Development of a behaviour rating system for rural/remote pre-hospital settings

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Abstract

Background: Remote and Rural pre-hospital care practitioners manage serious illness and injury on an unplanned basis, necessitating technical and non-technical skills (NTS). However, no behaviour rating systems currently address NTS within these settings. Informed by health psychology theory, a NTS-specific behaviour rating system was developed for use within pre-hospital care training for remote and rural practitioners.

Method: The Immediate Medical Care Behaviour Rating System (IMCBRS), was informed by literature, expert advice and review and observation of an Immediate Medical Care (IMC) course. Once developed, the usability and appropriateness of the rating system was tested through observation of candidates' behaviour at IMC courses during simulated scenarios and rating their use of NTS using the IMCBRS.

Results and Conclusion: Observation of training confirmed rating system items were demonstrated in 28-62% of scenarios, depending on context. The IMCBRS may thus be a useful addition to training for rural and remote practitioners.

Highlights
- A patient safety behaviour rating system for rural/remote settings was developed.
- Testing of the system suggests that its content may be appropriate and observable.
- Some elements were more observable, which may affect future work using this system.

1. Background

Rural/remote practitioners manage serious illness and injury on an infrequent, unplanned basis. Within rural/remote settings the first person at the scene of a medical emergency is often a general practitioner (GP) or practice nurse. Compared to urban or hospital-based settings, those attending an emergency in these settings may be doing so single-handedly or with limited assistance, for considerable time within potentially harsh conditions, prior to an ambulance providing transport to definitive care. Quite often, working in such settings requires decisions to be made based on the distance to hospital and the patient's likelihood of survival. Effective pre-hospital care thus necessitates a high level of non-technical skills (NTS), such as communication and decision-making (1). The importance of NTS within these settings is evident within research which suggests the factors involved in the likelihood of surviving out of hospital cardiac arrest include a witnessed cardiac arrest, provision of bystander CPR, shockable cardiac rhythm and return of spontaneous circulation (ROSC) within the field (2). The tasks involved in this example necessitate communication skills involved in the provision of CPR (e.g. communicating planned actions to others) and decision-making skills (e.g. who should do what) about how to respond to the situation. In order for optimal care to be provided both technical (e.g. providing CPR) and non-technical (e.g. co-ordinating people at the scene of an emergency) skills need to be employed. Consequently, approaches to improving patient safety and clinical outcomes from emergency care should focus not only on clinical skills and operational and service factors, such as ensuring equipment is maintained, but also NTS (3, 4).

A Scottish Ambulance Service publication reported that in 2013/14 4,591 responses related to cardiac/respiratory arrest, and 17.3% of eligible cardiac arrest patients had a ROSC upon arrival at hospital (5). This was associated with a 35-fold increased chance of survival, compared to those without ROSC (2). Due to the remoteness of areas within Scotland and the changeable nature of pre-hospital care, responding promptly to an emergency within these locations is challenging. Additionally, the infrequency with which responders are called out emphasizes the importance of consolidating NTS within this area, as highlighted within a Scottish Government document (1).

Behaviour rating systems have been developed within acute care to assess factors affecting patient safety behaviours for anaesthetists (Anaesthetists Non-Technical Skills (ANTS)) (6-8) surgeons (Non-Technical Skills for Surgeons (NOTSS)) (9,10) and scrub nurses (Scrub Practitioners List of Intra-Operative Non-Technical Skills (SPLINTS)) (11, 12). These systems were developed to identify NTS underpinning good practice and their use has been fundamental to reducing unintended and avoidable harm.

Outside the surgical context, an observational skill-based assessment tool for resuscitation (OSCAR) was developed for use within cardiac arrest teams, outlining behaviours specific to anaesthetists, physicians and nurses, incorporating communication, co-operation, co-ordination, monitoring/situation awareness, leadership and decision-making (13). A similar system, the Team Emergency Assessment Measure (TEAM), was developed for emergency resuscitation, featuring teamwork, leadership and task management (14). However, the TEAM may have omitted some NTS vital for successful resuscitation, including communication and decision-making, which are traditionally featured within patient safety rating systems, such as ANTS.

It is important to note that due to the acute care focus within OSCAR and TEAM they may not be applicable to contexts with less predictable characteristics, such as pre-hospital care. To date, no such behaviour rating

systems have been developed and implemented within rural/remote pre-hospital care. The use of such systems enables reliable and effective observational assessment of staff engagement in patient safety issues and measurement and benchmarking of behaviours related to the implementation of NTS. This can then inform interventions to improve understanding, knowledge and practice of relevant NTS measured via changes in behaviour.

It should be reiterated that many pre-hospital responders are called out on an unplanned, infrequent basis and their life-saving skills are in addition to skills required as part of their everyday work, this combined with the fact that emergency medical care consists of challenging physical (e.g. working in unknown settings with limited space/resources) and emotional (e.g. presence of a casualty's family/friends) environments (15, 16). Since these technical skills are prone to rapid decay (17) there may be pre-hospital care-specific patient safety issues, relating to the uncertainty associated with these rapidly changeable circumstances and consequently, existing rating systems may be unsuitable.

