Structured team communication in a simulated operation: an ethnographic approach

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JW contributed to data collection. CS undertook data analysis, cross-checked by TJ and JW. TJ drafted the manuscript. All authors contributed to writing and revising manuscript and final approval.

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1. Abstract

Background
Effective communication between operating room staff is widely acknowledged as an essential element that contributes to patient outcomes. Various structured communicative practices have been proposed to optimise patient safety in operating rooms, but ethnographic research in this area is scant.

Methods
We introduced a structured communication tool to a clinical simulation training programme that Weller and colleagues (2014) proposed for optimising patient safety during an anaesthetic crisis. The tool comprises six elements: stop, notify, assess, plan, prioritise, and invite ideas (SNAPPI). We wanted to know whether people would use the tool and the qualitative effect this tool would have on their practices. We studied 120 operating theatre staff participating in the MORSim study (a multidisciplinary operating room simulation team training study). Participants were shown the SNAPPI tool and then encouraged to use it during a simulated surgical crisis. The simulation was observed by members of the research team and filmed. The film was later analysed using ethnographic methods of observation to create structured field notes, which formed the data. SNAPPI scores were assigned to each surgical team based on clear SNAPPI use. We applied an ethnographic approach to the data analysis for understanding how communication manifests in the operating room. In this paper we look at the bearing that structured communication had on team engagement.

Results
In the context of an anaesthetic crisis the effectiveness of communication can be critical to informing patient safety and wellbeing. Participants in the MORSim training utilised the SNAPPI tool as a strategy to optimise communication during the simulated anaesthetic crisis.

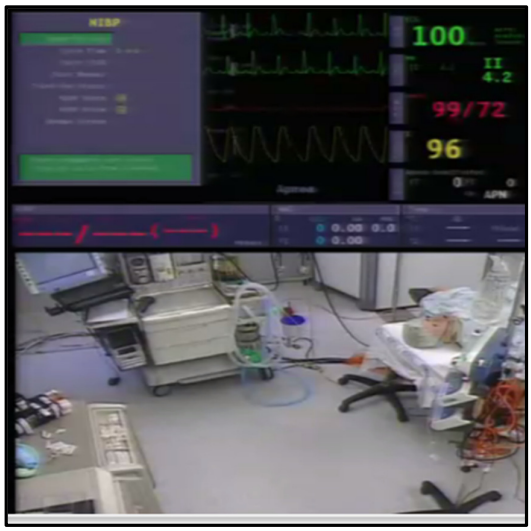
Conclusions and implications
Operating room staff can utilise structured communication tools during simulated anaesthetic crisis. Use of structured communication tools such as the SNAPPI appear to facilitate the sharing of mental models.

2. Background

Patient safety and quality of care in the healthcare environment is dependent on clear communication. Examples of communication strategies include structured call-outs, closed-loop communication, graded assertiveness, flying by voice, structured handovers, and repeat-back methods.(1-5) Brindley and Reynolds write, "Strong verbal communication skills are key whether for establishing a shared mental model, coordinating tasks, centralizing the flow of information, or stabilizing emotions. … A mental model means an understanding of the situation, task, and resources."(2) Weller and colleagues explain that the value of a shared mental model is that it "lead[s] to a common understanding of the situation, the plan for treatment, and the roles and tasks of the individuals in the team."(6) In the operating room (OR) the importance of effective communication and shared mental models cannot be over-stated. We need only to look at the impact of the WHO Surgical Safety Checklist on morbidity data to illustrate.(7, 8) But what does effective communication look like? What do people do? What do they say? How do inanimate objects inform communication? What structures are in place to assist effective communication? For those of us who may never see the inside of a surgical theatre, the idea of effective communication in this context may be hard to imagine. In this paper we draw on simulation operation data to apply an ethnographic approach for understanding how communication manifests in the OR. We look at the bearing that this communication has on team engagement.

2. The study

The data that inform this study were generated by documented film footage of Multidisciplinary Operating Room



Simulation (MORSim) courses that took place during 2013 at the University of Auckland Simulation Centre for Patient Safety.(9) The study was approved by the Central Regional Ethics Committee (Auckland), reference number CEN/12/03/002. Course participants were informed that the simulation would be filmed and audio-recorded for research purposes. All study participants provided informed consent prior to their engagement in the course, and none opted out.

