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## Research Brief

# The Development of a Skills Taxonomy for Nursing Crisis Management

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## KEYWORDS

skills taxonomy;  
nontechnical skills;  
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## Abstract

**Background:** Effective crisis management requires nurses to demonstrate proper nontechnical skills as first responders to intervene early in handling crisis situations. Currently, a behavioral marker system with structured taxonomy of nontechnical skills in crisis management is lacking in the nursing literature. This article outlines the development of a skills taxonomy, which will form the basis of the behavioral marker system that we aim to develop in our next phase of study.

**Methods:** We audio-recorded 50 registered nurses and enrolled nurses over five simulation debriefing sessions. We analyzed the data using a thematic analysis approach and developed a skills taxonomy. To ensure face validation, we invited four experts to review the skills taxonomy and to comment on each behavior's observability.

**Results:** We developed a skills taxonomy comprising six categories and 18 underlying observable behaviors (elements). The developed categories are task and resource management, situational awareness, teamwork, communication, control of emotions, and leadership.

**Conclusion:** We have developed a skills taxonomy fostering the use of a common terminology for nontechnical skills in nursing crisis-management teams. Further work to develop a rating system and to test its reliability will be conducted.

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Human factors and poor teamwork contribute to poor performance in high-risk industries (Flin, O'Connor & Crichton, 2008). This leads to the introduction of team-

oriented training, called crew resource management (CRM) in the aviation industry, for pilots in the late 1970s. The aim of the training is to promote safety through optimum use of equipment, procedures, and people (Lauber, 1984) with focus on nontechnical skills which complement technical or psychomotor proficiency (van Avermaete & Krujisen, 1998). Similarly, in health care, breakdowns in communication, poor

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teamwork, lack of leadership, poor decision-making, and failure in collaboration between individuals and teams have strong linkages to incidence of error and adverse events in hospitals (Greenberg et al., 2007; Kennedy, Regehr, Baker, & Lingard, 2009; Kohn, Corrigan, & Donaldson, 2000; Manser, 2009). In recent

### Key Point

- The skills taxonomy of nontechnical skills in the context of crisis management for nurses consists of six categories, namely task and resource management, situation awareness, teamwork, communication, control of emotions, and leadership.

years, there has been an upsurge in the application of CRM-type training within hospitals; such training provides a systematic teaching and learning approach for improving nontechnical skills.

Crisis situations are situations with life-threatening emergencies, for which urgent and coordinated actions between different professions are needed to ensure safe patient care.

Nurses, working as front-line health care professionals are required to respond early and in a timely manner in managing crisis situations in the clinical setting. Hence, it is critical for nurses to demonstrate not only clinical competence but also effective nontechnical skills. Nurses need to develop, learn, and improve their nontechnical skills to solve a myriad of problems and issues during their daily routine work to ensure safe and efficient task performance.

To facilitate trainings and assessments, nontechnical skills taxonomies have been developed in health care based on the CRM principles (e.g., situation awareness, teamwork). For example, the Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) system (King et al., 2008) aims to improve team training initiatives and outcomes. It comprises training programs and standardization and validation measures that allow health care providers to improve performance through training. In more specific health care contexts, assessment tools for nontechnical skills with tested reliability and validity in medical or in multidisciplinary team settings were developed: (1) Observational Teamwork Assessment for Surgery (Undre, Sevdalis, Healey, Darzi, & Vincent, 2007), Oxford Non-Technical Skills (Mishra, Catchpole, & McCulloch, 2009), Non-Technical Skills for Surgeons (Yule, Flin, Paterson-Brown, Maran & Rowley, 2006), and Scrub Practitioners' List of Intra-operative Non-Technical Skills (Mitchell et al., 2013) in the context of surgery; (2) Trauma Non-Technical Skills (Steiemann et al., 2012) for teams that attend trauma calls; (3) Anesthesiologists' Non-Technical Skills (Fletcher et al., 2004) for anesthetic personnel; (4) Ottawa Crisis Resource Management Global Rating Scale (Kim, Neilpovitz, Cardinal, Chiu, & Clinch, 2006) and Mayo High Performance Teamwork Scale (Malec et al., 2007) for teams in acute

settings; and (5) Observational Skill-based Clinical Assessment Tool for Resuscitation (Walker et al., 2011) for resuscitation teams. Some tools are developed in the form of behavioral marker, which comprise a skills taxonomy and a rating system. Behavioral marker system consists of a stipulated set of behaviors indicative of performance of an individual. It can be used as a standardized lexicon to structure assessments and feedback (Dietz et al., 2014) of different skill sets including communication, leadership, situation awareness, decision-making, teamwork, task management, problem solving, and resource utilization.

To date, tools to assess nurse anesthetists (Lyk-Jensen, Jepsen, Spanager, Dieckmann, & Østergaard, 2014) and scrub nurses (Mitchell et al., 2011) have been developed, but a tool to identify strengths and weaknesses among nurses within a crisis management context is lacking. To facilitate structured observation and systematic feedback on observable nontechnical skills among nurses, a tool to identify strengths and weaknesses of nurses' performances is required.