The purpose of this project was to develop a patient safety behaviour rating system for use within training courses and resources for rural/remote practitioners. Compared to many of the existing rating systems, the use of a rating system within this fast-paced, dynamic context should address the NTS involved in providing care outside a normal clinical role, potentially within an ad hoc team with a mixed skill level. Routine use of such a rating system both as a focus of training and a means of providing feedback could potentially improve patient safety within this context. The specific aims and objectives were to:

Aims

1. Identify NTS for use within a behaviour rating system relevant to the provision of pre-hospital emergency care within rural/remote settings,
2. Develop and pilot a behaviour rating system within immediate medical care and pre-hospital emergency care courses.

Objectives

- Identify key behaviours underpinning the use of NTS within pre-hospital care in rural/remote settings,
- Develop a behaviour rating system featuring specific NTS categories to enable identification and scoring of NTS tailored to rural/remote pre-hospital emergency settings.

2. Method

This was a mixed-methods project developed by health psychologists and pre-hospital care responders from NHS Education for Scotland (NES), a special health authority responsible for the training and career-long development of the workforce and BASICS Scotland, a charitable organisation which provides training in the management of trauma, medical emergencies and major incidents as well as co-ordinating groups of pre-hospital responders throughout Scotland.

Development

Rapid Literature Review

A rapid literature review to identify relevant NTS was conducted addressing:

1. Patient safety behaviour rating systems,
2. Pre-hospital care, especially relevant NTS,
3. Emotional barriers to the adoption of NTS.

Using key terms, PubMed, CINAHL, EMBASE, PsycINFO and Web of Science were searched during March to June 2013. References of key papers were also used to identify further relevant research. In addition to searches explicitly addressing ANTS, NOTSS, SPLINTS and OSCAR and using these as single search terms, further searches were employed, combining:

1. pre-hospital OR emergency OR rural/remote,
   AND
2. paramedic OR GP OR nurse,
   AND
3. non-technical (skills) OR crew/crisis resource management,
   OR
4. situation awareness OR decision-making OR leadership OR teamwork OR communication OR stress/distress OR anxiety

After inspecting titles and abstracts and removing duplicates, this search identified 53 research papers which subsequently informed the development of the rating system.

Once identified, papers were reviewed and information pertaining to the following was extracted:

1. Specific NTS and their relevance for pre-hospital care,
2. Social, organisational and environmental factors influencing NTS use within healthcare settings,
3. The development, application and evaluation of patient safety behaviour rating systems.

Observation of existing BASICS Scotland training

A BASICS Scotland Immediate Medical Care (IMC) Part 1 Course, an introductory course in pre-hospital emergency care, was attended and observed by a health psychologist. This enabled the identification of aspects of the course that could benefit from the inclusion of NTS. Specifically, a checklist was drafted featuring behaviours, based on the identified literature and similar rating systems. This checklist was then used to identify NTS that were demonstrated within the course, either through the training, or spontaneously by candidates. At the time of writing, a brief introduction to situational awareness, clinical decision-making, teamwork and communication was included in the course. However, any further reference to NTS was ad hoc, dependent on the trainer, thus, at the time of this initiative, the course did not explicitly train candidates on the use of NTS. Use of the checklist during observation of scenarios also enabled identification of situations where the inclusion of NTS could be beneficial. Additionally, attendance at the course provided the opportunity to discuss the initiative with trainers and candidates, providing insight into the potential utility of the inclusion of NTS within the training. This also provided information on trainers' and candidates' understanding of NTS and their perceived use of them within training scenarios.

The IMC courses are two and a half days long and consist of skills stations, a triage scenario and eight moulage scenarios consisting of equal numbers of cardiac and trauma scenarios. The skills stations focus on topics including chest assessment, advanced airway, including the use of a laryngeal mask and shock and vascular access, including defibrillator use. During the scenarios, candidates practice these skills in realistic scenarios, coached by a BASICS instructor and are provided with feedback relating to their technical skills. The final day of training consists mostly of observed moulage scenarios during which candidates conduct scenarios in an exam-like situation, and are thereafter provided with formative feedback. The Pre-hospital Emergency Care (PHEC) course has a similar structure and is based on the same manual from the Royal College of Surgeons of Edinburgh. However, the moulage scenarios are accompanied by summative feedback and candidates are required to complete a written multiple choice examination. The PHEC course was included alongside the IMC to allow the observation of various NTS within two separate courses addressing pre-hospital emergency care. These courses were used to gather observational information about how practitioners respond to such situations. Due to their unpredictability it would be difficult to observe actual emergency situations.

