Ecological interchangeability: supporting team adaptive expertise in moments of disruption

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Abstract

While undesirable, unexpected disruptions offer unique opportunities to enact adaptive expertise. For adaptive expertise to flourish, individuals and teams must embrace both efficiency and adaptation. While some industries do it readily, others continue to struggle with the tension between efficiency and adaptation, particularly when otherwise stable situations are unexpectedly disrupted. For instance, in healthcare settings, the efficiency mandate for strict compliance with scopes of practice can deter teams from using the adaptive strategy of making their members interchangeable. Yet, interchangeability has been hinted as a key capacity of today' teams that are required to navigate fluid team structures. Because interchangeability – as an adaptive strategy – can generate antagonistic reactions, it has not been well studied in fluid teams. Thus, in this exploratory qualitative study we sought to gain insights into how interchangeability manifests when fluid teams from five different contexts (healthcare, emergency services, orchestras, military, and business) deal with disruptive events. According to our participants, successful interchangeability was possible when people knew how to work within one's role while being aware of their teammates' roles. However, interchangeability included more than just role switching. Interchangeability took various forms and was most successful when teams capitalized on the procedural, emotional, and social dimensions of their work. To reflect this added complexity, we refer to interchangeability in fluid teams as Ecological Interchangeability. We suggest that ecological interchangeability may become a desired feature in the training of adaptive expertise in teams, if its underlying properties and enabling mechanisms are more fully understood.

Introduction

Adaptive expertise is most necessary – and most difficult – in the face of unexpected disruptions in practice (Mack et al., 2016; Potsangbam, 2017). It is necessary because unexpected disruptions require out of the box thinking to efficiently adapt or deviate from protocols when needed. It is difficult because such out of the box thinking requires an environment that welcomes and encourages adaptation, rather than punishing it. For adaptive expertise to

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flourish, individuals and teams must embrace both efficiency and adaptation (Mylopoulos et al., 2018; Mylopoulos & Regehr, 2009; Pusic et al., 2018; Schwartz et al., 2005). However, in healthcare, efficiency and adaptation rarely sit well together (Amalberti, 2015). While adaptation drives on-the-ground healthcare practice, it usually conflicts with the healthcare system's aspiration to prioritize efficiency at all costs, even if at times unattainable (Greenhalgh & Papoutsi, 2018). This tension between efficiency and adaptation intensifies when otherwise stable situations are unexpectedly disrupted. To illustrate, specialization and compliance with scope of practice are the preferred strategies in stable situations. However, when disruptive events happen, those strategies might hamper a team's ability to quickly change gears, resulting in paralysis, conflict, and neglected outcomes. For instance, in healthcare settings, fear of scope creep or the implicit messaging that someone must be at fault can dilute a team's willingness to experiment with adaptive strategies that contravene scopes of practice, such as making team members interchangeable (Davidson et al., 2007; Dower et al., 2013; Tannenbaum & Tsuyuki, 2013). Yet, interchangeability has been hinted as a key capacity of today's teams that are required to navigate fluid team structures (Chiu et al., 2017; Mortensen & Haas, 2018).

Fluid teams – those characterized by membership changes – are becoming unavoidable in today's organizations. Fluid teams are emerging as a solution to the constant turbulence of our society either by design (e.g., multinational teams working remotely) or by necessity (e.g., redeployment of healthcare providers during Covid-19) (Bushe & Chu, 2011). Membership changes refers to the dynamic flow of members in and out of teams, because of the need to integrate a new member, to replace a member, or to deal with the loss of a member that cannot be replaced (Bedwell et al., 2012; Hirst, 2009). While in creative industries, membership changes are welcome to spark new ideas, for most industries, membership changes appear problematic because they threaten members' sense of belonging and trust (Bushe & Chu, 2011). Current strategies to address these threats mostly focus on identifying traits to aid in the selection of team members (LePine, 2003) and on validating interventions to mitigate the negative effects of membership changes (Lewis et al., 2007). However, some have recently argued that rapidly evolving situations, not only alter team membership, but also alter team structure as dynamic task allocation, blurred roles and responsibilities, and changing leadership become the norm (Aime et al., 2014; Bresman & Zellmer-Bruhn, 2013). In fact, not only are teams more fluid in many contexts, so is the work those teams perform (Huckman and Staats 2011). Therefore, fluid teams are expected to embrace team adaptive expertise to effectively respond to disruption while dealing with the fluidity of their structure and of the environment in which they perform. This is particularly critical when a team member is lost or unavailable requiring remaining members to become interchangeable (Kozlowski, 1998; Summers et al., 2012). However, what this kind of team adaptive expertise looks like in fluid teams remains underexplored.

Exploring how fluid teams enact adaptive expertise requires a shift in focus to include the impact of their surroundings[1] – i.e., environmental factors. To that end, the first author of this paper (SC) recently launched the Collective Agility for Superior Teamwork (CASTe) program as an interdisciplinary research initiative (including healthcare, military, social sciences and biology researchers) to enhance our understanding of resilience in teams from high-stakes industries. To abide by an environmental orientation, the CASTe program chose sociobiology – the field concerned with the collective behaviour of superorganisms

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[1] Circumstances, objects, and conditions (Merriam Webster).

in changing environments – as its main conceptual framework. Two studies preceded the formation of the CASTe program. Both were aimed at gaining insights into how fluid teams conceived adaptation as they dealt with the Covid-19 pandemic (Cristancho et al., 2022) and other crises (Field et al., 2022) [ref]. Both studies provided hints about interchangeability as an environmentally-driven strategy these teams used to collectively adapt during disruptive events. Hence our intention in this paper to further excavate its mechanisms. Our choice to use a non-human analogy and conceptual framework was not based on exclusivity of already existing human-based ones, such as those from organizational behaviour. Analogies are powerful tools to inspire new ways of thinking differently about issues. Each brings forth unique aspects of a phenomenon, but no one applies perfectly. The sociobiology analogy places a strong emphasis on environmental changes to deal with membership changes and to guide division of labour (Pagano, 2020), over cognitive traits, as most human frameworks do. Therefore, from our perspective, adding the sociobiology analogy constitutes an important opportunity to reconsider strategies for team adaptive expertise, such as interchangeability.

