Delphi technique is an anonymous group information gathering technique designed to obtain the most reliable consensus opinion of a group of experts.(19) The Delphi study is different to other group data-gathering techniques in that it provides participants with feedback on iterations. The feedback process encourages participants to review and evaluate their initial judgements based on the feedback provided by other Delphi participants.(20) The Delphi technique involves multiple rounds. Round 1 traditionally begins as an idea gathering round; however, it is an acceptable variation to begin Round 1 with a structured questionnaire created from a previous review of the literature.(20,21) Data gathered from Round 1 are collated to develop a questionnaire that is distributed to participants in Round 2. Participants are required to answer the questionnaire in which the results are collated and redistributed to participants in Round 3. This encourages participants to re-evaluate their initial responses and change them if they feel necessary. This process continues for subsequent rounds until consensus is met or a pre-determined maximum number of rounds is reached.(20,21)

The Delphi technique differs from other group data gathering techniques in that individual responses are anonymous. The advantage of this is that individuals can provide an honest opinion of their thoughts without being influenced by dominant individuals, distracted by noise or conforming to the group opinion.(22) The conducting and reporting Delphi studies (CREDES) guideline was followed to ensure a systematic approach throughout.(23)

Process

A snowball sampling technique was used to recruit participants for this study. Participants were recruited from Ambulance Victoria, an emergency ambulance service in Australia. A small portion of participants in varied organisational positions were approached by the second author (RB) to participate in the study. These participants then recommended additional participants who met the inclusion criteria. This was done to gather a broad view of which NTS were considered important for a paramedic from different aspects of the organisation. The final participant list was distributed among all authors before participants were approached to ensure they all met the inclusion criteria. Twenty participants were approached to participate in the study, and this is within the range consistent in the literature.(20) To be eligible to participate in the study participants were required to have worked a minimum of 6 years in the organisation and as a paramedic.

A modified Delphi technique was utilised for this study as a structured questionnaire was used for the first round. This was developed from a previously conducted NTS literature review.(13) It was decided that for

consensus to be reached, an NTS was required to have 80% of participants rank it within two Likert scale points of the mode score. The mode was utilised as it represents the most selected score from the participants and is a more accurate reflection of where the majority of votes sit as opposed to the median and mean.(20,24) Where an NTS had two or more modes, the lowest of the modes was utilised.

For the study, an NTS was defined as "the cognitive, social, and personal resource skills that complement technical skills and contribute to safe and efficient task performance".(1)

The study concluded with whichever of the following occurred first; all NTS had reached 80% consensus within two Likert scale points, or three rounds of the study were completed. Data collection and analysis were undertaken by both authors (RB, BW); neither author had any direct supervision or power relationships with any participants.

Round 1
Participants were asked to rank a list of 26 individual NTS on a 10-point Likert scale from 1 (not important at all) to 10 (highly important). At the end of the round participants were able to include any additional NTS that they considered important to the role of a paramedic for evaluation by participants in future rounds.

Round 2
The results from Round 1 were collated, and all NTS that reached 80% consensus were removed from the Round 2 questionnaire. Any additional NTS participants added after Round 1 were added to the Round 2 questionnaire. Participants were again required to rank the NTS list on a 10-point Likert scale. The mode for each NTS that did not reach consensus was provided to participants to allow them to reconsider their feedback and decide whether they wished to change their answer in the coming round. Participants again had the opportunity to add any additional NTS to the list.

Round 3
As with the previous round, all NTS that reached 80% consensus in Round 2 were removed from the Round 3 questionnaire, and any additional NTS from Round 2 were added. The mode from the previous two rounds was listed next to the NTS that were distributed in Round 3. Participants were again asked to rank the NTS questionnaire on a 10-point Likert scale.

Statistical analysis
Non-technical skills were ranked according to three criteria. The primary ranking system was the round in which each NTS met consensus (ie. Round 1 ranked highest). The secondary ranking for each NTS was based according to their mode ranking. Finally, the tertiary ranking system was used when two or more NTS had the same mode rating; in this instance, the percentage of consensus was used to rank the NTS.