## Aim of the Study

We aim to develop a skills taxonomy in the context of nursing for crisis management by fostering common nontechnical skills terminologies in the nursing profession. This would form the basis of the behavioral marker system which we will be developing further in our next phase of study.

## Methods

### Data Collection

Fifty registered nurses (RNs) and enrolled nurses (ENs) with at least six months of work experience in a clinical environment were recruited over five "Crisis Management for Nurses" half-day simulation sessions between August and December 2016. Each simulation session was attended by 10 to 14 RNs and ENs. The half-day simulation sessions comprised an instructional simulation component that provided interactive and immersive simulated scenarios. The primary aim of the sessions was to assist RNs and ENs recognize their gaps in nontechnical skills through work coordination with team members; the secondary aim was to allow RNs and ENs to apply knowledge and skills in crisis management.

The simulation room was set up to mimic a clinical setting and with video- and audio-recording facilities. For each simulation, one EN and three RNs were randomly selected to form a team to role-play in a given scenario. A leader was nominated by the team members. The program facilitator clarified queries from the team members before

**Table 1** Skills Taxonomy in Crisis Management for Nurses

Category	Element	Examples of Good Behaviors	Examples of Poor Behaviors
Task and resource management: Skills for managing resources (e.g., people, equipment) and tasks by adhering to crisis management principles, protocols, and guidelines to accomplish team goals.	Applying knowledge and skills	Uses or applies learned crisis management nontechnical knowledge, nontechnical skills (e.g., leadership), crisis resource principles, protocols, and guidelines (e.g., using SBAR to communicate) to perform tasks appropriately.	Lack of crisis-management knowledge, skills, principles, protocols, and guidelines, which could risk patient safety.
	Managing available resources	Uses one or multiple resources (e.g., seek help from seniors or experienced personnel, activate alarm devices) to complete tasks at hand.	Not using resources appropriately (e.g., not seeking help from seniors or experienced personnel, phone, code blue button) which causes delays in task completion.
	Preventing and managing errors/lapses	Identifies potential risks and allocates attention to critical areas for error/lapse prevention (e.g., identifying presenting signs and symptoms of patients with deteriorating health condition that requires immediate attention and interventions).	Not performing appropriate measures to identify potential risk and/or avoid preventable errors/lapses.
	Setting priorities	Sets priority for task completion using a systematic approach.	Not comparing the alternative possibilities in making decision or solving problem.
Situation awareness: Skills for developing and maintaining overall awareness of the crisis situations based on observations of the dynamically changing environment/situation/circumstances; thinking ahead on potential outcomes and responding with appropriate course of action.	Gathering information	Collects information about the situation by observing surroundings and cues and verifying information to confirm their reliability.	Is inattentive with details of the surroundings when managing crisis situations/events. Fails to collect accurate information.
	Identifying risks	Performs risk assessment to determine appropriate follow-up actions.	Not performing appropriate measures to identify potential problems to determine appropriate follow-up actions.
	Knowing the physical environment	Aware of the physical environment (e.g., space constraints).	Unaware of constantly changing situations of the environment and surrounding (e.g., working with cables dangling around).
	Anticipating	Thinks ahead and prepares for upcoming tasks.	Fails to anticipate potential outcomes and consequences of actions.
	Being aware of individual and team member roles and responsibilities	Fulfills own job responsibility and recognizes dynamic inrole switching and able to assume new role immediately.	Fails to carry out own role and responsibilities or unaware of role switching among team members.
Being responsive to changing situations	Aware of problems. Responds early and intervenes in a timely manner in managing crisis situations according to the hospital standard of care and practices.	Fails to carry out appropriate course of action according to needs of patients or instructions of team members/leader.	

*(continued on next page)*

**Table 1** (continued)

Category	Element	Examples of Good Behaviors	Examples of Poor Behaviors
Teamwork: Skills for taking actions and initiatives in a group context; the focus is on the team rather than the task and individual.	Being present and involved	Takes initiative to help one another engaged in completing the tasks.	Is distracted and not focused on situations.
	Employing assertiveness	Is assertive in addressing potential errors/challenging situations for the safety of team members.	Fails to address potential errors/challenging situations for the safety of team members.
Communication: Skills for effective communication with team members; ensuring that information is received and delivered accurately.	Exchanging information	Provides and receives information on critical events (e.g., using SBAR) required for team coordination and task completion.	Fails to clearly communicate potential/identified problems to highlight the seriousness of the situation.
	Communicating loudly and clearly	Verifies orders in a loud and clear manner (e.g., task allocation) and has shared understanding with team members.	Communication is inaudible or incoherent.
	Clarifying roles with each other	Communicates to clarify assumptions of roles.	Assumes team members' roles without clarifying. Not aware on the roles and responsibilities of team members.
Control of emotions: Skills for controlling own emotions without affecting task performance; demonstrating confidence in task performance.	Being calm and focused	Coordinates and organizes patient care activities in a calm manner.	Appears stressed or panicky, which affects task performance.
	Demonstrating confidence	Has confidence in making decisions and performing tasks.	Is uncertain with decisions/steps required for task completion due to lack of confidence which might risk patient safety.
Leadership: Skills for leading teams and providing clear team goals; identifying strengths and weaknesses of team members and getting them to support each other.	Assuming a leadership role	Delegates tasks to team members with clear instructions and guidance during crisis situations.	Is disorganized when delegating tasks, and fails to identify issues and constraints that hinder team members from performing competently.