Interchangeability is a biological trait of superorganisms. A superorganism is a group of synergistically interacting individuals, whereby different tasks are performed by specialists (Hölldobler et al. 2009). Social insects are examples of superorganisms where division of labour is highly and exclusively focused on serving the needs of the collective, not of individuals. This biological analogy applies well to human teams where tasks are likewise specialised and are performed in service of others. Yet, what drives collective work appears different among the two given their intellectual powers (humans) or intellectual limitations (social insects). Despite these differences, when it comes to improving human teamwork in the face of disruptive events, perhaps some inspiration can be borrowed from less intelligent superorganisms (Duarte et al., 2012; Middleton n.d.). Social insects possess a heightened awareness of environmental changes and seamlessly integrate specialization and interchangeability. Specialization allows greater efficiency within a nest or colony. But as soon as they sense a disruption of their environment, they quickly switch tasks and roles to filling the gaps. For example, in honeybee societies, specialized individuals (e.g., nurses, foragers, guards, hygienists, undertakers, scouts, etc.) can be somewhat interchangeable. When the bee's environment is predictable and bountiful, the workers remain in their specialized roles. When the bee's environment is perturbed, such as predator's attack to the colony, and foragers or guards die, nurse bees can take over foraging or guarding roles (Seeley, 2009). By using social insects' collective behaviour as an analogy, we suggest interchangeability may be a potential key enabler of adaptive expertise in teams.

Making team members interchangeable is an adaptive strategy that can generate antagonistic reactions. Some industries embrace it without hesitation (Bohle Carbonell et al., 2014; Schraub et al., 2011), while others resist it. In military operations and disaster management, teams are trained to use cross-functionality as part of their uncertainty-response strategies. This strategy involves the repurposing of something or someone to act in a role that is outside of their primary role or function (Dyson, 2020; Nowell et al., 2017). In healthcare, embracing interchangeability remains a struggle (McLeod et al., 2021). This struggle may occur because of how interchangeability has previously been conceptualized as solely switching roles. The problem for healthcare teams in larger settings versus a military setting for example, is that the team composition is diffuse and individual members may not be familiar with each other. This undermines the trust that is often necessary for switching roles

(Mortensen & Haas, 2018). If interchangeability only means taking another individual's roles, then it is not surprising that it hasn't been embraced productively in healthcare. While role switching has been the biological trademark of social insects' ability to respond to disruptions, this assumption may not hold true with human teams.

Our society has become ever more disruptive. And it's an issue across organizations that is prompting the prevalence of fluid teams (Wageman et al., 2012)and the call for research on how they work particularly in the face of disruptions (Dibble & Gibson, 2018; Stachowski et al., 2009). To effectively do that, we first need to understand what strategies such as interchangeability look like and what promotes and hinders it. For instance, we need to question the assumption that interchangeability is purely about role allocation. We started to see traces of this in our previous work, prompting this preliminary qualitative study which explores how interchangeability manifests when fluid teams from various contexts deal with disruptive events. Interchangeability may become a desired feature in the training of fluid teams for adaptive expertise, if its underlying properties and enabling mechanisms are more fully understood. This is the scientific conversation this paper contributes to.

Methods

Given the exploratory nature of this study, we used a descriptive qualitative research approach (Sandelowski, 2000, 2010) to gain initial insights into how interchangeability unfolds when fluid teams must adapt to disruptive events. We selected this approach because of its focus on straight descriptions of phenomena anchored on the words and events used by participants. This approach often involves a thoughtful amalgamation of sampling strategies, methods, and data analysis (Sandelowski, 2000, 2010). Because the concept of interchangeability has not been well described in human teams, nor has the environmental features that may support it, we wanted to get a broader sense of the concept across several fluid teams in multiple contexts. In doing so, our goal was not to compare and contrast these teams as case studies, but rather to begin to capture the different environmental factors that impact fluid teams, thus we analyzed the data as a single dataset.

We selected the following contexts – Healthcare, Business, Military, Emergency Services, and Musical Ensembles – because; (1) They have higher stakes and require adaptation by necessity, (2) They have varied approaches to interchangeability (i.e. explicitly in policing, implicitly in musical ensembles), (3) They have a range of team dynamics given the nature of their composition – e.g., some have stable team members (military, and tactical policing) while others have shifting or ad-hoc teams (paramedic, healthcare), and (4) They have different hierarchical and organizational structures that impact teamwork.

Data collection and analysis occurred in iterative manner. We utilized purposeful and snowball sampling (Kuzel, 1992; Sandelowski, 1995) to recruit a total of 16 participants from the 5 separate contexts: Business (n=4), Healthcare (n=2 nurses, n=3 physicians), Emergency Services (n=2 tactical police officer, n=1 paramedic), Military (n=2), and Musical Ensemble (n=2).

Participants were invited to participate in a single 60-minute, audio-recorded semi-structured interview with research team members (SC or EF) via zoom. Ten participants agreed to participate in this set of interviews (Business n=2, Healthcare n=2 nurses, n=2 physicians, Emergency Services n=1 tactical police officer, n=1 paramedic, Military n=1, and

Musical Ensemble n=1). Participants were provided with the option of completing a rich picture interview or a semi-semi structured interview – all participants agreed to complete the rich picture interview (Cristancho et al., 2015; Cristancho & Helmich, 2019). Both SC and EF are qualitative researchers with XXXextensive experience using visual-elicitation interviews to explore adaptation in teams across different settings. Rich picture interviews involve participant-generated drawings and are helpful in augmenting traditional interviews as visual methods often help participants to think about a situation in greater detail and can show how social processes unfold (Cristancho et al., 2015; Cristancho & Helmich, 2019).

Rich picture interviews occur in three steps: (1) pre-drawing interview (2) drawing session (3) post-drawing interview. In the pre-drawing interview participants were asked to describe their roles, their team, and what adaptation looks like in their context. In the drawing stage, participants were given a prompt, "Can you recall a disruptive event where you team had to adapt? Please draw this event from your perspective". Because these were virtual interviews, participants were asked prior to the interview (via email) to bring drawing supplies with them. They were told in this email to bring a piece of paper, pen and/or markers. Once they completed their drawing, participants either emailed the image to the interview team or simply showed it via their computer camera. We then moved to the post-drawing interview. Participants were asked to describe their drawing and the events it depicted. We (SC, EF) then probed for additional details to nuance our understanding of interchangeability during this disruptive event, such as, "What was everyone's role during this event? Did team members have to switch roles/tasks? If so, how did team members know what to do? What were the challenges? Successes?" Drawings were used as an augmentation tool only and no aesthetic analysis was performed.

