



DECISION MAKING, TEAM MONITORING AND ORGANISATIONAL PERFORMANCE

Part three: team performance monitoring research
stream

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Cover: MFB, CFA and Victoria Police personnel discussing their incident management plan.

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TEAM PERFORMANCE MONITORING RESEARCH STREAM

This document forms Part three in a series of reports on decision making, team monitoring and organisational performance. It should be read in conjunction with:

- Decision making, team monitoring and organisational performance part one: executive summary
- Decision making, team monitoring and organisational performance part two: decision making research stream
- Decision making, team monitoring and organisational performance part four: organisational performance research stream.

All parts can be located at www.bnhcrc.com.au, under the **Practical decision tools for improved decision-making in complex, time constrained and multi-team environments** project page.

The team performance monitoring research stream seeks to develop enhanced methods for strategic level emergency managers (SEMs) to manage teams they are responsible for. To provide the background and context for this set of activities this report seeks to provide answers to the following questions

- What are the common approaches to team performance monitoring used in other high reliability industries?
- How do SEMs currently carry out team performance monitoring?
 - What formal methods are used to monitor team performance?
 - What informal methods are used to monitor team performance?
- What are the challenges and opportunities for team performance monitoring in emergency management?



TEAM PERFORMANCE MONITORING IN EMERGENCY MANAGEMENT

In Australia, large-scale emergencies are managed by a complex network of teams that pass information within and between the different teams. Initially, an emergency is managed at the incident level by an incident controller who manages a team of people who are dealing with the emergency. If the emergency grows in size then aspects of the incident controllers role (e.g. logistics, planning, operations) may be delegated to other people (AFAC, 2013). A large-scale emergency may be divided into sectors with a person in charge of managing the emergency in each of the sectors under the incident controller. If the emergency becomes complex, politically sensitive or there are multiple emergency sites then assistance is provided from the regional and then the state level. Typically the roles of the state and regional levels are to provide coordination between IMTs, manage regional and state level resources and ensure that the emergency is being managed effectively. The majority of research into emergency management has looked at the incident level (IMT) with relatively little research conducted into regional and state levels (Bremner et al., 2014; Owen, et al., 2013).

While there is often some ambiguity about the role of the regional and state coordinators (Owen et al., 2013), one of the important functions they carry out is to monitor the performance of teams in the organisational structure to ensure that they are functioning effectively (c.f. AFAC, 2013; South Australian Country Fire Service, 2011). For example, one of the tasks of a regional coordinator in one of our partner agencies is to: ensure that responses to fires and other emergencies are safe, effective and efficient. If a team is not functioning effectively they may not possess a shared understanding of the situation, which can cause them to create and implement inconsistent plans (Bearman et al., 2015). Moreover, an ineffective team may not adequately communicate information to others, leading to frustration, confusion and potentially widespread disruption to the operational response. Strategic level emergency managers (SEMs) therefore need to be sensitive to the operation of teams both at their own level and those below them in the organisational structure.

While monitoring the performance of teams is an important part of strategic level emergency management there is little or no published information on how regional and state level personnel do this. To provide some context and a common frame of reference for the research on team performance monitoring, we first consider the basic research on how teams function, team leadership and disruptions to team performance.

TEAMS, TEAM LEADERS AND DISRUPTIONS TO TEAM PERFORMANCE

TEAMS

A large-scale emergency response consists of a hierarchy of multiple teams working together to meet a common objective. These teams consist of a group of individuals who have a complex and dynamic interrelated set of attitudes, cognitions, and behaviours that change as the team members interact with the external environment and engage in coordinated tasks to achieve outcomes (Kozlowski and Ilgen, 2006; Wilson et al., 2007).

As team members engage in tasks they share information to develop a shared (but not necessarily fully overlapping) understanding of the situation, develop plans, execute plans, and learn about both the task and the team (Burke et al., 2007; Kozlowski & Klein, 2000). This is a cyclical process with many sub-routes back to previous phases (Bearman et al, 2015). Figure 1 presents a model of teamwork showing these cyclical processes. Individual and job design characteristics feed into the adaptive cycle. As the team goes through the adaptive cycle of activity of situation assessment; plan formulation and revision; plan execution; and team learning several emergent properties are produced. The team develops situation awareness for the immediate situation that the team faces and longer duration mental models about the task and team processes (Burke et al., 2007). The cycle of activity also determines the level of trust, collective efficacy and motivation that team members have (not shown in Figure 1) (Burke et al., 2007; Paskevich, et al., 1999; Rosen et al., 2007)