BASICS Scotland Course Directors were consulted, providing an understanding of the training process and the candidates' needs, particularly their working environments and job requirements. The course directors are active BASICS responders with several years of clinical experience, providing input into the design of the initiative and related materials from subject experts from the outset. This also provided an opportunity to discuss appropriateness of the proposed rating system and any subsequent NTS training. This took the form of a full-day face-to-face meeting with the team, including an informal group discussion, during which contemporaneous notes were taken and sent to stakeholders to confirm they accurately reflected the meeting. Various issues were discussed in-depth, using structured questions, addressing:

- The nature of pre-hospital care,
- Training available addressing pre-hospital care,
- The perceived relevance of NTS within the pre-hospital care environment,
- How NTS could be incorporated into pre-hospital care training and what this would entail.

Once a project brief had been developed, outlining a proposed NTS intervention, the three Course Directors with BASICS Scotland provided further comment and expert advice/opinion. This was an iterative process, carried out over two months to ensure the content and format of any subsequent intervention was appropriate and fully met candidates' needs.

Identification and definition of NTS (see Figure 1)

Based on the literature review, observation of the BASICS Scotland course, feedback from BASICS Scotland Course Directors and information from stakeholders, specific NTS relevant to pre-hospital care and resuscitation were identified, this approach was guided by recommendations outlining how rating systems should be developed (18). The authors, including one of the BASICS Scotland course directors, thereafter split this list into five categories representing distinct NTS sets, including situation awareness, decision-making, leadership, communication and teamwork and personal resources. This was done through discussion until consensus was reached. Four independent experts in pre-hospital care or emergency medicine, identified and approached by the Chair of the NES Patient Safety Multidisciplinary Group and Dean of Medicine in the East of Scotland were consulted for advice prior to the refinement process. This involved reviewing the proposed taxonomy, ranking the 10 most relevant elements (Figure 2) and providing feedback concerning potential overlap. This gave two items per each of the five system categories for analysis and provided a contender set of NTS, relevant to pre-

hospital care (Table 1). Based on feedback from these experts, a list of behavioural markers for these NTS was identified and agreed upon, and discussed and reviewed by the three BASICS Scotland Course Directors. They provided comment about the suitability of the proposed system for the IMC and PHEC courses and where appropriate, suggested final changes.

INSERT FIGURE 1 HERE

INSERT FIGURE 2 HERE

INSERT TABLE 1 HERE

Before finalising the Immediate Medical Care Behaviour Rating System (IMCBRS), it was tested for usability by two health psychologists, including one of the authors. One of the health psychologists attended the four BASICS Scotland training courses (three IMC, one pre-hospital emergency care; PHEC) taking place between September and December 2013 to ensure the content was observable and appropriate. This process involved using the rating system to observe and rate candidates during training scenarios to ensure the included behavioural markers were clearly defined and rateable. Final moulages and scenarios were also filmed and coded for NTS by the same two health psychologists using the IMCBRS, enabling calculation of inter-rater reliability (IRR). At the time of writing, no suitable critical incident systems for remote and rural practitioners existed, similarly, although work has been done involving the filming of cardiac arrests by paramedics (19), this was not possible within this context, as a result, the BASICS courses were used as a proxy for real-life emergencies.

To identify NTS within training scenarios, the IMCBRS was operationalised using a rating system record sheet featuring the 10 elements accompanied by 39 individual behavioural markers (Table 1). The elements related to specific behavioural markers and were informed by literature and existing NTS rating systems (6-12). Raters using the system were provided with four possible response items: demonstrated, not demonstrated, not clear and N/A. Space was also provided for comments relating to the observed scenarios.

Evaluation

Observation of NTS

Within each IMC course the final scenario was filmed and the behaviour of the candidate leading the task was rated by the health psychologists mentioned above, using the pilot IMCBRS. Every candidate present was invited to have their moulage filmed. Within the PHEC course, the final scenario was formally assessed and included only the examiner and candidate, providing limited opportunity to observe NTS. Thus only general training scenarios from within the training course were filmed. Despite the use of two different courses for the evaluation, the only differences in terms of the scenarios used was that candidates were more likely to interact with other candidates during PHEC scenarios and trainers were more likely to offer assistance as it was not considered an assessment. Written consent was sought from candidates and trainers prior to the filming. This

project was reviewed by the NES internal ethics committee and deemed to be service improvement, as a result formal ethical approval was not sought.

<u>Self-rated NTS</u>

Pre-training, all candidates completed a questionnaire, return of which was accepted as consent to participate in the pilot. This questionnaire was re-administered immediately post-training. The following definition was featured to accommodate those unfamiliar with NTS:

"Non-technical skills are cognitive and social skills that complement technical skills to achieve safe and efficient practice. The main skill categories include team working, communication, situation awareness and decision-making. This questionnaire was developed to understand health professional's views of non-technical skills and their use in practice and in particular, during emergency situations requiring resuscitation."

This questionnaire assessed candidates' use of NTS in relation to a resuscitation effort and requested they state the number of emergencies in which they had been involved to control for prior experience. It featured each element from the IMCBRS (e.g. Encourage other team members to voice their opinions), as outlined in table 1, preceded by the following stem: "In an emergency situation requiring resuscitation my ability to do the following is…". Candidates were requested to state their agreement with each statement on a likert-scale ranging from 1 "I would never do this" to 5 "I would always do this".