There is no single way to analyze data within a qualitative descriptive study, however, the analysis should stay close to participant's words and may employ analytic methods from more traditional methodologies (Sandelowski, 2000). We utilized constant comparative analysis including gerunds (i.e., words ending in -ing) and in vivo codes (i.e., participants own words) to identify categories across two interviews (1 physician interview, 1 business interview) (Charmaz, 2014). We used these categories to develop an initial coding framework and then applied this initial coding framework to 2 additional interviews (1 musical ensemble, 1 paramedic). We continued to collect data and refined our coding framework to identify deeper relationships between the codes. SC and EF refined the coding framework to connect codes that seemed related, removed codes that were repetitive, and identified new codes from the ongoing data collection. Once this framework was well defined, the entire research team met to review the framework and ensure coherence. EF applied this framework to the dataset (n=10) using Nvivo.

The research team met again following this coding to discuss early themes that EF and SC had identified at this stage of data collection and analysis: multiple forms of interchangeability and features that impacted how teams employed interchangeability. The team agreed that additional data collection exploring these themes was necessary to add depth and breadth. We refined the interview guide to specifically explore these themes (appendix 1). We purposefully sampled an additional 6 participants (n=2 physician, n=1 musical ensemble, n=2 business, n=1 military) for single semi-structured audio-recorded interviews using the revised interview guide. Following the interviews, EF and SC engaged in a more interpretive analysis of the dataset and themes were collapsed into abstract analytical categories and shared with the entire research team. Once the team reached consensus, SC and EF

developed and applied a final coding framework to the entire data set (n=16) using Nvivo. These were then shared in a codebook (including a definition for each code and an example) with the entire research team for a final analysis meeting. At this time, the team agreed we had reached data sufficiency to nuance the features of interchangeability and we ceased data collection (Nelson, 2017).

Our research team was composed by 7 researchers: three with experience exploring healthcare teamwork and team adaptation (SC, EF, and LL) and one with experience exploring inter-professional work during critical incidents such as the Fukushima nuclear disaster (KH). To bring the perspective from other industries, the team also included WH who has extensive policing experience in the specific area of accident reconstruction and TT who is a practicing physician leading interprofessional healthcare teams during crisis situations. Similarly, as we chose sociobiology as our conceptual lens, the team included GT who studies the biological basis of insect social behaviour.

All study procedures were approved by Westerns REB. Participants were given an anonymous ID code and will be referred to by their industry and ID number: Military is MIL-1, Musical Ensemble is ME-1, Emergency Services is ES-P-1 for police or ES-PA-1 for paramedic, Business is BUS-1, and Healthcare is HC-P- 1 for physician or HC-N-1 for nurse.

Results

A variety of disruptive events were depicted and described in our participants' accounts. These events included: (1) Saving, rescuing, or capturing someone – such as carrying out military or SWAT teams operations, (2) Looking after someone's financial or personal well-being – such as managing the 2008 financial crisis or the Covid-19 vaccine rollout, (3) Capturing an audience's attention – such as recovering from errors in orchestra performances. While this study is not intended to perform cross-context comparisons, we provided snapshots of some of the events narrated by our participants in appendix 2 to offer some context of the high-stakes nature of these events.

Our participants' stories offered insights into the features of interchangeability – a key strategy that enabled them to adapt to disruptive events. At its core, interchangeability allowed teams to keep performing despite the loss, unavailability, or underperformance of another team member. Interchangeability took many forms but was most successful when teams capitalized on the procedural, emotional, and social dimensions of their work *"to get things done"* [HC-P-1] despite environmental disruptions. In what follows, we will illustrate what interchangeability looked like and the various factors that shaped it as an adaptive expertise strategy in fluid teams.

What did interchangeability look like?

Flexible definition

The situations these teams encountered were described as dynamic and in constant flux. Teams were aware that *"there are just so many different things in our day-to-day stuff that we can't plan for"* [ES-P-3]. They had to be prepared to respond to multiple environmental

disruptions, *"whether it's human error, fatigue, equipment failure"* [ES-P-3]. In doing so, interchangeability was described as *"one of the highlights* [because] *everyone passed off jobs and traded off and said I got this… I'll finish this off for you. So, people could more effectively manage the chaos that was unfolding."* [HC-P-2]. The key to successful interchangeability was knowing how to work within one's particular role while being aware of other roles that people might play because *"there's a lot of continuous assessment of what's going on around you and then the goal just sort of plug and play as needed"* [MIL-2]. This awareness came with a caveat. While participants understood that *"I might not be able to switch instruments and suddenly become a woodwind player"*, they also realized that *"I might be able to support that process of role switching* [by] *switching to a role that's close to my role that would then enable somebody else to move into a role that is close to their role and gradually fill a gap"* [ME-2]. Therefore, switching roles to cope with disruption was not unfamiliar to most of our participants. Disruptive situations forced participants to become creative in their responses so that interchangeability included more than just role switching. Table 1 includes a description of those strategies along with illustrative quotes.

Embedded in practice

The diversity of strategies revealed interchangeability as an ecology of procedural, emotional and social factors that *"takes time and familiarity to develop"* [MIL-2]. While participants readily embraced the benefits of interchangeability, they also acknowledged its limitations by reflecting that *"one of the only drawbacks could be if a person gets themselves into a feeling that they have to go out… as opposed to just saying, I don't know but I will get back to you"* [BUS-3]. In other words, not appreciating their limits. As one participant illustrated:

> *"you're not going to replace a surgeon with a physician because that would be ridiculous, but it might be that there are overlap skills that surgeons and physicians have, such as IV canulation, and/or history taking, or catheterization, those sorts of skills that either of them could do. And in those situations, there's a meeting in the middle of a skill set where those two people could potentially act interchangeably in order to adapt to an unsteady situation."* [ME-2]

However, convincing people that *"meeting in the middle of a skill set"* was a good thing was not always a popular idea. According to participants, the assumption that *"if everybody just did their jobs, we wouldn't need to have this interchangeability"* [BUS-3] was sometimes too entrenched in their contexts and required effort to challenge it. Participants reflected on the need to make their teams aware that that's not how the real-world works. To survive a dynamic situation,

> *"everybody [should] know what their role is and what the role is of the person next to them because if something happens to number one going into the house, I am now number one. I have to now be able to do what he was planned to do and then everybody has to adjust behind me off of that"* [ES-P-1].