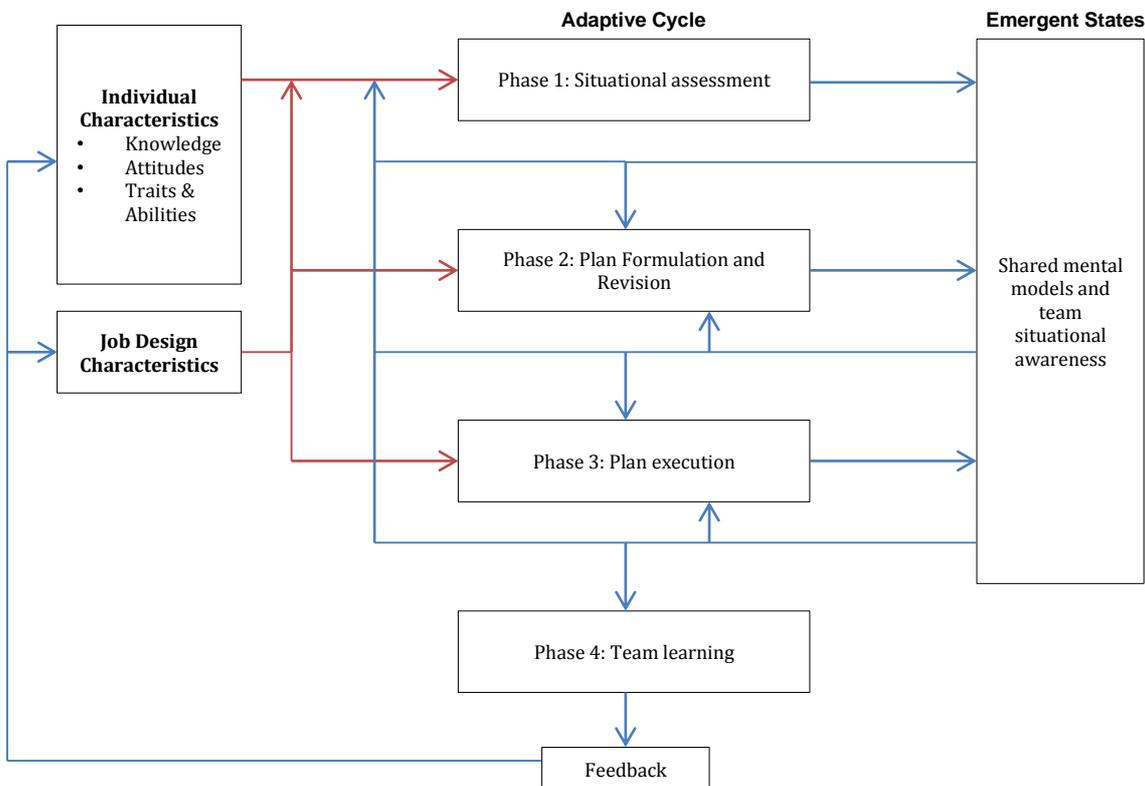


Figure 1. Model of Teamwork (adapted by Bearman et al., 2015 from Burke et al., 2007)



There has been a good deal of research that has investigated the components of effective teamwork and a number of reviews have been produced that have attempted to synthesise this literature (e.g. Marks, Mathieu and Zaccaro, 2001; Rousseau, Aube & Savoie, 2006; Salas, Sims & Burke, 2005) each of which takes a slightly different approach. In emergency management, AIMS (AFAC, 2013) considers the components of effective teamwork to be: Sharing a clear purpose; participation in decision making; listening effectively, comfort with civilized disagreement; decisions by consensus (where possible); open communication; clear roles and assignments; sharing the leadership; building external relationships; seeking diversity in style and skills; and undertaking regular self-assessment. Based on the work of Salas et al., and Marks et al., one could also add mutual performance monitoring, backup behaviours, motivation, confidence building and affect management. How well a team performs then depends on a number of factors related to: team norms, leadership, context, and the characteristics of individual team members (Hayes, 2014). As these factors change as part of the normal fluctuations of ongoing team performance in complex environments there may be times when a team is more susceptible to dysfunction (Allen et al., 2008; Hayes, 2014).

One aspect of teams that has been related to success is familiarity, with preformed teams typically performing better than ad-hoc teams (Hayes, 2014). Familiar teams have been found to possess enhanced communication, coordination, leadership interactions and trust (Hayes, 2014). However, as Hayes points out "team member familiarity in no way guarantees good performance." (Hayes, 2014, p?).

LEADERSHIP

Emergency management is characterised by a hierarchical structure, with each team typically having a leader who is assigned to guide that team's behaviour. The team leader is the person who directs and guides the activities of the team, sets the context for team interactions and is the person who the team look to for their cues about how to act (Carson, Tesluk & Marrone, 2007; Crichton, Lauche & Flin, 2005; Edmondson, 2005; Owen, 2014). The effectiveness of the team is therefore critically dependent on the abilities of the leader.

Much of the literature on leadership focuses on the attributes of an effective leader in relation to how they motivate teams. For example, two different leadership styles have been identified: Transformational leadership and transactional leadership (Bass, 1985; Burns, 1978). Transformational leadership is where leaders motivate their followers by providing a purpose that goes beyond the short-term goals of the individual or team (Judge and Piccolo, 2004).

Transformational leadership is characterized by charisma, inspirational motivation, intellectual stimulation and individualized consideration (Judge and Piccolo, 2004). Transactional leadership is where leaders motivate their followers through reward and punishment and is characterized by contingent reward, actively monitoring for exceptions and managing exceptions when they occur (Judge and Piccolo, 2004). The two leadership styles are not mutually exclusive, and in fact seem to be highly related with effective leaders appearing to use both styles of leadership (Bass, 1999; Judge & Piccolo, 2004).