Statistical analysis

Descriptive analysis and non-parametric comparisons over time were used to provide basic information about the rating system items and candidates' self-ratings of NTS use. Non-parametric analysis was used to account for the non-normally distributed data.

IRR was used to establish the consistency of ratings provided by two health psychologists using the IMCBRS. This was calculated based on the independent rating of video recordings of 15 scenarios. The results of these analyses are presented using Cohen's Kappa, interpreted using the recommendations of Landis and Koch (18). Prior to the analysis, the authors agreed that a Kappa of ≥40 would warrant inclusion within the final version of the system.

Wilcoxon signed-rank tests were used to identify any changes in self-ratings of NTS use, pre- and post-course.

3. Results

The IMCBRS was piloted at three BASICS IMC Refresher courses and one PHEC course by observing and rating the content of 65 training scenarios by two health psychologists, using the rating system record sheet described. Forty-seven additional scenarios, consisting of 55% of candidates, were filmed and their content rated to identify candidates' use of NTS; 15 (32%) of these scenarios were rated independently by two raters. Overall, the

behaviour of 85 health professionals was observed, 81 of whom stated their profession, which consisted of GPs (83%, 67/81), practice nurses (11%, 9/81) and paramedics (3%, 2/81).

Observations using the IMCBRS

Behavioural markers reflecting all aspects apart from personal resources were demonstrated in 28-62% of scenarios (Table 2). The items from the personal resources sub-system were demonstrated in a median of 1 scenario (range 1-6). When rated independently by two raters, this sub-system demonstrated poor reliability (Cohen's Kappa -0.11 (-0.27-0.04)).

INSERT TABLE 2 HERE

Of 39 potential behavioural markers, 14 (35.8%) were demonstrated in at least 50% of scenarios and observed with reasonable reliability. These 14 behavioural markers included 5 situational awareness, 6 decision-making and leadership and 3 communication and teamwork items. Observations of these behavioural markers were identified in 53-95% of scenarios (Table 3). Cohen's Kappas were calculated reflecting the rating system's reliability using the independent responses from two raters. Cohen's Kappas for the elements including these 14 behavioural markers was ≥0.42, indicating moderate-very good reliability (21). However, one communication item was demonstrated in only 2 scenarios, with a Cohen's Kappa of 0.18 (0.04-0.32) indicating poor reliability.

INSERT TABLE 3 HERE

Self-ratings of NTS use

Of those who provided a response, most (92%, 48/52) reported involvement in at least one prior resuscitation; the median was 10 (range=0-100).

Participants' self-ratings can be seen in Table 4. Wilcoxon signed-rank tests revealed statistically significant increases in candidates' self-ratings of NTS use post-course in various areas (p<0.05), including relating to trying alternative options (gathering information; Z=-4.84, p≤0.001) and taking charge of the situation, where necessary (leadership; Z=-4.11, p≤0.001) .

INSERT TABLE 4 HERE

4. Discussion

An IMCBRS was developed for use within training for rural/remote pre-hospital care settings. Findings suggest its use is feasible and may provide added value to training initiatives in this context.

IMCBRS

The IMCBRS was used to identify NTS use within 127 scenarios; 14 of 39 items were demonstrated in at least 50% of cases. This variation may be explained by the nature of the scenario, the relevance of the NTS to the scenario, the proficiency of a candidate in a particular NTS (22) or assumptions made by candidates (23). One of the communication items "encourage other team members to voice their opinions" was only observed in a minority of scenarios, potentially due to the stress of the scenario (24, 25), the 'false' nature of training scenarios or uncertainty about what was acceptable in this context, or being observed during a scenario, which is known to affect factors such as decision-making. Although the observed candidates may have delegated tasks and kept their team informed of what was happening, they rarely asked others for their opinion. This may be due to a mismatch between what they thought they were demonstrating and what was actually demonstrated, as evidenced by the high mean self-ratings of this NTS (3.82-3.95/5.00) pre- and post-training. Alternatively, this may reflect a lack of understanding about the need to obtain feedback from colleagues, as noted elsewhere (26). Candidates may have been unaware of the need to explicitly prompt others to provide their opinions. The use of good communication skills during scenarios is crucial to developing a shared understanding, thus it is important to identify ways to improve this.

The IMCBRS used 'gathering information' as a heading rather than 'situation awareness' which is included in similar systems. This heading was chosen as the authors felt it would be familiar to users. The elements used within the system to demonstrate situation awareness were chosen based on expert opinion and were deemed to be those most relevant to rural/remote pre-hospital care.