Table 1 Various interchangeability strategies as described by participants

Interchangeability strategies	Illustrative quotes
Doing/assuming another team member's tasks (by request or by necessity)	*"So in a much more dynamic situation where if we're making entry into the house, members will have assigned tasks, but inside the house those tasks can change. Where we have a person, pick five people, one, two, three, four, five will all kind of have different roles inside the house, but we're also prepared that if something happens to number one, he's injured, that position has to be taken over. So everybody will now assume a new role based off who has gone missing."* [ES-P-1]
Doing tasks above (or below) level of training	*"So, you have the admin person, who frankly is getting feedback from the client because if they're calling in needing money, everybody is saying, by the way, how is my account? You have the client service person. They're getting feedback and questions from the client. And neither one of these positions are advisors, but yet they have to kind of shift and pivot or adapt to provide peace of mind on something that they have no full understanding."* [BUS-1]
Doing tasks outside/ Adding tasks to scope of practice	*"These nurses were amazing because they had always had to do a little bit more, way to the end of their scope… and when I say, beyond scope, it's mostly mentally, it's nothing technical. Nobody was doing some big, far-out procedure that they had just seen done once and do it, it was never anything like that. But it was manage a patient, get them started, do these things, come get me if they're sick."* [HC-P-1]
Working with/in small teams	*"By the time we were done, we had essentially four different teams at the scene working together. Myself and my partner are considered one team. Local EMS is considered one team. They have a supervisor, like, an operations commander on scene to command, and then the institute command will be the highest ranking Fire Rescue person who is guiding the rescue part of it. And then we have the surgical site team… on the plus side, between the teams there's a lot of conversation and communication, and there was a lot of just one-on-one looking out for one each other sort of thing so that was very good to have. It's to click into all these other teams for the collective minds, skills, and everything else to be brought to their optimal level, but that's the whole point."* [ES-PAR-2]
Feeding off each other's cues and miscues	*A lot of it is, if it's all going well, you're looking at the other sections to see when they're about to play in order to get your timing from them. Equally, if something goes wrong, you get a bit of a startling, might get a subtle glare, or a kind of, whoa guys, why are you playing at that point? You're not meant to be coming in for another three bars. That sort of thing. And that might get picked up by the people who had started playing too early… And then they have little quirks, so they may have a particular way of playing in the sense that if when the section is about to come in, they might take a breath in, and they might sit up a little bit straighter, so there's a bit of a visual cue. So, between the leads of each section, there will be that visual communication. If they want to say, hey guys, I want to get your attention, they might just lean forwards a little bit, or shuffle and turn sideways."* [ME-1]
Bringing in other/ new team members	*"I think bringing in the surgeons, when we brought the surgeons in close, and asked them basically on the one limb if they would just get haemostatic control so they did a cut-down and did haemostatic control of the femoral artery on the one so it's better than a tourniquet. That's, of course, within their scope, but it's just not something that happens very often on scene at all."* [ES-PAR-2]
Considering external factors when distributing tasks: being aware of personal issues at home or work or environmental issues that team is facing	*"Working with the same team all the time has very strong benefits. As a Unit Commander, again, because I knew all the members, I also knew when they were having good days and bad days. So when I'm actually making a plan driving, if I know that number four has had no sleep this week because his three month old is still colicky, I'm not going to put him purposefully in a spot where he may be faced with additional stressors. So I can actually plan around some of this stuff based off just my personal knowledge of the members I work with."* [ES-P-1]

Table 1 (continued)

Interchangeability strategies	Illustrative quotes
Deviating from protocols/plans	*"The anaesthetist lost a few years off her life because that would never have happened. Everybody around said it, if this was in* [major city], *there is no way. They would have had to have an anaesthesia consult, they would have had to do … you just don't go doing that kind of thing. But he did, he was an incredibly experienced obstetrician, he had seen a lot. This wasn't a rogue kind of… he just knew what he could do and what had to be done, and nuts to protocols, we'll just get in there and deal with it."* [HC-P-1]
Rallying the team: Having conversations to clarify tasks/ message; seeking perspective from others to inform the team	*We have a 3 C meeting on a bi-weekly basis. So, everybody goes around the table and talks about what's new in their life personally, so we get better understanding of what's going on in people's lives. The next we talk about, generally speaking, is there anything that's specific to your role that you think should be shared with the team that you either need feedback on or you need to get information on. And then the third point is how do you provide the exemplary world-class service to our clients? If you're an admin-related person, then maybe in that two-week period you didn't have a lot of client interaction, what did you do as part of the connectability of everybody else in their roles that helped to give that world-class service to the client?"* [BUS-1]

According to participants, this level of awareness *"is one of those things that you should plan for and incorporate all the time, not just sort of thrown at them"* [MIL-2]. In some situations, participants talked about the importance of cross-training particularly designed to help team members *"not getting pigeonholed into this is the only job I have"* [ES-P-1]. For these teams,

> *"if people feel like they're capable of being interchangeable to an extent, they're more than likely to adapt… if they haven't had some sort of introduction or experience, if they've only been in that silo in the hospital, they're probably not going to."* [MIL-2]

In other situations, introducing people to the idea that they could be interchangeable came out of the need to respond to resource scarcity. In small community hospitals, for instance, *"we aren't going to wait for two nurses to be freed up to do that kind of thing… so they taught me how to do it, I'm going to do it"* [HC-P-1]. Regardless of how it happened, the importance of interchangeability was highlighted by participants as a necessary strategy to ensure the ongoing function of their teams.

What factors influenced the enactment of interchangeability?

Flattened hierarchy

The teams in this study belonged to larger organizational hierarchies that determined roles and tasks. While organizational hierarchies influenced the structure of the teams, participants acknowledged that to promote interchangeability on the ground, *"there has to be a flat leadership model that everybody is just a peer… because they're going to be more motivated to take those chances of going outside their comfort zone"* [BUS-2]. Situational leadership appeared as the hallmark of such flat hierarchy, because despite belonging to a rank *"it doesn't mean that I have been in this particular situation, there may be somebody that*

has got more experience in this situation. And my role as a supervisor, I'll step aside, and I now support them" [ES-P-3]. This support, in many cases, amounted to letting decisions be made from the bottom up, as *"if something comes up, the orange shirt* [on-the-ground volunteers] *brings an issue to the purple shirt* [mid-level managers]*... if they can't, they go to the clinic lead... if they can't, purple shirt will bring it to my attention"* [BUS-2].

Flexible processes

Enacting interchangeability while abiding by processes, such as standards of operation (SOP) or checklists, was viewed as necessary and helpful, only when those processes were flexible. When rigid processes stifled adaptation, it created fatal outcomes. In one case, this rigidity prevented a stroke patient from receiving life-saving medication due to checklists and procedures. While the team tried to adapt these procedures, even, *"yelling on the phone to get things done"* ultimately, "*the person was dead by the time they got there and realizing there was so many steps along the way that were major clusters that could have been avoided"* [HC-P-2]. Participants acknowledged that *"checklists allow messaging that this is what is acceptable and this is what's not"* [HC-P-3]. However, checklists hampered team responses because "*if you always do the same role, or the same job, and never do anything else, then, if there's an emergency situation in which one might need to cover a gap if you've never done it before, then that's really tricky"* [ME-2]. This duality was further highlighted when participants reflected about legal implications. For instance, *"*[in healthcare,] *if you haven't done it for a certain amount of time, and you haven't been signed off and had your certificate and your tick sheet, is it right for that person to do it if they haven't had all of their, I guess, boxes ticked?"* [ME-2]. In some other situations, checklists were treated as *"I would say they are like guidelines. And the reason is our environment, there's a lot of unexpected variables. If you're bound by a rigid structure it wouldn't work for our organization"* [MIL-1].