Another body of work in relation to leadership has examined the way that leaders influence the communication and interactions within the team (cf. Nembhard & Edmondson, 2006; Owen, 2014). Leaders who are supportive and inclusive in their communication and have a non-defensive attitude towards questions and challenges tend to provide an environment where team members are more likely to be open about problems and errors (Edmondson, 2005). There is some evidence that this type of interaction with the team can overcome the inhibiting effects of status differences (Nembhard and Edmondson, 2006), which is important in organisations with a hierarchical structure (such as those in emergency management).

For emergency management and other hierarchical operations there is an additional level of the team structure to consider and that is the role of the person who has supervisory responsibility over that team. In emergency management, strategic level managers (SEMs) at the regional and state level play this role. This person is often not a formal part of the team itself and may not be co-located with the team but has a responsibility to ensure that the team is functioning as effectively as possible.

DISRUPTIONS TO TEAM FUNCTIONING

Emergency management often presents situations that are complex, highly dynamic and require the coordination of multiple teams. The response to an emergency therefore will often be challenging for the personnel involved, particularly in the early stages. In this environment it is likely that there will be some disruptions to team functioning (Bearman et al., 2015). Some of these disruptions will be fairly minor and can be dealt with quickly and effectively by the team. Others disruptions however may not be identified by the team or may be more difficult to resolve. These disruptions can seriously affect the performance of the team, leading to significant breakdowns in team coordination and an impaired operational response (Bearman et al., 2015). In the context of challenging, complex and dynamic situations it is important for SEMs to provide effective oversight of the way that teams are operating to ensure that disruptions to team functioning are not impairing operational performance (Bearman et al., 2015).

One way to conceptualize the way that teams deal with disruptions to performance is through the idea of safe spaces of operation. Rasmussen (1997) has argued that organisations try to maintain a notional space of safe operations. This space describes the usual operations of an organisation and within this space the organisation can recover from disruptions to their operations. From time to time large disruptions occur and if these are not managed effectively the organisation moves outside of the space of safe operations and into an area that Brooks (2014) has described as the Zone of Coping Ugly. In this zone the organisation is able to continue operations safely but people are placed under considerable pressure. They are coping but only just. As further disruptions occur, the operation moves outside of the zone of coping ugly and into a zone where incidents and accidents are more likely to occur. Figure 2 shows the different zones within a notional safety space.

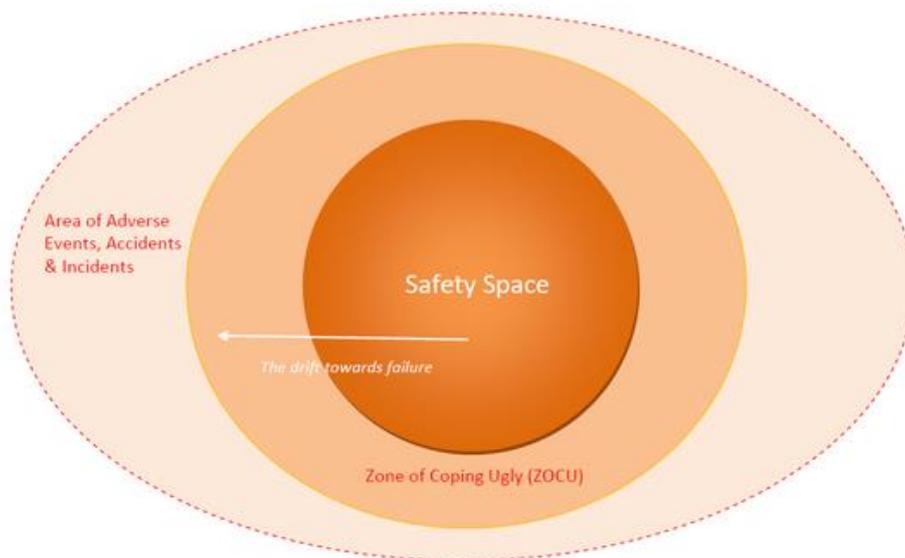


Figure 2. The Notional Space of Safe and Unsafe Operations (from Brooks, 2014)

In emergency management an agency responding to an emergency can be conceptualized as operating within these spaces. Moreover, given the complexity of an emergency management agency response, it may well be that different parts of the agency are operating in different parts of the safety space. For example, a large-scale incident where there are multiple incident management teams (IMTs) operating, two IMTs may be operating in the safe zone, one IMT may be operating in the zone of coping ugly and one IMT may be operating in the zone of accidents and incidents. The dynamism and complexity of emergency management, particularly in the early stages of a response may also mean that teams spend time outside the safe zone, in the zone of coping ugly and in the zone of accidents and incidents.

From a safety management perspective then it is important for SEMs to be able to identify where teams are in the safety space and either move them back into safer spaces of operation or provide them with 'Coping Ugly' strategies (Brooks, 2014) that allow them to function safely outside of the zone of safe operations.

LITERATURE REVIEW OF THE APPROACHES TO TEAM PERFORMANCE MONITORING

There are a number of ways that strategic level managers (SEMs) can potentially approach the task of examining the performance of teams they are responsible for supervising. Based on our review of the literature a number of different categories of performance monitoring approaches can be identified. These categories are based on: Monitoring Team Outputs, Mapping Team Information Flow, Examining Team-Based Behavioural Markers, Inspecting Linguistic Correlates and Assessing Individual Team Members. Table 1 presents these different approaches.