Participants were invited to attend the day-long immersive simulation course and were informed that they would be participating in scenarios and would be under observation in situ during the simulation itself. The three scenarios were developed by the research team and each one involved a simulated anaesthetic crisis situation. Two of the scenarios (Brian Richards – a patient with a septic appendix who develops anaphylaxis, and Ian Peterson – an abdominal stab wound victim with a perforated inferior vena cava who develops an air embolus) were analysed for this study and information about the particular scenario was provided to each participant prior to the simulation.
OR teams consisted of six team members (the anaesthetist, anaesthetic technician,

surgeon, surgical trainee, circulating nurse, and surgical nurse), including one faculty member (the circulating nurse). A total of 120 participants took part in the MORSim course making up a total of 20 OR teams. Each team participating in the simulation event was filmed using four cameras and was audio recorded. The film footage was drawn from four stationary camera angles: the top of the bed, the bottom of the bed, the side of the bed, and on the anaesthetic monitor screen. One microphone was placed on the left side of the simulation room. We ran three simulations, of 45 minutes' duration for each team. Each film was analysed from the time point of the anaesthetic crisis beginning (crisis onset time) to the end of the simulation or the end of the crisis (whichever was the sooner).

MORSim participants engaged in a short training session prior to the surgical simulation, whereby they were introduced to a structured communication tool that they were encouraged to use during the simulation. The tool comprises six elements: stop, notify, assess, plan, prioritise, and invite ideas (SNAPPI). During the training session information probes (clinically relevant information about the patient) were also provided to participants, which Weller and colleagues describe elsewhere in terms of how participants shared probe information during the simulation.(10)

The research team made in-depth notes of that audio-visual data, attending to the presence of the six elements of SNAPPI. SNAPPI scores were assigned to each surgical team based on identified SNAPPI use. The availability of film that we could analyse after the OR event meant that we were not restricted to making observations of what team members said to one another during the simulation events, or after them (such as in post-simulation interviews). Rather, we could see how a range of experiences were translated into verbal form during the OR event, in and through the use of SNAPPI. The films permitted us to observe, "not just talk, but other bodily actions and behaviours"(11) that might have been difficult to capture in written observations.(12) Through film we were able to see the tacit, individual and non-verbal experiences of practitioners at work, and how they were made explicit in and through the SNAPPI strategy to inform decision making in the OR event.

In what follows, we discuss these observations using the thick description techniques of ethnography.(13-15) We present thick description of a single MORSim simulation scenario and discuss the ways in which this particular scenario evidences complexities in communication during anaesthetic crisis.

Two members of the research team observed and rated the video footage for SNAPPI behaviours. A third member of the team checked these ratings. The number of SNAPPI elements utilised in each scenario were recorded. A SNAPPI was deemed to be complete based on number of included elements (minimum elements=3). The mean of highest SNAPPI scores was calculated for each scenario. The highest mean score was seven (see table 1).

3.1 Findings

Many elements of SNAPPI were utilised during simulation scenarios. Table 1 outlines the top-scoring scenarios with examples of how specific elements were used (see table 1).