Trust, values, and relationships

While policies, processes and leadership structures facilitated the technical aspects of a team's work, they were not the only catalysts of interchangeability. In participants accounts, social aspects such as trust, values, and relationships featured prominently in fostering a mindset of *"no matter what, I had their back"* [HC-P-1], which was referred to as the key ingredient in the successful enactment of interchangeability. For some, engaging in interchangeability *"established a sense of pride"* [BUS-1]. For others, *"it's sort of a badge of honour"* [BUS-2], because *"it elevated practice, it challenged us as a nursing team because the expectations were different, higher bar... and that was exciting"* [HC-N-502]. In many cases, participants described it as *"a very rewarding experience... to be associated with something that is impactful and helpful"* [BUS-4]. Yet, negative feelings like indifference and frustration also arouse when interchangeability was stifled by *"people say[ing] that's not your job, or that's mine"* [HC-P-3]. Enhancing the positive feelings and preventing the negative ones required *"a sense of psychological safety knowing that there's probably going to be mistakes made... but their strong leadership is going to give them safety... they might go out and try different things"* [BUS-1].

Teams were also encouraged to engage in interchangeability when they experienced strong camaraderie; what participants called *"the personal element* [as] *trust that you could be vulnerable"* [HC-N-2]. In many instances, the development of trust was attributed to experiencing disruption repeatedly, *"and if you are in there with a bunch of people, and you get through it… that's really a bonding experience"* [HC-P-1]. With this level of bonding, interchangeability was facilitated by *"cues, verbal and non-verbal,… where people know people's boundaries… they know their hesitation points and they can see when someone needed something thrown in or suggested"* [HC-P-2] and augmented by *"the shared responsibility of everybody getting the job done"* [ES-P-3]. Those participants who had a leadership role in their teams pointed out the importance of *"very clear values and beliefs, so when the shit hits the fan, they* [the team] *fall back to those"* [BUS-1], because *"I think words flashing up into your head is a whole lot better than checklists in front of you"* [BUS-3]. A tangible benefit of leading a team through values was the realization that in crisis *"you don't need to be a specialist. Be curious. You don't need to be a specialist to do that."* [BUS-3]. Curiosity, respect and careful listening were three key team values our participants emphasized as critical during moments, such as, when they knew *"they should not be following the leader… [because] the person that's next to them is the one playing the right notes"* [ME-1]. These values not only guided teams in dealing with hierarchical issues, but also with the emotional and social dynamics of disruptive events.

How was adaptive expertise revealed in the enactment of interchangeability?

When disruption struck, *"the cream rose to the top"* [BUS-4]. The "cream" were people often referred to as, *"I am going to call it, lynchpin"* [ES-PAR-2]. These were the people who are especially adept at navigating the procedural, emotional and social aspects of interchangeability. These lynchpins were often not the leaders of the team in a hierarchal, traditional sense, but rather were people who seemed to know how to operationalize adaptive expertise. They were described by one participant as,

> *"They're like wizards, they'll stand in between, and they always position themselves in the middle. And they will just continuously look around and see what you need, and they'll reach over, and they'll hand you another pack of whatever. They just sort of have this continuous situational awareness that is amazing and they're constantly looking around, constantly thinking kind of two or three steps ahead… these guys are like the masters of making sure that everybody is safe, and nothing happens. They're very good about all those other little intangibles that can be significant"*. [MIL-2]

Every situation had a version of their lynchpins. For instance, a physician told the story of,

> *"… this woman, who had kind of a mythic presence up in the OR didn't appear to be particularly warm and fuzzy. I learned so much from her that night, I was absolutely amazed. She very quickly saw that we were drowning, we were keeping people alive, but we needed help, got people from the ICU down to say, take that patient away from them, they've got to do this. She helped a little bit with that, and then she went to each*

of the nurses and said, you've got to take some time and sit down, go sit down for 20 minutes. I really don't know what I'm doing down here, but I'm sure [name] *can lead me through. These were just cleaning up after the resuscitations. She just went around with me, she made sure each of the nurses got a chance to sit down. Very much praised them, and sort of, look, you did something extraordinary tonight, that was really, really good work".* [HC-P-1]

"This woman" happened to be a non-healthcare professional. As such, participants emphasized that lynchpins didn't come from a particular profession, in fact,

"my lynchpins wouldn't necessarily be another physician. But they would be nurses… social workers and absolutely ward clerks, admin clerks, who can cut through the nonsense. Because there's more and more nonsense, more and more rules, more and more lists, more and more checklists." [HC-P-3]

To be able to cut through the nonsense, *"you had to pick your right nurse who would be able to do that smoothly and be insistent but appropriately insistent"* [HC-P-3] or, *"those great nurses who have been around for a while, who will just like [say], do the code, we'll run the ER in the meantime"* [MIL-2].

Lynchpins were also found in the form of community organizations who stepped up to navigate the politics between the hospital, community doctors and the health units in the midst of the Covid-19 pandemic, as this participant described:

"It just needs one or two or three people to get the ball rolling… [but] *how many people could do that? Because what if it was a politician that did this. People would say, well, he just wants to get re-elected. And what if it was someone from the health unit, they would say, well, that's their job anyway. So, why follow them, they can do it themselves, they're the experts. And that sort of thing. So, I think when you have individuals who want to do something with nothing personal to gain from it, you'll find support quicker".* [BUS-4]

Selflessness and the willingness to be ready to step in at a moment's notice characterized these lynchpins. For example, when *"you play in an orchestra where you know that if something goes wrong, then there are the people who will adapt and go off piece a little bit in order to improvise to work around the problem."* [ME-1]. However, improvising didn't happen automatically, it hinged on strong awareness of the boundaries of their skills, because they *"recognize it's not in their scope of practice and they will say I'm not supposed to do that, but if you'll supervise me, I'll help you"* [MIL-2]. This sense of awareness was highly praised in situations that required or called for interchangeability.