Observation of specific NTS

It is difficult to observe factors such as personal resources. Similar work suggests that only in extreme cases may it be possible to observe behaviour related to stress or fatigue (27). Despite this, the impact of stress within this context should be addressed due to its potential impact on patient safety and the outcomes of a situation. For instance, acute stress may impact decision-making (23) including strategy use (deciding which approach to take) and feedback processing (interpreting information and thereafter deciding whether the approach being used is appropriate), both of which may be vital during a pre-hospital emergency. Furthermore, stress may affect a person's cognitive functioning and their ability to problem-solve and conduct reasoning tasks, which are necessary pre-hospital care skills. Although stress may affect the outcome of an emergency not only for the casualty, but also the practitioners involved, it is difficult to identify whether somebody is stressed, unless they verbalise this, or are under extreme stress. Recommendations within NTS literature state that the content of a behaviour rating system should be observable (8). Thus, although personal resources and acknowledgement of stress may be relevant to the delivery of optimal care during an emergency (28) their inclusion within a system such as this may be inappropriate (27, 29). In addition, as personal resources including stress, affect other NTS, stress itself may not be recognised by a rater, but the impact of that stress on other factors, such as decision-making may be, thus it is possible that the explicit inclusion of personal resources in a system may not be necessary. Revision of the system should remove personal resources or assess this differently, such as asking participants to self-rate their NTS use. Alternatively, it may be worthwhile considering capturing a candidate's emotional response to a scenario, for instance by asking them to self-rate how they felt during a scenario. The impact of stress should, however, be highlighted within training for personnel working in rural/remote areas, as

featured within similar training within Aviation and Offshore Crew Resource Management (11, 30), and should address an awareness of the consequences of stress, during and after an emergency, and how to manage such stress.

Some of the items within the IMCBRS may be cognitive factors, such as situation awareness and decision-making, which would need to be reflected by a candidate's behaviour, e.g. through retrospective verbalisation, for them to be observable and rateable. These conclusions reflect literature suggesting that certain NTS are not observable or appropriate in all situations and often when they are demonstrated they may be done so subtly (6, 31). Nevertheless, as the IMCBRS was developed with the assistance of subject experts, the items included should be appropriate to rural/remote settings. It is suggested that the NTS observed less often should be addressed within educational interventions and assessed via self-report. However, it is possible that some of the NTS included within the IMCBRS may not be relevant/prioritised in certain contexts. Indeed, the raters experienced difficulty rating some scenarios and differentiating when a behavioural marker was 'not demonstrated' rather than 'not applicable', for instance, a candidate may not have demonstrated aspects of communication, however, this may be due to them being unable to discuss alternative options with those present, because their assistant's role was as a postman. In order to develop consistency, a number of recorded scenarios were double rated and inconsistencies discussed. Additionally, the second rater was used to 'sense check' when the primary rater struggled to allocate a rating.

In terms of situational awareness, noting hazards to oneself or the patient and verbalising the decision to approach the patient was only demonstrated in a minority of cases. However, this may be due to difficulties directly observing this, and the nature of the training scenarios. For instance, one scenario took place within the consultation room and thus use of these skills would be unnecessary as it would already be considered physically 'safe'. This could be easily addressed through amending the scenarios used.

Compared to similar systems (e.g. ANTS) the IMCBRS consisted of a demonstrated/not demonstrated option. The response options featured within systems are inconsistent (14). Given that the purpose of the IMCBRS was to inform training, the use of such response options may be appropriate. However, the observations of certain behaviours may have differed had a likert scale reflecting how well the demonstrated NTS matched the elements been included.

Self-rated NTS

The items within the IMCBRS were included within a self-report questionnaire administered pre- and post-course. An encouraging finding was that the NTS observed more often were those that candidates self-rated with a higher frequency, suggesting they had insight into the NTS they employed during simulated emergencies. There were some statistically significant changes in self-rated NTS post-course, although these changes were small and may not be clinically significant. This may be due to the prior high experience levels of attendees and the 'expert' nature of the BASICS courses thus the minimal observed changes may be due to a ceiling effect. Given that the observed courses did not specifically instruct candidates on NTS use, candidates may potentially have overestimated their ability to use NTS pre-course due to a lack of understanding of what each NTS entailed and thus, it could have been of interest to request candidates to list the NTS they thought were being employed, and compared this with observers' ratings. Furthermore, had the IMCBRS been used within novice groups the findings may have differed and the system may have had a greater impact (26).

4.1 Limitations

Potential limitations of this work include a lack of filmed scenarios featuring nervous or stressed candidates, many of whom may have opted out of filming. The authors used a member of the BASICS Scotland team as a gate-keeper and thus were not able to directly identify the reasons why some candidates chose not to be filmed. However, had they been more closely observed, this may have provided insight into the impact of negative emotions on the demonstration of NTS.

The ratings used to determine the IRR of the IMCBRS components were based on a pool of scenarios which were not linked to specific candidates, thus it was not possible to draw conclusions about the impact of the training on their use of NTS. Additionally, as candidates were from GP and practice nursing backgrounds, this could have identified gaps in training for these professions and informed training initiatives.

Self-rated NTS increased significantly post-course, however these increases may not be clinically significant. As this was a pilot addressing the development of the IMCBRS, we were initially interested in statistical significance. It is important that future work addressing the implementation of the scale should consider clinical significance.

