

Building a Taxonomy to Understand Health Care Worker's Response to Workplace 'Pressure' in Complex, Volatile and Emergency Situations

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Abstract

This research aims to better understand performance under pressure as experienced by health and emergency staff in the workplace. Three basic questions underpin the work: (1) how do health and emergency workers experience and make sense of the 'pressures' entailed in their jobs? (2) What impacts do these pressures have on their working lives and work performance, both positively and negatively? (3) Can we develop a useful explanatory model for 'working under pressure' in complex, volatile and emergency situations? The present article addresses the first question regarding the nature of pressure; a subsequent article will address the question of its impact on performance. Using detailed interviews with workers in a range of roles and from diverse settings across Ecuador, our analysis aims to better understand the genesis of pressure, how people respond to it and to gain insights into managing it more effectively, especially with a view to reducing workplace errors and staff burnout. Rather than imposing preformulated definitions of either 'pressure' or 'performance', we took an emic approach to gain a fresh understanding of how workers themselves experience, describe and make sense of workplace pressure. This article catalogues a wide range of pressures as experienced by our participants and maps relationships between them. We argue that while individuals are often held responsible for workplace errors, both 'pressure' and 'performance' are multifactorial, involving individuals, teams, case complexity, expertise and organizational systems and these must be considered in order to gain better understandings of performing under pressure.

Keywords

health care professionals, performance, pressure, grounded theory, taxonomy

What do we already know about this topic?

There is evidence that the impact of workplace pressure forms part of a vicious cycle, whereby pressure itself will compromise staff performance and, in turn, that compromised performance places greater pressures not only on the individual but his or her team, patients and the system as a whole.

How does your research contribute to the field?

What this article attempts to do is to list and classify the multifactorial nature of pressure in order that it be easier to understand and as a basis for interventions in different

scenarios for health care workers. Pressure can be a constructive and productive force. The system and its personnel are tasked with monitoring the pressure ecology of pressure and managing it productively.

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What are your research's implications towards theory, practice or policy?

In this sense, the classification foregrounds a range of pressure points which might be useful for monitoring, evaluation, auditing and moderating workplace pressures for health care workers.

Introduction

Performing under pressure is a fundamentally important workplace issue, not least for complex, volatile and emergency situations.² Working under pressure has the potential to lead to serious consequences including compromised performance of staff, teams and systems clinical errors and adverse patient care outcomes; deteriorating staff wellbeing, burnout and attrition; compromised emergency and clinical team integrity; and wider systemic and organizational dysfunction.²

Pressure in the workplace has been studied in several settings. Many studies have examined pressure from physiological and psychological perspectives, mainly through studies on stress.³⁻⁵ These studies have been able to link adverse events to changes in biochemical markers, which have typically been called stress indicators and stress reactions.⁶⁻¹¹ While this work is very valuable, we argue that it suffers from being reductionist: first, there is the risk that a diverse range of complex, multifactorial events be reduced to a single category of individual 'stress', and second, these extremely complex events are assessed using a few physiological indicators; the focus is typically on the physiological impact on individuals. In our view, there is a need to step back from the concept of 'stress' and to revisit workplace pressures in a broader sense in order to develop a rich and complex understanding of diverse pressures, their genesis and their consequences and to model these events in order to permit more sophisticated interventions.^{2,12,13} For this reason, we chose not to use the term 'stress' as the lynchpin of this project; instead, we opted for the less restrictive term 'pressure'. Further, rather than approaching the research with the term already (possibly too narrowly) defined, we felt there was a need to approach people in the workplace to unpack and catalogue their understandings of what might constitute pressure for them. We are interested not only in the impact on individuals and, indeed, their physiology, but also in understanding pressure on teams and organizational systems, which clearly do not benefit from having biochemical markers.