After the third round, the results from the final round were collated. Any NTS that received a rank of 5 or less was considered not important and not included in the end list. If an NTS scored 6 or higher, it was deemed to be important and was included in the end list.

Ethical considerations
Independent ethical approval was sought from the Monash University Human Research Ethics Committee (MUHREC) before the commencement of this study. Project ID number 19599. As participants were employed by Ambulance Victoria, governance approval was granted from the organisation.
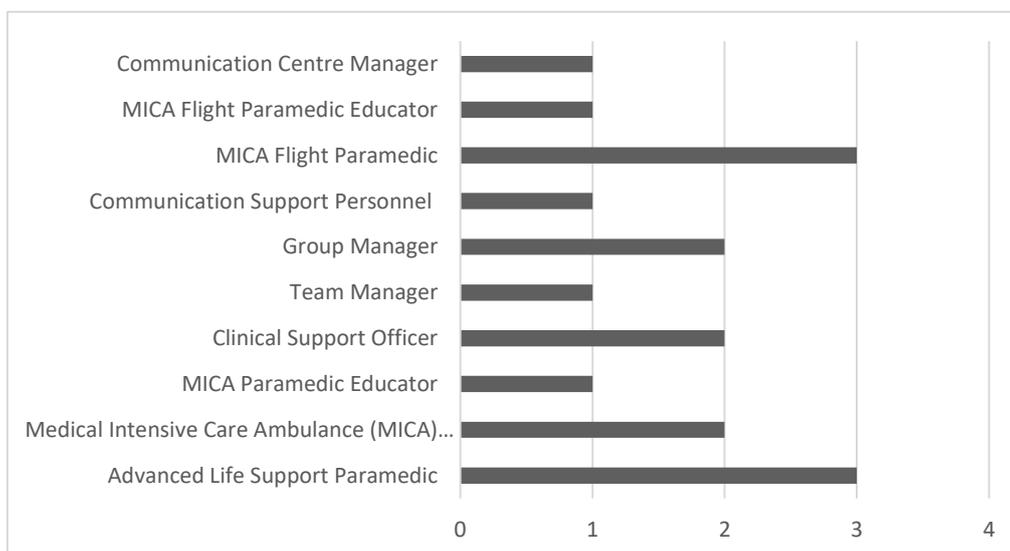

Figure 1. Employment positions of paramedics (n=17)

RESULTS

Of the participants that were approached to participate in the study (n=20), 17 agreed (n=17). The most represented age of participants was 44 and 49 years (n=6), and the majority of participants had over 15 years' experience as a paramedic (n=13). All participants have direct interaction with operational staff daily and have all worked as operational paramedics. Figure 1 outlines the positions held by participants within the organisation.

Round 1

Seventeen participants participated in Round 1. Eight of the 26 NTS in the pre-determined questionnaire reached consensus in Round 1 (Table 1). Communication was the most highly rated with a mode of 10. The lowest rating NTS in Round 1 was mentoring with a mode of 6. Both empathy and compassion achieved the least amount of consensus with 47.06% agreement with their respective modes.

Table 1. Round 1 Consensus non-technical skills

NTS	Mode	Consensus
Communication	10	88.24
Problem solving skills	9	100
Situational awareness	9	100
Professionalism	9	82.35
Interpersonal skills	8	88.24
Task management	8	88.24
Scene management	8	82.35
Time management	7	82.35

NTS: non-technical skills

Round 2

One participant failed to return a response to the Round 2 questionnaire and was excluded from future questionnaires. Thus, 16 (n=16) participants completed the Round 2 questionnaire. An additional nine NTS were included in the Round 2 questionnaire after feedback from participants in Round 1 (logical, cultural safety, bias recognition, observational skills, analytical, providing and receiving feedback, hierarchical reduction, cognitive offloading). In the Round 2 questionnaire, 14 of the 27 NTS reached consensus (Table 2). Decision making, Ethical, and Teamwork all had the highest mode ranking of 9.