Table 1. Highest scoring SNAPPIs in MORSim scenarios

Scenario ID	Case	SNAPPI Elements utilised	SNAPPI score mean	Notes and examples of quality SNAPPI behaviour
130305	Appendix	A, N, Pr, Pl	5.5	A very brief discussion, primarily consisting of the anaesthetist notifying the surgeon of the problem and asking her to get to a point in the surgery when they can stop.
130408	Appendix	N, A, Pl, S, N, A, (I), N, Pl, I, Pr, A, I	6.0	A long, ongoing thought-stream. Many SNAPPI elements identified before and after the clear 'Stop'. invite="We just need to be conversant of other potential problems"
130604	Appendix	A, N, Pl, A, Pr	5.5	The anaesthetist debates what the problem is (with herself) and concludes that it is probably anaphylaxis. The other team members do not contribute much. Prioritise = Asking the anaesthetic technician for the adrenaline that he is drawing up "can I have that now please?"
130625	Appendix	I, S, N, N, Pl, N, Pr, A, Pr	5.5	A long, disjointed conversation between a few of the team members. The anaesthetist tests the air entry during the call-out. Ideas are suggested without an explicit invite from the anaesthetist. Filters off and then picks up again. Prioritise: "So there is no air entry, the next thing is to look at his asthma."
130701	Appendix	N, S, N, A, (Pl)	6	The anaesthetist tries to get the attention of the team by notifying them but a 'Stop' is required to really engage the surgical team. The anaesthetic and surgical teams seem quite separated (may be due to the surgical screen acting as a barrier). plan= The anaesthetist tells the surgeon to "carry on with what you're doing, (name)." Then there is a brief pause and the anaesthetist announces "OK, I think, let's call for help."
121015	Stab	Pl, N, Pl/Pr, A, Pl, S, N, A, Pl	5	Two call-outs with a pause in the middle. The first attempted call-out involves the anaesthetist asking for CPR and the follow-up call-out is the response to the treatment. There is a clear finish to this last call-out. Plan/prioritise= The circulating nurse asks "do you want me to get the defibrillator in?" The anaesthetist replies "press the bell and get the defibrillator in."
130208	Stab	Pr, N, S, N, I, Pl	6	This call-out is very near the end of the simulation. The anaesthetic technician suggests calling the anaesthetic coordinator but the anaesthetist doesn't really get a chance to make more of a plan. Plan= The anaesthetic technician suggests calling the anaesthetic coordinator and the anaesthetist agrees that it's a good idea.

130422	Stab	S, N, A, Pl, I	7	Efficient use of SNAPPI elements. Communication was concise and clear. Ideas invited.
130604	Stab	S, N, N, A, I, N, A, I, I, N, A	5.5	Starts off with a clear team engagement structure but turns into a discussion between the anaesthetist and surgeon as they try to figure out what is going on. The plan comes much later on. Invite= "Ok, anyone got any other ideas?"
130208	Appendix	S, I, N, A, Pl, I	6	A brief call-out to the team notifying them of the situation. The anaesthetist asks the surgeon for advice regarding the medications that could be given.
121015	Appendix	A, N, A, N, A, Pl, I, Pl, N	5	This is mainly a discussion between the anaesthetist and the surgeon. The other team members wait by the sides.

Statistical analyses of communication during MORSim and SNAPPI use during the simulation have been presented elsewhere.(9, 10) Team performance improvements following the MORSim intervention were observed and have been reported elsewhere using an extended Behavioural Marker Risk Index (BMRI) to measure teamwork and communication.(16)

3.2 Ethnographic description of a simulated scenario

Simulation training is underway in the OR. The simulation participants have been asked to focus on several elements of care, including communication. A 3G mannequin patient with a knife in his bare abdomen lies on the operating table. He has a mass of nylon brown hair hidden under a green cotton surgical hat. His eyes blink and from his open plastic mouth comes a moaning sound. The anaesthetic technician places his hand on the patient's shoulder and asks him, "How are you doing Ian? Are you alright?" A voice coming from the simulated patient replies, "Bloody hell."

"We are just working on some things now, so we can get that knife fixed up."

"Who the hell are you?"

"I've been looking after you for a while, I'm David. We brought you up for review, remember?" The patient groans again. "Get it out of me." A nurse holds the patient's arm and reassures him that they will remove the knife soon. Another nurse arrives. They discuss the forensic needs of the case. There are bustling noises in the room as more people enter. They introduce themselves to one another and update each other on the status of the patient. The handover doctor says, "He's disorientated. His GCS is only 13 out of 15. There's an A-line in situ, I believe." The anaesthetic technician points to the location of the A-line. The anaesthetist moves over to look

at the patient's arm and then addresses the anaesthetic technician and nurse; "Let's just check the equipment. So we've got a 14 gauge here [leaning and pointing toward IV cannula], a 16 gauge there [pointing]. And a 20 gauge arterial line there [pointing]."

The anaesthetic technician replies, "yes that's all hooked up and running. Bloods are over here [pointing]. I'll hand that over to the surgeon when I see him. You can hand that info over too when you see him.
"Sounds good."
People are attentive and efficient as they prepare the space and the patient. Although the pace of conversation is very quick, there are few moments when more than one person is talking at the same time. Machines beep in the background in a constant reassuring rhythm (beep – beep – beep). The surgeon enters and with the team complete they surround the patient. The 'time out' (a structured communication element in the WHO Surgical Safety Checklist) usually happens when the patient is anaesthetised, but in this emergency situation, with the risk of serious problems with induction, the team opt for a time-out prior to induction of anaesthesia. People are introduced by name. The surgeon asks if any team members have any concerns, none are stated. The patient is anaesthetised and the operation begins.