The scenarios used to develop and test the IMCBRS were training scenarios. The comparability of these to real-life emergencies could be questioned. However, they are based on real events and represent those likely to happen within these settings. Additionally, prior to leading a moulage scenario, candidates are asked who would assist them should they be called out, ensuring the scenario is realistic. Despite this, the fidelity of the scenarios in relation to the IMCBRS could be questioned, to address this, it is suggested that scenarios included within the BASICS course should explicitly require candidates to use NTS.

Lastly, to increase the usability of the rating system, a maximum of 10 elements was included. Consequently, it is possible that aspects of NTS featured in similar systems, or in established NTS work may have been omitted (32). However, as the rating system was developed with the assistance of subject experts, the authors were confident the included items represented a core set of important behaviours needed during a pre-hospital emergency.

4.2 Recommendations for future work

Future work should address the further development and implementation of NTS-related training for healthcare professionals working in pre-hospital emergency care in rural/remote environments based on the IMCBRS. It is anticipated such training could improve use and awareness of NTS, which could complement existing technical skills and improve the safety and quality of care provided in these settings.

Training addressing the use of NTS within resuscitation may benefit from focusing on NTS demonstrated in a minority of cases, for instance, aspects of communication. Skills gaps such as those around communication and teamwork should be addressed due to their potential impact on the development of a shared understanding

and mental model of the situation (2) affecting the overall functioning of the team, patient safety and the occurrence of adverse events (20, 33).

It may be worthwhile to observe and evaluate the behaviour of individual practitioners pre- and post-training to identify whether this affected their use of NTS during scenarios. Unfortunately due to the design of this initiative this was not possible. Similarly, it may be useful to examine the influence of extraneous situational factors on the performance of NTS in more detail, for instance, whether the people at the scene or the demand of a situation inhibited the use of NTS, as reported elsewhere (34).

It is hoped that the IMCBRS will be tested, reviewed and refined for specific contexts. It may be beneficial to pilot the IMCBRS with less skilled groups as larger changes pre- and post-training may be noted and the training may have a greater impact on self-rated NTS.

Conclusion

An IMCBRS was developed based on a literature review and consultation with stakeholders. The findings from observation of 86 GPs and practice nurses attending pre-hospital care courses suggests its content may be observable and appropriate for use within these contexts and may help improve patient safety within rural/remote settings.

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Figure 1. Flow chart of development process

Stage 1 - Development

Rapid review resulting in identification of 53 research papers	Observation of BASICS Scotland IMC course	Meeting with BASICS Scotland Course Directors
↓	↓	↓
Development of checklist of potential NTS and behavioural markers	Use of checklist to identify NTS demonstrated within course	Understanding of the training process Project brief outlining proposed NTS intervention

Identification of list of NTS relevant to pre-hospital care and resuscitation

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Stage 2 - Development

Authors categorise NTS representing distinct NTS sets	Prototype list of behavioural markers reviewed by four experts, including ranking of 10 most relevant items	Discussion of prototype list of NTS with BASICS Scotland Course Directors
↓	↓	↓
Prototype list of NTS reflecting five different categories	Prototype list of 10 most relevant items reflecting five different NTS categories	Final changes made to list Approval for testing at courses