SBAR = situation, background, assessment, recommendation.

role play. During the role-play, the program facilitator voiced over as a medical doctor and the patient (manikin). Here is an example of the scenario:

Mr. Goh was admitted for chest pain from ED two days ago. He has been complaining about chest discomfort for the past 3 weeks. ECG showed atrial fibrillation in ED. His vital signs at 12pm were BP-121/72 mmHg, PR – 99 bpm, RR-15 bpm and SPO<sub>2</sub>-97%. At 1.30 pm, while you approached him to serve his medication, he was found unconscious.

The RNs and ENs responded to and managed patients' conditions (e.g., breathlessness, chest pain, low blood pressure reading, and so forth) according to the given scenarios that are found common in clinical situations for

patients with deteriorating health conditions. Each scenario took approximately 10 minutes. Nurses' performances were video-recorded for debriefing purposes. A debrief session lasting for 30 to 45 minutes was conducted in a group setting immediately after the role play. During debriefings, the program facilitator helped RNs and ENs reflect on their behaviors and actions during role play by replaying the video and asking open-ended reflective questions rather than directed questions about nontechnical skills. For example, "There was a delay in preparing for the intubation. I am curious what were you thinking? Could you share with us?" The facilitator would then probe the RNs or ENs to elaborate on their responses whenever they mentioned about aspects related to nontechnical skills. The debriefing sessions were audio-recorded for data analysis.

## Analysis

Data collected during debriefings were audio-recorded over five simulation sessions and transcribed. Data on nontechnical skills were analyzed using thematic analysis approach. Similar codes were grouped together to form observable behaviors called elements; similar elements were grouped together to form categories. A brief description for each category was developed. To contextualize the use of each behavioral element, good and bad practice exemplars for each element were provided. The exemplars were either identified during the simulations or debriefing or developed by the study team members after reaching consensus. In view of the need for easy usage of the behavioral marker system as a tool of assessment and feedback for nurses, original terms and words used by the participants were retained as much as possible by the study team in the analysis process. All elements and categories were discussed and reviewed iteratively between study team members to minimize overlap between categories and to ensure the taxonomy was relevant to crisis management in nursing. Data were analyzed using ATLAS.ti 8.0.

The developed skills taxonomy was assessed further for face validation by nursing experts to better align with the nurses' role, competence, and task in crisis management. Four nursing experts (e.g., nurse clinicians, nurse educators) were invited based on their expertise as a life support trainer and experience in managing clinical crisis situations. They were asked to review the categories, descriptions, elements, and examples of good and bad practices. Specifically, they were asked to review the skills taxonomy by answering these questions: (1) Are the categories well defined? (2) Does each category consist of the right set of elements? (3) Is the wording common among nurses/Is the language used easy to understand? and (4) Are the good and bad practices of behavior related to the elements? Modifications to wording or deletions were made by the nursing experts as deemed appropriate. At the end of the reviews, nursing experts explained the rationales for changes made. This process is important for the study team members to decide whether recommended changes should be considered if nursing experts have contradicting views. Finally, the experts were asked to decide on each element's observability.

## Results

Based on the qualitative data collected during debriefings, the first version of the newly developed skills taxonomy comprised seven categories and 21 underlying elements. Modifications were made to the first version of the skills taxonomy in accordance with suggestions made by nursing experts and opinions of the study team. "Decision-making" and its elements were removed due to its low observability. Half of the nursing experts viewed that decision-making skills can be determined more accurately through verbal questioning and

conversations rather than through observations. There were no other amendments made for the other six categories and their descriptions. All nursing experts deemed the categories to be appropriate and the descriptions as well defined and accurate.

When reviewing each category's element, half of the nursing experts commented that the element "anticipating and thinking ahead" should be removed from the category "situation awareness" due to its low observability in real settings. However, the study team reconsidered the suggestion and decided not to remove the element because this element reflects the importance of task planning. A simple task such as preparing emergency drugs for patients before doctors' arrival reflects the behavior of "anticipating". Hence, the element has to be retained. In the process of language review, wordings for four out of eighteen elements were modified to better reflect accuracy and easy reading. Examples such as "anticipating and thinking ahead" was modified to "anticipating" and "identifying options and barriers" to "identifying risks". Six out of eighteen good practices and eleven out of eighteen bad practices were revised. Table 1 shows the final version of skills taxonomy, consisting of six categories and 18 underlying elements with examples of good and poor behaviors.

## Conclusion

We have developed a skills taxonomy of nontechnical skills in the context of crisis management for nurses. The skills taxonomy contains contextual information for observable behaviors with examples of good and poor behaviors. In our next phase of study, we aim to develop a rating system and to test its reliability for practical use in assessment and feedback. We anticipate that this will lead to an overall improvement in nurses' performances at crisis events, which will ultimately translate into a subsequent reduction in the rate of errors and adverse events.

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