Multiple communication techniques are evident in this simulation. Direct communication with the patient allows assessment to be undertaken to establish that the patient is disorientated, and this is reported to other team members. Numerous checks are made between team members and with technology to establish that different sized IV cannulae are in, that extra blood is available, and that members of the team are informed and ready. People make hand and eye gestures to clarify their communication, such as pointing. Even the regular beeping of the machine informs people in the room about the patient's status. The team members are highly attuned to these modes of communication because they know that clarity of communication and closed-loop communication in the OR – and especially during a crisis – is paramount to informing patient safety.

Four minutes pass. The knife has been removed. Something is wrong. The anaesthetic machine makes high-pitched long beeps.

Surgeon [to anaesthetist]: "Just keep talking to me, Jill." Anaesthetist [looking

at monitor]: "Um, systolic is fifty, which is where it has been for the last, sort of, twenty seconds. I'm sort of rapidly losing him."
Surgeon [raised voice]: "Okay, um."
Anaesthetist: "Okay, so have we got time to have a quick stop and listen?"
Surgeon : "Yes."
Anaesthetist: "You think you've got control but I've got falling Sats, falling

blood pressure. So let's consider possible alternatives."
Surgeon: "Okay."
Anaesthetist: "This could be a tamponade, it could be another injury, he could be having some on-table ischemia. Things to do; can we send for an echo tech? We need to do an echo to look for evidence of tamponade. Can you pack and just have a quick look around there?" [turning to faculty nurse] "Vivian can I get you in touch with blood bank? I want another four units of blood urgently."
Nurse: "Another four units, yes, lovely." [walks quickly to phone].
Surgeon: [turning toward anaesthetist] "Look Jill, I can honestly put my hand on my heart and say I can't see a problem here."
Anaesthetist: "Okay well, I can't help but feel that we are missing something."
Surgeon [in an urgent tone]: "Okay, hold up, hold up, hold up!" [team silence whilst the surgical team search the abdomen]. "I'm just having a look, just to make sure there is not a huge bleed. There's a bit of ooze here. Clamp please." [clamp inserted].
Anaesthetist: "Yeah, my blood pressure is sort of turning around a little bit."
Surgeon: "Yeah."
Anaesthetist [joking tone]: "The patient's and mine."

Teaching faculty enter the room and bring the simulation to a close. Members of the team sigh with relief.

4. Effective communication versus silences

The surgical team effectively communicated throughout the crisis to inform a positive outcome for the patient. In addition to the WHO Surgical Safety Checklist(7), they utilised the SNAPPI tool (see table 2).

Table 2. Example of SNAPPI(6) use in simulated OR

Stop - *Have we got time to have a quick stop and listen?*
Notify - *I've got falling sats, falling blood pressure*
Assess - *This could be a tamponade, it could be another injury, he could be having some on-table ischemia*
Plan - *Things to do; can we send for an echo tech? We need to do an echo to look for evidence of tamponade*
Prioritise - *I want another four units of blood urgently*
Invite ideas - *I can't help but feel that we are missing something*

SNAPPI places emphasis on the clarity of verbal communication, and can also be effective in translating the non-verbal elements of team communication into verbal form, thus bringing people's ideas and otherwise tacit forms of communication to the fore, where they might be brought to bear on patient safety. The surgeon thought he had control of the situation until the anaesthetist communicated her own feeling of stress about it. These quite different individual experiences of interpretations of the patient's situation were brought into concert when a 'Stop' was called, and brought those different feelings into clear verbal form, where they were used to resolve an unfurling crisis.