**Table 1. Different Approaches to Monitoring Team Performance**

| |
|--|
| Monitoring Team Outputs |
| Mapping Team Information Flow |
| Examining Team-Based Behavioural Markers |
| Inspecting Linguistic Correlates |
| Assessing Individual Team Members |

This review will deal with these categories at a relatively high level of detail to provide the essence of each approach and discuss some of the issues that may be involved in applying these approaches to emergency management. This review describes the broad approaches to team performance monitoring. For the sake of clarity and brevity, we do not consider here all of the different measurement techniques (e.g. observer ratings, conversation analysis, questionnaires, etc.) that have been used to implement these approaches. For a review of some of these measurement techniques see Shanahan et al. (2007).

MONITORING TEAM OUTPUTS

One of the ways to evaluate the performance of a team is to examine the quality and timeliness of the outputs that the team produces. In the context of emergency management operations, for example, this may be the production of timely and well-constructed Incident Action Plans.

While the use of outputs to measure team performance may seem attractive and can alert people to the fact that there is a problem in the functioning of a team, they do so only at a fairly general level since there is no consideration of the processes that contributed to those outputs (Salas et al., 2007; Shanahan et al., 2007). One of the problems with this approach is that an ineffective team may nonetheless produce some outputs that are effective since there is not a necessary relationship between impaired team functioning and degraded performance on all of that team's outputs. This means that quality of output is not necessarily a veridical indicator of how that team is performing and will perform in the future.

MAPPING TEAM INFORMATION FLOW

A more sophisticated version of monitoring team outputs that can consider team processes is mapping information flow within and outside the team. To be able to effectively coordinate their activities in the cycle of team activity, team members need to communicate with each other. The quantity, directionality, timing, and type of communications that occur within and between teams and between the leader and the team can be captured and used to understand the functioning of that team (Entin and Entin, 2001).

In their research studies on military command and control, Entin and colleagues (c.f. Entin and Entin, 2001) have examined the patterns of information sent and received by each team member. In these studies, researchers captured information on total number of communications, communication types (e.g. number of information requests, number of transmissions of information, number



of statements of actions to be taken), and communication ratios (e.g. anticipation of information, anticipation of actions) (Entin & Entin, 2001). See Table 2 for more information. Entin and Entin (2001) report that these measures have proved to be useful for analysing the effectiveness of alternative team structures and the way that team members push or pull information.

Table 2. Measures of Verbal Communication (adapted from Entin and Entin, 2001)

| |
|--|
| Description |
| Overall Rate |
| Total Number of Communications |
| Communication Types (per minute) |
| Number of information requests |
| Number of transmissions of information |
| Number of requests for action |
| Number of statements of actions (to be) taken |
| Number of requests to coordinate an action |
| Number of agreements to coordinate an action |
| Number of non-substantive acknowledgements of receipt of communication (e.g. ok) |
| Communication Ratios |
| Overall anticipation (all communication transfers divided by all communication requests) |
| Information anticipation (information transfers divided by information requests) |
| Action anticipation (action transfers divided by action requests) |

Similarly, Fischer et al. (2007) examined the different patterns of interaction between team members in a simulated search and rescue operation. Fischer et al. mapped the number of messages sent and received by different team members, concluding that high performing teams had more equal patterns of interaction with all team members than low performing teams. Low performing teams were characterised by unequal patterns of interaction, where team members interacted with some of the other team members but not others.

While team information flow can provide useful information this approach possesses a number of potential problems. First, it relies on having a base measure of effective team functioning to compare the data to. In a dynamic environment such as emergency management, these base measures may be difficult to derive and may not be valid at different times in an emergency response. The second issue is that by mapping information flow you can potentially detect a problem, but these measures don't necessarily determine why the problem is occurring or how it can be fixed.

A slightly different method of using information flow to evaluate team performance is to consider the information that is coming to the SEM as part of the operational response. SEMs are involved in the information flow of the team as the team reports up their activities. The SEM can therefore easily monitor the information flow of the team. Missing or inaccurate reports for example may signal that the team is not functioning effectively.



While this seems fairly simple this approach has similar problems to monitoring team outputs. This may detect problems at a fairly gross level, but it will not necessarily detect all teams that are not functioning effectively. Teams could quite conceivably have impaired functioning but this would not necessarily show up in the quality and timeliness of their information flow.

EXAMINING TEAM-BASED BEHAVIOURAL MARKERS

A more detailed approach to examining the performance of teams is to use the literature on team processes to identify behavioural markers that indicate effective performance by the team and its leader. For example, teams that are communicating effectively would be expected to use standardized terminology and standardized patterns of communication (Salas et al., 2007). Teams can therefore be examined on the extent to which they are using standardized terminology and patterns of communication. This approach provides a very detailed way of examining the performance of the team and its leader on markers of effective teamwork.

There is a profusion of different dimensions of teamwork that have been proposed in the literature that could be measured (Marks et al., 2001; Militello et al., 1999; from Shanahan et al., 2007). It is not surprising then that there are a number of slightly different approaches to using team process based behavioural markers. A few examples of this approach include Salas et al., (2007) who have identified behavioural makers that are based on the behaviours that support shared mental models and shared situation awareness. Rosen et al. (2011) have identified behavioural makers based on the model of team adaption (proposed by Burke et al., 2007; see Figure 1) and Wilson et al. (2007) have identified behavioural markers based on the processes of communication, coordination and cooperation. As an example of this approach Wilson et al.'s research is described below.