Participants were grateful for the lynchpins on their teams and often acknowledged their adaptive capabilities during a disruptive event, as when *"you will be at a call, and you'll be like, oh god, I wish so-and-so was here or thank goodness so-and-so is coming"* [ES-P-3]". Despite their importance, participants recognized the systemic constraints in their workplaces that left the development of lynchpins up to individuals, not organizational structures. As one participant described,

"There's always more patients to see, there's always more notes to sign, there's always more stuff to do and so the time that it takes to develop people, because it takes a lot of time to develop people in those relationships, that's not typically paid. You have to find people that care enough about it to do it, which is going to take more time and effort and loss of sleep or whatever else." [MIL-2]

Discovering, developing and promoting lynchpins therefore, was not a solo enterprise. According to participants, it required others, particularly, team leaders *"to be able to stand back and say, you know what, maybe I don't know everything and I need to be open to listening and change"* [BUS-4]. For most, this requirement came down to understanding when *"[situational] expertise is the hierarchy, not rank"* [MIL-2] to look for the real expert for the particular issue at hand.

Even though healthcare participants reflected that their industry was likely lagging the most in embracing the interchangeability mindset, they resorted to lessons from the Covid-19 pandemic where *"we would take nurses who are not critical care nurses and then kind of give them a little introduction".* Despite receiving push back due to the unconventional nature of this arrangement, *"most of them did just fine so the interchangeability was successful, and I think most people recognized that this was totally doable".* While participants recognized that *"hospitals are much more constrained by traditional viewpoints of scopes of practice, administrative policy, bodies of influence",* they advocated for *"more interchangeability than there is"* [MIL-2].

Overall, there was a sense of urgency amongst participants for professional organizations to recognize the potential of interchangeability because, *"there is never perfect… I would love to be in that perfect workplace where nothing ever falls off the rails, whether it's human error or human fatigue, equipment failure, I've never worked in a perfect work environment"* (ES-P-3). As all participants agreed, *"to survive in the world today… you need to have that interchangeability"* [BUS-3].

Discussion

When adaptive expertise is required to deal with disruptive events (Grote et al., 2018; Kozlowski, 1998; Mylopoulos et al., 2018), fluid teams readily harness the power of interchangeability. This early analysis of interchangeability suggests that in human teams, interchangeability involved three intertwined features: social, procedural, and emotional. Together, these features shaped the environments in which these teams must perform and to which these teams adapted. Therefore, interchangeability in fluid teams appeared environmentally-driven and materialized as an ecology of strategies beyond taking on another individual's role. To reflect this environmental complexity, we refer to interchangeability in fluid teams as, **Ecological[2]Interchangeability**. We suggest that ecological interchangeability may serve as a strategy to deal with the environmental element when teams experience membership changes, such as the loss or unavailability of a member

Changes in membership and structure are what make a team fluid (Bushe & Chu, 2011; Chiu et al., 2017). The prevalence of fluid teams in today's organizations has prompted recent calls for a new conceptualization of teams where team composition is not dictated by

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[2] Ecology refers to the relationships between organisms, including humans, and their physical environment.

membership, but by participation (Mortensen & Haas 2018). Furthermore, there are calls for researchers to start "mapping the ecology of teams" by adopting and evolutionary perspective (Mortensen & Haas, 2018). If we are to do this, then we must bring the organizational environment of a collective – such as a team – to the forefront. Sociobiology – with its focus on the evolution of collective behavior in relation to environmental changes – is one conceptual lens that allows us to shift our thinking and tackle the changing landscape for fluid teams (Gordon, 2016). Specifically, sociobiology provides a framework to account for the sporadic nature of learning on fluid teams (Wageman et al., 2012), and the everyday nature of disruption and adaptation.

Despite its usefulness, the pace of uptake of sociobiology principles varies across industries. Some industries, like tactical operations are already incorporating some of these principles into their formal training (Arquilla & Ronfeldt, 2000; Livingston, 2015). For other industries, such as healthcare, sociobiology hasn't made its way as prominently (McLeod et al., 2021). The sentiment that ecological interchangeability is not only good but necessary for work in fluid teams was shared by all participants. It was particularly useful when there was a "meeting in the middle of a skill set" for tasks that could be completed by multiple team members. However, they also cautioned about its dangers and limitations. If ecological interchangeability is blindly pursued, people might lose track of their ability to know their limits, which may result in fatal outcomes. Careful attention needs to be paid to the trade-off between generalizability and specialization. Both are necessary in human teamwork. Therefore, we encourage fluid teams in healthcare settings to think about not only the limitations of ecological interchangeability, but also its potentialities.

In the healthcare setting, our study suggests that fluid teams may employ interchangeability as a strategy to provide what they perceived as the best care to the patient. As our participants described, during disruptive events, social and emotional aspects may take precedent over checklists, processes, and scopes of practice. When that happens, the boundaries of a team might expand to include more than the original members or more than their typical tasks. This suggests that while policies, checklists, and scopes of practice are important organizational features of ensuring patient safety, they must remain flexible, or people may circumvent them. Focusing solely on organizational features (i.e. scopes of practices) fails to account for the significance of the social and emotional fabric underpinning fluid team adaptation. This represents a threat to fully appreciating the inherent complexity of healthcare practice (Bedwell et al., 2012).

The need for organizational flexibility was especially clear in the stories we heard about lynchpins – i.e., those people with the willingness to navigate and troubleshoot the various aspects of ecological interchangeability. In our view, lynchpins appeared as another catalyst for adaptive expertise in fluid teams. Always willing to learn, willing to expand their scope if provided with supervision, willing to cut through the discrepancies of rules and checklists, lynchpins were present in most disruptive events. While highly valued by their teammates, lynchpins were rarely visible to the organization. This may be explained by the traditional conceptualization of teams as bounded groups where every member must abide by a scope of practice (Davidson et al., 2007; Mortensen & Haas, 2018). There's no scope of practice for lynchpins because they are the jack-of-all-trades. Therefore, if we are to embrace the recent calls for conceptualizing teams as participation hubs, rather than bounded groups, it would be useful to think about lynchpins as 'resource brokers' that fluid teams require to successfully deal with disruption (Mortensen & Haas, 2018). As such, depending on the

nature of the disruption, the need for resources will change and therefore, who the lynchpin becomes will shift, rendering them interchangeable as well. We have a lot to learn from them including: does adaptive expertise in fluid teams hinge on having a lynchpin? Or are lynchpins a product of highly adaptive fluid teams? This requires further exploration in future studies.