Selection of items included within the IMCBRS

Stage 3 - Development

Rating system record sheet developed

Stage 4 - Evaluation

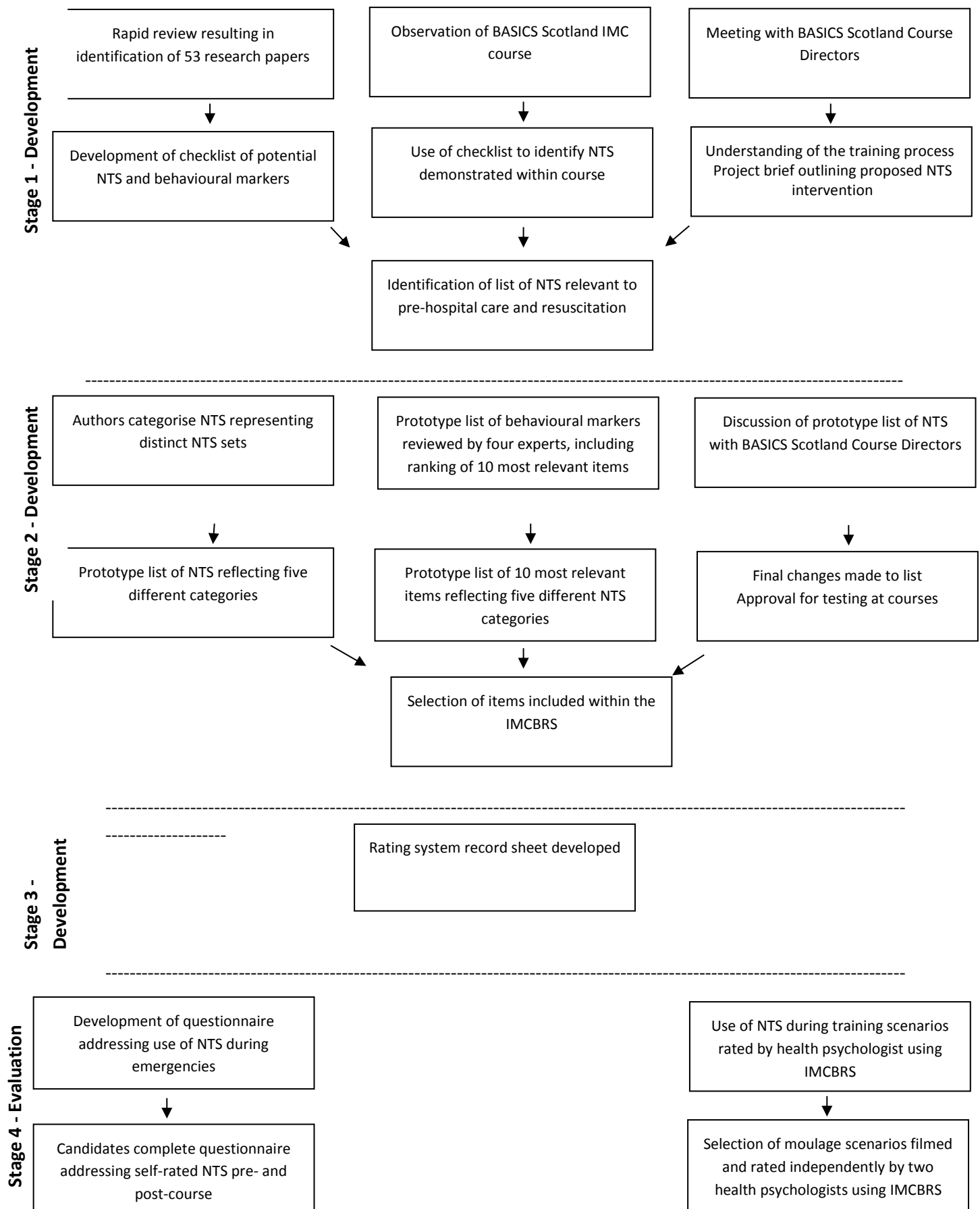| Development of questionnaire addressing use of NTS during emergencies		Use of NTS during training scenarios rated by health psychologist using IMCBRS
↓		↓
Candidates complete questionnaire addressing self-rated NTS pre- and post-course		Selection of moulage scenarios filmed and rated independently by two health psychologists using IMCBRS

Figure 2. Example of ranking task, reflecting situation awareness, carried out by experts

Situation awareness-skills for developing and maintaining an overall awareness of the scene, interpreting information and planning ahead to ensure preparation for any eventuality.

Element	Descriptors	Behavioural markers	Ranking
Avoiding fixation errors	Displays an overall awareness of the various tasks required in order to stabilise a patient/optimise the care provided-thinks laterally	Reviews decisions to ensure they are still appropriate requesting a second opinion from others, where possible	2
		Tries alternative options when a certain approach is not working	3
Projecting and anticipating future state	Shows evidence of having a contingency plan	Verbalises alternative options	
		Prepares alternative equipment so it is ready for use if/when required	
Monitoring progress of protocol with careful checking of time & constant reassessment	Repeatedly goes through algorithms and ensures they are aware of the patient's condition	Follows ABCDE algorithm	4
		Checks 4 H's and 4 T's	
Gathering information	Collects data about the situation by observing the whole environment and monitoring all available sources of information	Conducts a risk assessment of the scene and makes sure it is safe to approach the patient before proceeding	
		Regularly requests information from team members about patient's status	

Are there any behavioural markers that you feel may overlap with each other?
Makes clear requests of others and clearly instructs others at the scene on what to do

Were there any behavioural markers that you had difficulties differentiating between?
Makes clear requests of others….and asks others to undertake specific tasks….

Were there any behavioural markers that you feel should be grouped together?
Reviews decisions to ensure they are still appropriate….. and verbalises alternative options could be grouped together under one element

Table 1. Content of the IMCBRS

Category	Elements	Behavioural Marker
Gathering Information	Conducting a risk assessment of the scene and ensuring it is safe to approach the patient before proceeding	Observing the scene (stop and look, note time and other information) Noting (state) any environmental hazards to self Noting (state) any environmental hazards to the patient State decision to approach patient (or not) depending on assessment of the scene
	Reviewing decisions to ensure they are still appropriate requesting a second opinion from others, where possible	State what the decision is that has been made Ask others for a second opinion regarding the decision Discuss alternative suggestions Agree on the final decision State the final decision
	Trying alternative options when a certain approach is not working	Review time/gather information (e.g. change states) Assess progress against plan/goals Stop current intervention State alternative approach/intervention to be tried Begin using new approach/intervention
Decision-making and Leadership	Taking charge of the situation and making requests of others at necessary times	Assess priorities of the situation Assess potential capabilities/resources of others and decide on their roles Allocates tasks Monitors workload of others
	Asking others to undertake specific tasks at appropriate times providing clear direction	Assess the need for others to carry out tasks Ask for information about other's ability to perform task Confirms shared understanding Gives instruction of task to be performed
Communication and Teamwork	Clearly communicating information about the chosen course of action	Shares/gives information about chosen course of action Asks for information/feedback from others about chosen course of action Confirms shared understanding about course of action Adapts style to suit the situation Uses specific accurate language when giving information or instruction
	Not dismissing suggestions of others based on their status/experience	Ask for information/feedback from all members Responds to all members Objectively considers suggestions from all members