Wilson et al., (2007) have proposed a number of behavioural markers of team disruption in the context of fratricide incidents on the battlefield. These behavioural markers are based on effective communication, coordination of the teams actions and cooperation between team members. Wilson et al. identify three aspects of communication that can lead to breakdowns: inappropriate information exchange, ambiguous phraseology and not verifying information is correctly received. Table 3 presents the team-based behavioural markers for communication.

Table 3 Team-Based Behavioural Markers of Communication (taken from Wilson et al., 2007)

| |
|--|
| Information Exchange |
| Did team members seek information from all available resources? |
| Did team members pass information within a timely manner before being asked? |
| Did team members provide "big picture" situation updates? |
| Phraseology |
| Did team members use proper terminology and communication procedures? |
| Did team members communicate correctly? |



| |
|--|
| Did team members pass on complete information? |
| Did team members communicate audibly and without garble? |
| Closed-loop communications |
| Did team members acknowledge requests from others? |
| Did team members acknowledge the receipt of information? |
| Did team members verify that information sent was interpreted as intended? |

To act effectively members of a team must coordinate their actions. They must sequence, synchronize and integrate their contributions to the task (Wilson et al., 2007). Wilson et al identify four aspects of coordination that can lead to breakdowns: non-overlapping knowledge about the team or task, inadequate mutual performance monitoring, not backing-up other team members, and not being adaptable.

When team members lack the desire or motivation to coordinate then cooperation breakdowns can occur. Wilson et al. identify four aspects that can lead to cooperation breakdowns: not having a team orientation, not having belief in the team's ability to be effective, mistrust amongst team members, and being non-cohesive or not sticking together in the pursuit of team and individual goals.

Within each category Wilson et al identify different behaviours that indicate that a problem of that type is being experienced. The behavioural markers provide a set of detailed indicators of how that team is performing that potentially can be examined by people who are responsible for that team. However, there is a need to translate this into an emergency management context and into a set of things that a regional coordinator can actually look for in state, regional and incident management teams. The time taken to examine each of the behavioural markers and the restricted level of information about the team available to coordinators who are not part of but have oversight of that team present challenges to this approach.

A similar approach to examining breakdowns in team coordination has been proposed by Bearman et al. (2015). In contrast to behavioural markers that examine aspects of successful team functioning, Bearman and colleagues approach is to look for evidence of disconnects that underlie the breakdowns. For example, Bearman et al. (2015) have identified a number of distinct types of disconnects between teams that contribute to breakdowns in coordination in emergency management. These are based on team members not having shared information, different interpretations of the same information and different plans about aspects of the response. Table 4 outlines the different types of disconnects and their definitions. These disconnects therefore provide a set of things that SEMs should be alert to in the functioning of teams since they indicate a breakdown in that team's coordination. Bearman et al. (2015) argue that if left unresolved these breakdowns can carry through the cycle of team activity creating further disconnects. While this is a useful approach to considering teams, this work is at a relatively recent stage of development and the indicators of breakdowns have not yet been specified in detail.

**Table 4. Different types of disconnects and their definitions.**

| Disconnect | Definition |
|-------------------|---|
| Informational | Differences between parties in the information they possess |
| Evaluative | Differences between parties in their interpretation or evaluation of the same information |
| Operational | Differences in operational plans between two parties. |
| Operational | Differences in the actions of one party and the expectations of another |

INSPECTING LINGUISTIC CORRELATES

Another approach to examining team performance is to examine linguistic correlates of team performance in the team's communication. As the members of the team perform their tasks they will communicate with each other. Certain aspects of this communication then would be expected to correlate with how the team is performing and can be used to measure the effectiveness of the team.

For example, Fischer et al. (2007) investigated a number of components of communication, such as: the extent to which team members referred to self or to the team; expressions of positive affect and expressions of negative affect. Table 5 presents the categories of interpersonal affect and interactive patterns used in Fischer et al. Fischer et al. found in a simulated search and rescue task that high performing teams used more positive emotion words (e.g. humour, empathy and praise), more assenting responses following another team member's contribution (e.g. acknowledgements, elaborations and continuations) and more use of humour, praise and empathy. In contrast, low performing teams used fewer positive emotion words, had more missing responses following another team member's contribution and used more insults and defensive utterances.

While communication can also be used to examine behavioural markers (Rosen et al. 2011) the approach of Fischer et al to measuring language-based correlates of team performance is distinct from the behavioural markers approach since it focuses on the language itself rather than the concepts that it conveys.

As the authors themselves point out Fischer et al.'s work is correlational in nature. This means that we are not certain whether high performing teams show more of these types of communication because they are successful or they are successful because they show these types of communication. The types of communication patterns that they observed are also likely to be context dependent to the particular type of group interaction that was observed, where there was no overt leader or command structure. It is also not clear how easily a regional coordinator who is remote from the team would be able to detect these communication patterns of the team. However, this research does show that it might be possible to develop linguistic markers that indicate the psychosocial aspects of team functioning.