Round 3

Sixteen participants returned the Round 3 questionnaire. No additional NTS were included from participants after Round 2; thus, the Round 3 questionnaire contained 13 NTS. In the third and final round of the study, 11 of the 13 NTS reached consensus. Integrity and bias recognition both were rated the highest with a mode of 10 (Table 3).

Table 2. Round 2 consensus non-technical skills

NTS	Mode R2	Consensus R2 (n=16)	Mode R1	Consensus R1 (n=17)
Decision making	9	100	10	70.59
Ethical	9	100	10	64.71
Teamwork	9	100	10	58.82
Leadership	9	93.75	9	64.71
Respect	9	81.25	8	64.71
Logical	8	93.75		
Resilience	8	93.75	8	76.47
Assertive	8	93.75	7	58.82
Coping with stress	8	93.75	7	58.82
Emotional intelligence	8	93.75	7	58.82
Adaptive	8	81.25	9	76.47
Listening	8	81.25	8	64.71
Cultural safety	7	87.50		
Mentor	7	87.50	6	58.82

NTS: non-technical skills; R2: round two; R1; round one

Two of the listed NTS did not reach 80% consensus over the three rounds. These included empathy and cognitive offloading. Neither NTS received a ranking of 5 or below by any participants across the three rounds, however consensus could not be reached on a ranking.

Additionally, data collection indicated there was also no relationship between organisational positions and an individual's ranking of these two NTS. This would indicate that these NTS were ranked from personal experience and that lack of consensus was not due to specific positional demands.

This study identified that a total of 35 NTS were considered important for a paramedic, of which 33 reached consensuses. This has provided a ranked expert-based list of important NTS for a paramedic (Table 4).

DISCUSSION

The results from this study have provided an expert-based list of important NTS for an operational paramedic. This builds on the previous empirically-based list of NTS and can provide a foundation for NTS work in the paramedic field.(13) The results yielded increased the list of NTS that are considered important to the role of a paramedic. As this list was the opinion of experienced paramedics, it would be prudent to ensure the additional NTS are included in discussions of NTS in paramedics. The authors acknowledge further work is required to reduce this list, however empirical evidence on paramedic NTS taxonomy is limited with opinions based on anecdotal experience. Thus, this first step is required before refinement of the list can occur. With further development through grouping, statistical analysis (eg. factor analysis or cluster analysis) and larger sample sizes, this list of NTS has the potential to be utilised in the creation of behavioural marker systems.(13)

Table 3. Round 3 consensus non-technical skills

NTS	Mode R3	Consensus R3	Mode R2	Consensus R2	Mode R1	Consensus R1
Integrity	10	93.75	10	56.75	10	76.47
Bias recognition	10	87.50	9	75.00		
Observational skills	9	100	8	75.00		
Rapport	9	100	8	68.75	8	64.71
Non-discriminatory	9	87.50	9	75.00	9	76.47
Compassion	9	81.25	9	75.00	7	47.06
Analytical	8	93.75	8	75.00		
Receive feedback	8	87.50	8	75.00		
Reflective	8	87.50	8	75.00	7	64.71
Provide feedback	8	87.50	8	62.75		
Hierarchical reduction (ie. MICA & ALS)	7	81.25	7	75.00		

NTS: non-technical skills; R3: round three; R2: round two; R1: round one; MICA: mobile intensive care ambulance; ALS: advanced life support

It was no surprise that 'communication' was ranked as the most important NTS for a paramedic. Paramedics use communication in all facets of their day-to-day work, including communicating with patients, colleagues and other health and emergency service professionals. Furthermore, communication plays an integral part in acquiring and disseminating information which is pivotal to diagnosis and treatment.(25) Communication has been found to benefit other NTS in the setting of paramedicine with communication contributing to improved decision-making, as well as improving rapport and interactions in sensitive situations or with different patient demographics.(26-29) Thus, communication skills are recognised in multiple governing body position descriptions and the paramedic literature as an essential and desirable NTS.(14-17,30)

There were similarities between other medical field taxonomies and the results of this study. Non-technical skills such as communication, decision making, situational awareness and teamwork, which are consistent in the anaesthetist and surgeon NTS taxonomies, were also considered relevant to the field of paramedics.(10,31) These similarities can be explained due to the transferability of generic NTS, which all play a significant part in improving performance.(4,32) However, this could also be attributed to the similarities between both professions that operate in dynamic and time-sensitive circumstances.