Ecological interchangeability requires more than the individual team member's cognitive capacity to embrace efficiency and adaptation (Schwartz et al., 2005). It requires an environment to gain traction and flourish. People may not buy into ecological interchangeability if they do not have a leader who is able to step back and foster situational leadership. People may not buy into ecological interchangeability if they are not introduced to it formally (cross-training policies in tactical teams) or informally (teaching each other when available in healthcare or business). People may not buy into ecological interchangeability if they don't feel that they belong to a team where everybody supports each other. We acknowledged that the latter might be difficult to achieve in industries where fluid teams are drawn from a large pool of professionals, as it happens in healthcare. However, using this difficulty as a justification for rejecting the idea of ecological interchangeability is more harmful than productive. Regardless of whether people or institutions are comfortable with the idea, ecological interchangeability is happening because it is a necessity for fluid teams to deal with disruptions – as we saw during the Covid-19 pandemic (Cristancho et al., 2022). To harness its full potential requires that we thoughtfully consider its principles. We can look to other industries for lessons on how we can thoughtfully employ principles of ecological interchangeability and adapt these to medicine.

As a preliminary study, we narrowed our focus on a few successful instances of interchangeability. We acknowledge that this decision prevents us from making broader claims about theoretical and practical implications of how ecological interchangeability might impact team performance. However, we suggest that this preliminary study still represents a valuable contribution to the literature around team adaptive expertise. On one hand, it brings awareness to a complementary conceptual lens – sociobiology – that team researchers can use to further unpack team strategies that are currently perceived as problematic, such as interchangeability. On the other hand, team adaptive expertise and team fluidity are areas where empirical studies in real work settings are nascent. Through this preliminary study, we were able to identify some conceptual connections that may be useful for further explorations of fluid teams, as the most likely staple of teamwork research in the future.

Furthermore, given the preliminary nature of this study, we did not investigate issues around risks/misses/failures. While we asked participants about the drawbacks or times ecological interchangeability may have failed, we heard very few of these stories other than suggestions that some team members may "go rogue" without guidelines and that resource limitations (e.g., limited staff) may trigger ecological interchangeability. Understanding how these issues may impact team members – both positively and/or negatively – remains to be explored. Similarly, the impact of team size/composition, the changing tenure of the team, and the uniqueness and dynamic nature of work contexts in the enactment of ecological interchangeability will require more sophisticated methodological approaches (Kerrissey et al., 2020). These insights will guide the next phase of the CASTe program's exploration of interchangeability in fluid teams.

In conclusion, our preliminary study suggests that ecological interchangeability in fluid teams is more versatile than the type of interchangeability – i.e., switching roles – exhibited

by social insects. However, when it comes to responding to disruptive events, social insects offer us an entrance point to the scientific conversation around whether and how interchangeability may be a defining feature of adaptive expertise in fluid teams.

Appendix 1

Theoretical Sampling Interview Guide.

One finding we saw with experts from these interviews was the concept of interchangeability during events that required adaptation. What we mean by this is:

- A team's focus on cross training – for example making sure all team members are trained in life saving measures during military events in case the Physicians are harmed.
- Pushing scopes of practice – in smaller hospitals Nurses taking charge while Physicians are busy in resuscitations.
- In tactical, they train all team members to automatically assume the role of a colleague if that colleague is harmed, to complete the mission.
- How do you understand the concept of interchangeability in your context? Are there words people use to describe the phenomenon (say cross training, redundancy)?
- What are your perceptions of interchangeability?
- Can you think of times where you saw interchangeability happen? During these events was interchangeability helpful in the scenario? A hindrance?
- Are there benefits?
- Are there risks? Can you think of specific examples?
- What enables this?
- What limits this?
- Are their social dynamics on your team that enable/hinder it?
- Are there institutional/administrative/medico-legal factors that shape interchangeability in your context? What about the role of hierarchy?
- Interchangeability brought up many emotions for participants – what emotions does it evoke for you?
- Any final thoughts other the concept of interchangeability for adaptation?

Additionally, we found that every interview contained reference to a person who was a "lynch pin, jack of all trades, gets things done" when cases required adaptation. These people often filled gaps or helped navigate the obstacles.

- In your experience, do you have "lynch pins"? Who are these people?
- Can you think of a time where one of these people were instrumental to moving a case along?
- What is your perception of these "jack of all trades"? (probing questions – are they necessary? Should we train for them? Are there risk? Do they highlight system affordances/flaws?)

Appendix 2

Healthcare

"The worst paediatric night I'd ever had in my life".

The first one I got, I think, was a really bad croup kid. Sometimes they actually have to be intubated, usually in the Operating Room, sometimes even a tracheostomy. [I thought to myself], *is this kid sick enough to pull the rope?, which would mean I'd get the paediatrician, the ear, nose and throat surgeon, and anaesthesia, and get this kid up to the O.R.*

Then I got called to the room across the hall with a kid that weighed five pounds, and had been in the neonatal ICU in [city] *for three weeks, had just been discharged. They just picked this kid out of the car seat, and it was a floppy … the child looked like he was dead. I'm kind of, oh my goodness. We started resuscitating this kid. I called the paediatrician and said, you've got to come now, I am in trouble, you've got to manage this kid. She helped me a little bit in terms of, here's the plan, here's what I'm going to do. Got it started, and then I could leave that plan with the nurses Ie there really wasn't much else.*

Then a kid came in seizing, that we couldn't stop, and it was the grandson of probably the best nurse that we had in our Emergency department. There's one physician, three nurses, and all of these [kids] *were kind of like, whoa. People were really good, and stepped up, and just called for help. Paeds people came … the nurses said, you've got to give us some more help here, and they would…, we can take this kid up, and we can watch them, the paediatrician is there. We're overwhelmed, but people just did their job, called for specific help, and we knew what help was there, and we could call for it. It wasn't like a code blue where you get a thunderous, 20 people coming in. It was more like, look, this is what we need, this kid needs to be transported, I'm not doing the transport because I've got a mess here, so the paediatrician had to leave and transport that kid back to* [city]. *The second kid who was seizing, we were able to get a CAT scan, and it turned out he'd had a congenital stroke when he was born, and had differences in the sides of his brain, and probably should have gone to* [city], *but* [city] *was full, and so we had to kind of keep managing him.*

I won't forget that night. It was kind of, yeah, if you can get through that, I'll be able to get through all the other stuff.

Policing

A child was kidnapped and was held by a deranged relative with a knife and was not going to let the child get back to the family. He felt that the child was in danger with the family so if he was to send the child to heaven he'd be safe.