Table 5. Categories of interpersonal affect and interaction patterns (adapted from Fischer et al., 2007).

| Category | Examples |
|-----------------------------|--|
| Expressed Affect | |
| Positive Affect | Humour, Empathy, Teasing, Praise, Positive Reinforcement, Concern for Others |
| Neutral | Politeness, Mediation, Appeasement |
| Negative Affect | Irony, Patronizing, Blame, Insults, Attacks, Defensiveness |
| Interactive Patterns | |
| Acknowledgements | Acknowledgements, Agreement, Concessions |
| Disagreements | Disagreements, Contradictions |
| Elaborations | Elaboration, Completion, Follow-Up Questions |
| Answers | Answers to Questions |
| Missing Response | Expected Response Missing |

ASSESSING INDIVIDUAL TEAM MEMBERS

A slightly different approach to examining the performance of teams is to get the team members to provide information on different factors that may affect team performance, such as fatigue and workload. Both fatigue and workload have been shown to have consistently detrimental effects on individual and team performance (Dorrian, et al., 2000; Harrison and Horne, 2000). One of the effects of fatigue for example is to impair language skills and communication. (Harrison and Horne, 2000).

The information provided by participants can be either in the form of self-reports or more objective measures (e.g. the NASA TLX measure of workload) (Dorrian, et al., 2000; Entin and Entin, 2001; Hart and Staveland, 1988). These measures provide a useful indication of individual level of impairment and potentially identify issues that can lead to impaired team performance. However, it should be noted that these measures do not actually provide a measure of team performance. Teams may be able to perform reasonably effectively despite having individuals in them who are fatigued or have high workload by adjusting the way that they function.

CONCLUSIONS

This review has considered the different approaches to monitoring team performance that have been discussed in the literature. Each of these approaches has different strengths and limitations. Monitoring team outputs is perhaps the weakest of these approaches, with a number of authors pointing out problems with its use. Similarly, monitoring information flow that is passed up the chain to the supervisor as part of the operational response can also only detect some of the problems in team functioning at a general level. At the other end of the scale, the use of team-based behavioural markers potentially provides a detailed examination of team functioning, but may be difficult for an SEM with limited time and resources to conduct. There is also as yet little



translation of any of these approaches into a form that is suitable for strategic level emergency management.

We have now considered the main methods for monitoring the performance of teams to provide information on what is possible. We now turn to a consideration of how SEMs report they monitor teams.

INDUSTRY ENGAGEMENT & DATA COLLECTION METHODS

Over the last 18 months, the team members have visited 18 agencies in Australia and New Zealand to collect data and discuss the issues involved in monitoring team performance. Many of these agencies are participating in the Bushfire & Natural Hazards CRC Cognitive Decision Strategies project. We have also collected data on team performance monitoring in two main research studies, which are reported here. The team has discussed the research and/or collected data with: chief officers, deputy chief officers, principle rural fire officers, senior officers, state coordination personnel, regional coordination personnel, and incident management team personnel. These personnel represented the National Rural Fire Authority, urban fire brigades, rural fire agencies, land management agencies, state emergency services, council officers with responsibility for search and rescue and the Red Cross.

DESIGN

The data considered in this report is drawn from two main research studies: 1) a combined desktop simulation & semi-structured interview with regional coordinators, and 2) semi-structured interviews with members of incident, regional, state and national (NZ) management teams.

PARTICIPANTS

In Study 1, there were eleven participants with a mean age of 46 years. These participants had on average 6 years of experience. Participants were interviewed in their chosen location (which was usually their office). One participant was female with the rest male. Participants took part in the study during work time but were not otherwise paid for their participation.

In Study 2, there were 14 participants with a median age was 55 years. These participants had on average (median) 28 years of experience. All participants were male and were interviewed in their chosen location (which was usually their office). Participants took part in the study during work time but were not otherwise paid for their participation.

DESIGN AND PROCEDURE

In Study 1, participants were asked to verbally manage a fictitious desktop simulation of a large-scale emergency within their own region. After an initial briefing, participants were provided with a situation brief that described a major



fire-based emergency and asked how they would manage it. Once the participant had managed a particular phase of the event, further information was provided in the form of situation reports (or sitreps) and other fictional communication (e.g. such as phone calls, or debriefs with other key staff members). The participant was then queried as to whether this 'new' information would prompt changes to their emergency management strategies. Throughout the simulation semi-structured interview questions were asked which addressed why participants made the decisions that they did and about how they would manage other similar situations. For example, following the management of a simulated disconnect the researcher would ask 'Have you ever been in a similar situation where the information you were receiving was incorrect? If so, how did you know it was incorrect and how did you resolve the issue?' Responses were followed up with neutral probes, such as "Why would you do x?" This was followed by a more general discussion about emergency management at the end of the simulation. The data presented here is from participants' responses to the questions. Participant's responses were audio recorded.

In Study 2, participants took part in a semi-structured interview that asked questions about: the strategies and heuristics that they used to manage complex situations, how the agency helped them manage complexity, how they tracked teams they were responsible for, how they identified coordination breakdowns in teams, and how they agency knows it did a good job. Interviews lasted for approximately 1 hour and were audio recorded.