From our observations of the video footage from 20 simulations, team members were more attentive to the crisis situation when the anaesthetist explicitly asked team members to stop (for example,

saying "can everyone stop what you are doing for a moment"). If the anaesthetist (or other team member) did not ask the team to stop then team members tended to continue focusing on their own individual jobs and did not demonstrate that they were attentive to what the anaesthetist was saying. This lack of attention towards the anaesthetist resulted in fewer backup behaviours and input from the other OR team members.(6) We also observed that SNAPPI elements were performed regularly during anaesthetic crisis in the simulated operations. The elements that were most frequently performed were (Notify, Assessment, and Plan) and the elements that were least frequently performed were (Stop and Invite). This is not surprising, since we would expect multiple 'Notifications' to be made between team members during any operation, whereas we would not expect multiple 'Stops' to be made. While 'Invite ideas' was performed less frequently than we expected, it is possible that team members were familiar with each other, which may have reduced their perception that they needed to explicitly invite ideas (as they may have believed that if team members had ideas that they would have felt comfortable to raise them without being especially invited to do so). However, since the WHO Surgical Safety Checklist research shows that inviting all team members to raise their concerns is an important tool towards levelling hierarchies,(8) and thereby increasing patient safety, we suggest that the 'Invite ideas' element of the SNAPPI may also serve such functions, and is therefore an important element that should continue to be emphasised in training of use of the SNAPPI during crisis.(17)

Weldon and colleagues note that there is a heavy emphasis on analysis of the verbal elements of OR team communication and that when analytic attention is paid exclusively to what is said in the OR, analysts might miss that which remains unarticulated.(11) They note that analysts are at particular risk of missing how "[p]ower relationships affect communication in the operating theatre; power relationships can prevent junior staff from speaking up, in turn relating to unsafe practice."(11) Brindley and Reynolds describe the impact of unarticulated thoughts in terms of 'mitigating speech' whereby the language used "de-emphasizes" or "sugarcoats" the situation, often as a means of being polite or 'saving face.'(2)

SNAPPI contracts the space in which silences might otherwise occur and it serves to flatten the impact of existing power hierarchies in the OR on patient safety. This occurs when, for example, an explicit invitation is made to everyone in the team to submit ideas or contribute to the plan. Issuing an explicit invitation to the whole team can create an environment in which team members not only feel that they can speak up, but that it is their duty and opportunity to do so. This sense of duty might also ensure that it is not necessary for team members to know one another well in order to feel sufficiently comfortable to submit their ideas, since the formalisation of the step 'Invite' means that all team members should offer their suggestions when called upon to do so. Somewhat ironically, this sense of responsibility might be enhanced if it is the surgeon or anaesthetist occupying a position of power who makes that invitation. It is in and through this calling out to the *whole* team that the SNAPPI strategy reduces the opportunity for powerful silences to block communication between team members, whatever their position in the OR team.

Weldon and colleagues note the importance of "[s]eemingly mundane actions such as eye gaze, anticipatory movements and gestures can often be

overlooked."(11) Zheng and colleagues suggest that such mundane actions are effective communicators and they can give better insight into how clinicians actually organize and accomplish collaborative work in the operating theatre.(18) We suggest that such gestures and movements should be supported by verbal structured communication strategies such as the WHO Surgical Safety Checklist and SNAPPI to increase patient safety.

In addition to the gestural and verbal communication, surgical team members draw their individual interpretations of a crisis direct from their engagements with the patient's body to articulate those in concert with the data from machines such as the anaesthetic machine and the resuscitation trolley. In the simulation described above during the 'Stop' phase the anaesthetist made the meaning of the beeping machine clearer to the whole team by explaining that the machine was displaying dropping saturation and blood pressure. Similarly, the surgeon was able to make available information drawn from his own personal engagement with the patient's body. The pooling of information allowed for incongruent information, drawn from different sources, to become available and articulated to all members of the team.

5. Conclusion

Patient safety and quality of care in the healthcare environment is dependent on effective communication. In the OR thousands of pieces of information are communicated between the surgical team, the patient, and technology. Some communication occurs in a semi-structured way, through a gesture, for example. But increasingly we are realising the potential of structured communication for providing a bridge between the individual's experience and a shared mental model. Observational research of communication that occurs in the OR (in this case during an anaesthetic crisis) is important to informing future training of OR staff.

6. Acknowledgements

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8. Author contributions

TJ wrote the first draft of the manuscript. CS, SD & JW revised the manuscript critically and gave final approval of the version submitted. TJ and CS attended to reviewer comments for the final version of the manuscript.

9. Competing interests

None

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