	Encouraging other team members to voice their opinions	Observes team members, especially those who are less vocal than others Ask for information/feedback from all team members Ask for information specifically from those who are less vocal
Personal resources	Acknowledging when a task (e.g. chest compressions) is too physically demanding and asking others for assistance	Assesses the task Assesses own capabilities to perform the task Asks others for assistance
	Asking others for help when I am overwhelmed by a task/tasks	Recognise (emotional) change states within self Shares information with other team members Asks for assistance from other team members

Table 2. Use of NTS during observed scenarios (n=127) and associated Cohen's Kappas

Item	Demonstrated*	Cohen's Kappa[1]
Gathering information		
Conduct a risk assessment of the scene and makes sure it is safe to approach the patient before proceeding	44 (41-64)	0.65 (0.52-0.78)
Review decisions to ensure they are still appropriate requesting a second opinion from others, where possible	28 (14-67)	0.91 (0.84-0.97)
Try alternative options when a certain approach is not working	47 (21-74)	0.59 (0.47-0.70)
Communication and Teamwork		
Clearly communicate information about the chosen course of action	43 (29-79)	0.42 (0.31-0.56)
Not dismiss suggestions of others based on their status/experience	43 (38-43)	0.34 (0.20-0.48)
Encourage other team members to voice their opinions	2 (2-8)	0.18 (0.04-0.32)
Decision-making and Leadership		
Take charge of the situation and make requests of others at necessary times	62 (46-95)	0.49 (0.35-0.64)
Ask others to undertake specific tasks at appropriate times providing clear direction	62 (20-94)	0.77 (0.67-0.88)
Personal resources		
Acknowledge when a task (e.g. chest compressions) is too physically demanding and ask others for assistance	2 (1-6)	-0.11 (-0.27-0.04)
Ask others for help when I am overwhelmed by a task/tasks	1 (1)	-0.20 (-0.27--0.13)

*Median% (range)

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[1] Agreement based on Cohen's Kappa can be interpreted as: ≤0.20=poor, 0.21-0.40=fair, 0.41-0.60=moderate, 0.61-0.80=good, 0.81-1.00=very good

Table 3. NTS Elements observed in more than 50% of scenarios

Category	Elements	Observations*
Gathering Information	Observing the scene (stop and look, note time and other information)	64 (81/127)
	Noting (state) any environmental hazards to self	53 (67/127)
	State what the decision is that has been made	67 (85/127)
	Review time/gather information (e.g. change states)	74 (94/127)
	Assess progress against plan/goals	76 (96/127)
Decision-making & leadership	Assess priorities of the situation	95 (121/127)
	Assess potential capabilities/resources of others and decide on their roles	62 (79/127)
	Allocates tasks	90 (114/127)
	Monitors workload of others	55 (70/127)
	Assess the need for others to carry out tasks	80 (101/127)
	Gives instruction of task to be performed	74 (94/127)
Communication & teamwork	Shares/gives information about chosen course of action	79 (100/127)
	Uses specific accurate language when giving information or instruction	63 (80/127)
	Responds to all members	62 (79/127)

*Percentage (frequency)

Table 4. Candidates' self-ratings of use of NTS elements during emergencies pre- and post-course (Median (SD))

Item	Pre-course	Post-course
Assess risk to self and others at scene and make sure it is safe to approach the patient before proceeding	4.00 (0.87)	4.29 (0.79)*
Take charge of the situation (where necessary)	3.00 (0.94)	3.89 (0.83)*
Try alternative options when a certain approach is not working	4.00 (0.71)	4.17 (0.74)*
Review treatment decisions you have made to ensure they are still appropriate requesting a second opinion from others, where possible	4.00 (0.76)	4.16 (0.79)
Accept suggestions of others regardless of their status/experience	4.00 (0.98)	3.89 (0.92)
Clearly communicate information about the chosen course of action	4.00 (0.81)	4.05 (0.75)*
Ask others to undertake specific tasks at appropriate times providing clear direction	4.00 (0.75)	4.04 (0.73)*
Ask others for help when I am becoming overwhelmed by a task/tasks	4.00 (0.83)	4.16 (0.79)
Acknowledge when a task is too physically demanding and ask others for assistance	4.00 (1.02)	4.05 (0.87)
Encourage other team members to voice their opinions	4.00 (0.90)	3.97 (0.87)

*p≤0.05