CURRENT PRACTICE

The findings of the two studies were very similar and will be discussed together here. Of the 16 agencies who participated in the research component of the study, only one had a formal method for monitoring team performance during an emergency. The method is conducted by senior officers who are endorsed by the Chief Officer to carry out this role and is employed when it is requested by the incident management or regional coordination team or if senior officers deem that there is a problem in the operation. Within this method, the monitoring team comment on the following question - "Is the team demonstrating unity of purpose, effective communication, functioning and cohesiveness." This method of monitoring has been predominantly used at the incident management level, but has been used at the regional level. Challenges with the use of this method include: not having enough resources to staff a monitoring team and having no formal triggers for its deployment. The method is not used as a matter of course.

With the exception of the one method discussed above, there were few formal methods that agencies used to monitor teams. Generally little training is provided by agencies in how to best monitor team performance. Instead, SEMs typically used informal methods that they had developed themselves. These methods could be categorised as prevention, identification and resolution strategies and are discussed in more detail below.

PREVENTION

Many of the participants were able to anticipate issues in the teams they oversaw and took steps before an emergency occurred to try to prevent them



from occurring. This included preplanning, exercising through simulation and building cooperative cultures.

Preplanning encompassed a wide range of activities such as planning for different emergencies and considering personnel who would perform roles in the various teams. Many agencies tried to use pre-formed teams where possible. Also most agencies who were represented in the study developed plans about how they would respond to emergencies in a variety of different situation and locations. This often included different ways in which those situations could develop and different issues that could occur. In terms of the people who would be involved in an emergency response, SEMs were usually familiar with most people in the agency having worked with them on previous emergencies. This meant that they could anticipate how they would act in certain situations. Individuals with a history of creating issues would be identified for more careful monitoring during an emergency. As one participant commented

“So having the right people and therefore doing a bit of screening as you nominate people for positions is a valuable bit of pre-planning.”

Participants also discussed engaging in exercises and simulations as a way of preventing potential issues before an emergency response. This allowed personnel to develop experience of dealing with emergencies and to work with other people in both their own and different agencies (depending on the scale of the exercise). This was considered to be important in developing familiarity with both the roles and the different people who may be involved in a response. This also potentially allowed for performance to be evaluated and feedback provided to the various individuals and teams involved in the response.

Finally, SEMs discussed the importance of developing a culture where people felt able to discuss operational problems, question the safety of a superior's decisions or if they made mistakes to discuss these with superiors. This is an important way to develop a culture where individuals are empowered to identify where they are in the safety space and to take action (either directly or by raising questions with supervisors) to move to safer zones of operation. As one participant stated

“we've got a fairly good culture now that we don't hide mistakes. Yes it's not great when you have to own up and go oops hasn't gone quite to plan, but as soon as you know it you can let them know, it's like, if something's broken the sooner you can tell me the sooner we can get it fixed...”

IDENTIFICATION

The strategies that participants used to identify issues could be described as external and internal strategies. External strategies were based on using the formal and informal networks of which the participants are a part. Personnel in management teams are typically very well connected to other people in the agency and these people can act as the eyes and ears of the SEM, informing the SEM when there is an issue with an individual or team, or corroborating information obtained from other sources. In such cases the RCs receive information about a problem rather than detecting the issue for themselves. For example



"One of our group officers [person 1] in [place 1], they weren't involved in the fire, but they were concerned about a fire in [place 2]... he said, "I don't think [the team] knows what's going on"... so he'd rung [person 2]... and [person 2] rang me. So then I rang [person 1] and said "what's your concern?"

Internal identification was driven by the SEM's own logic, experience or intuition. SEMs receive a large amount of information as an incident progresses and they can use this information to detect issues. Inconsistent, repetitive, or missing information could all act as a trigger to the SEM that something was wrong. In addition, the SEM will typically be comparing incoming information to their own opinions about the situation based on their experience with previous fires. This process can either happen consciously (e.g. where the SEM is doing their own mapping of the emergency) or unconsciously (where the SEM feels that there is something wrong in the situation). The feeling that there is something wrong is based on the stored experience of similar situations, although the exact situation cannot be consciously remembered, a phenomenon described by Klein (1999) as Intuition. One participant discussed how he used a combination of formal assessment and gut-feel

"I'm doing formal assessment and everything else but there's also this gut-feel thing, and if one or the other isn't adding up I use the other one to sort of help compliment the other one, so if my gut-feel is going 'aww something's not right' but the analytical side of me is going 'nah nah nah it's all fine', my gut-feel I go 'nah listen to it, go back and have another look', or vice versa."

SEMs also actively look for things that might indicate that there is a problem. For example, SEMs look at the non-verbal aspects of the team communications. For example, one participant identified that "a lack of talk straight away, when things are going quiet." might indicate there is a problem brewing. Another participant stated

"when you become isolated, when they're not talking to you and you don't hear from them and if you do make a soft inquiry and all you get back is a one or two line answer then it's time to go and talk to their particular manager and find out what the issue is."

Another participant stated

"It doesn't appear that they're telling you anything about what is going on, they just seem to be reacting to things, there's little alarm bells going, 'hang on, there's something going wrong here, so you want to look more deeply."

Another thing that SEMs might look for is the role that people are playing in teams, since this is known to be an area of potential problem that can disrupt team functioning. When people are under-pressure, one of the things that can happen is that they revert to tasks they know how to do very well. As one participant stated

"So often you'll see some people that will put on the operational functional bibs but they don't stick religiously to that task, they start drifting into their normal job. [...] So you also look for that, where people are starting to drift outside of the command function job they've got. Now there's always a little bit of drift and



there's always a little bit of overlap to do with the workload, but then there's those that are obviously not doing the job that they've been assigned in there."