Additional NTS were also identified as necessary to the paramedic field that was not included in anaesthetist and surgeon taxonomies. Given the intended broad scope of this Delphi study, this was not unexpected, however for NTS such as problem-solving, professionalism, interpersonal skills and scene management to reach consensus in the first round indicates they play a significant part in a paramedic's ability to execute their job requirements. Some of these skills would not be as important to an anaesthetist or

surgeon as they would for a paramedic given the environment they are operating in. The identification of these different NTS highlights the requirement for paramedics to work to create their behavioural marker systems to improve these NTS that are specific to the profession.(12)

Empathy and cognitive offloading were unable to reach consensus on their ranking; this was despite both NTS being ranked 6 or higher in each round by all participants. Healthcare research supports the importance of empathetic behaviour and has been linked to a decrease in medical errors, along with increased patient compliance and diagnosis.(33-35) Additionally, cognitive overload has been attributed to a breakdown of system one (intuitive) and system two (rational) thinking styles, causing individuals to take longer to make analytical decisions.(36,37) Consequently, individuals become more reliant on intuitive thinking; thus, the individual is prone to biased reasoning and risk of making poor decisions.(37) Cognitive offloading can contribute to decreased cognitive load and reduce the effects of cognitive overload, improving decision-making. Both empathy and cognitive offloading are recognised as critical NTS in broader healthcare. This study supports that these NTS are essential for a paramedic to complete their duties; however, it appears the extent of that importance was varied among the experts, further research is required to determine the consensus of where they sit with the other listed NTS.

Limitations

The authors acknowledge that this study is not without limitations. The study population for this study was small, and larger sample size would be required to determine the validity and reliability of the results. Furthermore, the terms utilised in the study may be interpreted differently by individuals. By utilising a predetermined questionnaire, the investigators could introduce bias into the study. One of the benefits of the Delphi technique is that participants have the

opportunity to provide feedback after each round. This allowed participants to include any additional NTS and thus would alleviate any potential investigator bias that may have been introduced. Lastly, by removing NTS that reached consensus in the previous round, it prevented a more in-depth statistical analysis and inter-rater correlation through the study.

Table 4. Ranked list of expert-rated non-technical skills for paramedics

Rank	NTS
1	Communication
2	Problem solving skills
3	Situational awareness
4	Professionalism
5	Interpersonal skills
6	Task management
7	Scene management
8	Time management
9	Decision making
10	Ethical
11	Teamwork
12	Leadership
13	Respect
14	Logical
15	Resilience
16	Assertive
17	Coping with stress
18	Emotional intelligence
19	Adaptive
20	Listening
21	Cultural safety
22	Mentor
23	Integrity
24	Bias recognition
25	Observational skills
26	Rapport
27	Non-discriminatory
28	Compassion
29	Analytical
30	Receive feedback
31	Reflective
32	Provide feedback
33	Hierarchical reduction (ie. MICA & ALS)
34	Empathy
35	Cognitive offloading

NTS: Non-technical skills; MICA: mobile intensive care ambulance; ALS: advanced life support

CONCLUSION

The results of this Delphi study have created an expert-based list of important NTS for a paramedic. This will have significant implications for paramedicine as we now have a foundation of which NTS is important for a paramedic to complete their duties. Further research is required to determine the reliability and validity of the results; however, once completed can be utilised to form future paramedic behavioural marker systems that could be implemented to improve paramedic performance of NTS, ultimately leading to improved patient safety.

COMPETING INTERESTS

The authors of this paper report no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

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