So with that we bring two teams in so it just allows us a lot more resources to be able to deal with any contingency. So what we have when we get into these type of calls we have our main action plan. In a perfect scenario this is what's going to happen. In our main action plan is always we're going to negotiate a surrender, that's our action plan all the time. He refused to talk to us so there wasn't much for negotiations.

We have a three year old that's inside this place whose life has been threatened, we have to be in a position to act quickly. So while the main action plan is the one that is the optimal one, we're now coming up with an immediate action plan. This is why we bring in two teams for a hostage rescue is that we'll have the closest team set up out outside the door ready to

make an entry if needed to rescue the child. As the other team arrives they're going to kind of augment our support around the building. If we need additional people inside then we can bring them in and really set ourselves up for success with multiple options. We do have a protocol so for hostage taking or a barricaded person we know what we're going to do, but until we actually get there because every house is different. Are they in the upstairs of a house or in a second or third story apartment building? So, it's not a cookie cutter per se this is what's going to happen at every call, but we have our general knowledge.

We have a rank structure because we're police, but realistically the most junior member on ground has as much say in the operation as I do as the Unit Commander. I could be a kilometre away at a command post and I'm looking at pictures, but I'm not seeing really what's happening there. If I tell them do this and they say no, we can't do that, well okay, I'm not even going to ask why. So then quite often then when I'm coming up with alternate action plans it's actually coming from the information that the members on the ground are giving me because they're saying we can't do that but this is what we can do.

Military

We were supporting another QS force and heading to pick them up not expecting injuries actually. And that's quite frequent because the most dangerous times of these operations is usually when you're putting the troops into the area where they're going to work, picking them up, because of the aircraft and the attention it draws.

There's was a mechanical failure of the second team's aircraft that crashed, not in the location we were headed to but short of it. It was completely unexpected; it wasn't enemy action it was just out of the blue. It happened to coincide, unfortunately, with a [soldier] getting shot almost simultaneously. In one ear the radio is, the aircraft went down next to us, and the other ear is there is a [soldier] shot. It was hard to decipher whether those were conflicting or whether they were the same account because frequently the information is inaccurate at first.

Because we were so close and flying in tandem, we just landed with the aircraft that had crashed. And we had to immediately come up with a plan, because we knew that there was someone else not too far away that we needed to get and bring to [safety] as well as the people in the aircraft that crashed. So, it was sort of a stressful few minutes of coming up with what was available for resources. We figured the fastest way to get people out of the area was to split our team even further and to send two individuals to a third aircraft that landed, picked them up and went to pick up the [soldier]. And then we all decided to meet back at one of the original contingency landing sites to get together, reconsolidate the team, figure out who was injured, what the injuries were, what we needed to do and then continue the evacuation.

Unfortunately, we were missing an aircraft, which is a lot of space and lift to get people out. So, we were rapidly assessing the patients, treating the patients and then deciding what we could leave behind that, obviously, wasn't sensitive material or what could be just thrown out for weight and space. There was kind of a hasty few minutes of figuring out, even though you might not have wanted to throw it away, what could be thrown away. And get all the sensitive items out of the crashed aircraft and then getting the patients reorganized and then getting out of there as fast as we could.

Business

In the wealth advisory business, probably the thing that causes clients the most pervasive disruption personally and financially is market fluctuation. Because market fluctuation isn't necessarily about just the dollars. It's about the impact that the dollars have on either expectations, plans, business, all that stuff. It's the emotional disruption or almost trauma that it causes.

I think the biggest thing that I felt in 2008's financial crisis is that I was waking up every day and I was either getting shot by arrows every day or getting stabbed every day. This lasted from October to March. So, from a client perspective, the truth of the matter is that we were at the abyss. There's no doubt we were at the abyss. What do you tell people? You just have to weather the storm, right? So, I created the diagram just to give clients a vision of our path. I think I used this thing hundreds of times. And I didn't know if exactly it was going to happen the way that I presented, but I had faith that it was going to actually happen.

Now, that's the clients. On the team side of things, here's the challenge, we are a fee-based advisory firm. There's no commissions that we charge. So, if the clients are down, say 25% in terms of their portfolios, business revenue is down by 25%. And 25% decline in revenues isn't necessarily a small number. So, from a team perspective, and I had a team of five people then. You have the admin person or the client service person, who are getting feedback from the client because if they're calling in needing money, everybody is saying, by the way, how is my account? And neither one of these positions are advisors, but yet they have to kind of shift and pivot or adapt… Even though their job is to schedule appointments and, they're being asked directly or indirectly to provide peace of mind on something that they have no understanding of how to provide you peace of mind.

Two things popped out of this 2008. Everybody had to quickly adapt. We were fielding the calls that came to start answering some of these questions that people had. But what we had to do with everybody on the team is we had to get them to breathe, because even though they weren't giving advice, if there was fear or anxiety about the stability of their jobs or really kind of a sense of dejection, it didn't matter what they said, that's going to come through in the conversations.

Paramedic

This here is a concrete monolithic block. It's about 50,000 pounds. It's about two stories tall, and I want to say about 15 to 20 feet across, and this person's legs are underneath it so he's pinned and crashed underneath it. This is where we landed, and then we had to travel down so we're not very close. We had to go through forest, and there's a river running along, more like a stream.

So, as we were getting a little more information, saying that this is going to be a prolonged extrication, we started thinking about going and getting other things from local hospitals, like, more blood. And this idea of whether we need a surgical site team, and then also to manage the very specific injuries he had, which is probably going to be crush syndrome, so that's another thing where we have to just get all these other supplies. So, when you get there and then when you take an actual look at it, all of the steps of just getting to him physically are, like, well, this is complicated just to get to him. And these would be the airbags, we were trying to lift it, but it was too heavy for them. We tried to cut him out of

here. We couldn't chisel the rock away, and then we had to call in a crane to try and lift it off of him. By the time you get there, you're up to your knees so you're wet, everybody is standing in water, and it was also 40 degrees that day with the humidex. It was ridiculous so yeah, you start to think about all of these other things that you don't normally need, and then how you're going to get that.

The number of people that are involved in something like this, when you add them up, it's just astounding. There are so many different groups, and that's part of the challenge there as well. You're trusting that the Fire Rescue has it together as to what they're going to do, and what their options are for getting this done. We have to keep managing the patient, and they've got a lot of things to focus on so keeping the communication happening and point people to keep the right people talking to each other is a bit challenging. And then we have the surgical site team, who by the way have no out-of-hospital experience, and they show up in scrubs. They have no gear. They're not prepared for this. They're really ill-prepared so we've got to also deal with making sure none of them get hurt, and work with them to try and get their expertise in there where appropriate.

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