RESOLUTION

Once an issue has been identified the SEM needs to try to resolve that issue. A number of strategies could be identified in the data that are designed to resolve issues. Because the SEM is acting in a supervisory capacity these strategies are often enacted indirectly through other people. SEMs discussed: delegating a representative who could resolve the issue; providing additional physical or human resources; mentoring staff by asking questions and making suggestions; asserting their authority; or replacing staff. Table 6 presents examples of each of these strategies.

Table 6. Resolution Strategies and Examples.

| Resolution Strategy | Example |
|-----------------------------|--|
| Delegating a representative | "We'd have our regional liaison officer there which'd be giving us feedback on some of the current situation. They'd be stop-gapping some of the little gaps to start with, like there might be information going directly to us until we can put the process in." |
| Mentoring | The way I attacked it was trying to... make them understand or give them an understanding of what would be a better way of doing it... 'Have you thought of this? Have you thought of that? Have you thought of something else, and if you do that do you realise this is what's going to happen?' ...I found if you make them understand, or see all the other options they might not have thought of, you generally get better results." |
| Asserting authority | "I would ring the incident controller direct... so it would be no excuse. The incident controller must talk to me. That would be a direction. It wouldn't be a nice request." |
| Replacing staff | "It may be that we need to give them another job or stand them down, you know, tell them they've been out there a long time. There's different ways of going about it, you don't want to crucify the poor [expletive] unless they're being an absolute out-and-out cowboy." |



CHALLENGES

One of the challenges for SEMs in an emergency is to maintain an appropriate distance from the operational response so that they can maintain the 'bigger picture.' It can be difficult for SEMs not to get drawn into the detail of the operation, referred to as being 'down in the weeds.' The maintenance of this distance can be a challenge when the SEM is looking at incident actions plans and monitoring teams they are responsible for who are engaging in detailed tactical operations. As one participant said in relation to monitoring a team and providing advice

"But, you've still got to resist doing their job for them, because if you do, you might as well be there, because you're not doing this job."

Many of the emergencies that an agency face are small-scale. In small-scale incidents SEMs have the time and resources to be able to carry out some of the command and control roles and some SEMs will do this, as the following example shows.

"I mean I struggle with the terminology 'manager'. To me, you just do the work. I can see it would be different if you were back in here and you had several events happening and that you were the logistics manager for all of those events. That would be different. But we've never had anything to that. Not yet."

However, the problem with engaging in command and control in small-scale emergencies is that it potentially becomes the learned way to manage emergencies and while this may work for small-scale emergencies, it will not work for medium or large-scale emergencies where the person may quickly become overwhelmed.

The use of informal methods of team performance monitoring can be difficult to maintain when the SEMs themselves are under pressure. There is some evidence from Brooks et al. (2014) that supervision can drop out in large-scale bushfires. Paradoxically it is likely to be in large-scale emergencies where team monitoring is needed the most. Providing SEMs with a formal process that allows them to effectively monitor teams may go some way towards helping them perform this task even when they are under pressure themselves from the emergency.



OPPORTUNITIES

At present it seems that there is little or no formal procedures in most agencies to monitor teams responding to an emergency. Only one agency used a formal method of monitoring teams and then only when this was requested either by the team leader or if a problem was detected by a senior officer. There is also typically little in the way of training or procedures to inform people how they should be monitoring teams. It is clear from the research that people are using informal methods to monitor teams, such as monitoring the information flow and looking for things that might indicate that there is a problem, such as reduced team communication.

As discussed in the review of approaches to team performance monitoring, monitoring the information that emerges from the team will not necessarily indicate that there is a problem with a given team. Similarly, using ad hoc indicators, such as reduced team communication may provide some indication of a problem, but will not detect all teams that are functioning in a sub-optimal way. While the development of a set of things to look out for in the functioning of the team (e.g. reduced team communication, people not performing the role they've been assigned) appears to be worthwhile, to provide a more definitive method of monitoring teams this should be supplemented with methods that can provide insight into the team processes.

Comparing the data on what SEMs currently do to the literature on team performance monitoring shows that there are a number of possible methods that can be used to enhance how SEMs monitor team performance and to develop more formal processes. For example, in addition to monitoring information flow, a more comprehensive list of things to look out for could be developed and used together with a set of behavioural markers of breakdowns and effective team performance.

However, these methods are currently not developed in a way that is appropriate for emergency management and have not been tested for effectiveness in this domain. There is also a challenge for SEMs in potentially having to monitor multiple teams at the same time, tracking where each one of these teams is in the safety space. It will be important to have detailed discussions concerning possible enhanced team performance monitoring methods with our industry partners before heading in a particular direction. This constitutes an important next step in the project.

After a problem has been identified the SEM needs to act to try to resolve that problem. However, the SEM typically operates outside the team if it is below them in the hierarchy of operations. In such situations the SEM often uses indirect means to try to resolve the problem, such as: mentoring. A number of such resolution methods have been identified here that could form the basis of further research into how problems are resolved once they have been identified.



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