Studies have shown that pressure can stem from many sources and that multiple pressures can arise simultaneously.^{13,14} For this reason, we took a wide perspective and intentionally set out to gather rich contextual data. An additional dimension to understanding pressure in the workplace is when it occurs in complex, volatile and emergency situations.^{2,3} These environments might be expected to be particularly susceptible to

pressure in acute and severe forms and with especially serious consequences for both staff and patients.¹⁴⁻¹⁷ To understand these issues better, we first reviewed the literature on pressure in aviation,^{17,19} the military²⁰ and other high-performance roles outside of patient care settings, and second, we incorporated scenarios from beyond institutions such as hospitals²¹ to include field emergency workers,²²⁻²⁷ workers preparing for natural disasters and staff in solo and remote locations.²⁸⁻³¹

Recognizing the diverse nature of 'pressure' also raises the possibility that the impacts of that pressure are similarly diverse.⁴ This possibility is supported by the literature and was something that we needed to account in our research, consequently, in keeping with the principles of purposive and maximum variation sampling. We also sought out situations involving workplace errors and patient safety, as well as possible impacts on personnel such as staff burnout, attrition and immediate and long-term hazards to staff wellbeing. We were interested in what ways workplace pressure might contribute to both safer and less safe workplaces for both staff and patients.

Finally, teams with suitable support systems often handle complex, volatile and emergency situations more effectively. Attention therefore needed to be directed to how those teams and systems might be involved in an 'ecology of pressure'. The literature identifies teamwork as a vital tool for managing complexity,³²⁻⁴¹ but it is also the case that pressure can stem from systemic, organizational and team dysfunction.⁴² There is evidence that the impact of workplace pressure forms part of a vicious cycle, whereby pressure itself will compromise staff performance⁴³ and, in turn, that compromised performance places greater pressures not only on the individual but his or her team, patients and the system as a whole.^{44,45}

In summary, this research seeks to understand the following question: How do health and emergency workers experience and make sense of the 'pressures' entailed in their jobs; and as a result, can we develop a useful explanatory taxonomic model for 'working under pressure' in complex, volatile and emergency situations? This article primarily addresses this question.

Method

The present article reports on our findings for the research question: how do health and emergency workers experience and make sense of the 'pressures' entailed in their jobs?

Before data collection, the informed consent was signed by the participants accepted by Griffith University Human Research Ethics Committee, The Reference Number MED/05/15/HREC. Data was collected using in-depth interviews of key stakeholders⁴⁶ and analysed using a 'Grounded Theory' framework according to the methods described by Glaser et al⁴⁷ with modifications outlined by Layder.⁴⁸ These changes allowed the project to take macro, micro and contextual perspectives into account and to incorporate interviews.

Table 1. Descriptive characteristics of participants.

Gender	M	F
Age (range mean years)	36–55	25–45
Experience (range mean years)	11–30	5–20
Profession	M	F
Paramedic	5	2
Nurse		13
Medical doctor	18	5
Pharmacist		1
Laboratory		1
Highlands	10	9
Tungurahua	1	2
Pichincha	5	6
Imbabura	4	1
Amazonas region	9	
Tena	3	
Puyo	1	
Sucumbios	3	
Francisco de Orellana	1	
Zamora	1	
Coast and Galapagos	5	12
El Oro	3	4
Guayas	2	7
Galapagos		1
Total	24	21

Elaborated: by the authors. The numbers in bold are important because it can help the differences between the participants.

This methodology underpinned the development of new and more meaningful conceptual models for understanding the phenomena and provided a solid basis for developing effective, culturally appropriate interventions that could be further tested.

Detailed interviews were conducted with 45 health and emergency workers occupying diverse roles and from a wide range of locations across Ecuador. We chose Ecuador as the focus for our fieldwork because Ecuador is susceptible to natural disasters and one of the researchers (AZ) has extensive experience and detailed first-hand knowledge of the health and emergency care system of that country. The follow locations, settings and roles were sampled:

1. Geographical locations: the Galapagos Islands, the equatorial Pacific coast, the cold-climate Andes highlands, and the remote Amazon basin.
2. Workplace settings: hospitals, emergency departments, paramedic and emergency field operations, and remote, solo practices.
3. Workplace roles: hospital surgical staff, emergency department workers, field paramedics, staff involved in a rapidly developing cholera epidemic, natural disaster teams preparing for a seismic event, and sole practitioners in remote jungle locations (see [Tables 1](#) and [2](#) for a full list).

Importantly, for the purposes of this research, participants had a dual role: (1) they provided their own personal accounts of working under pressure, and (2) they also functioned as field observers and provided in-depth data on complex social systems and wide-ranging high-pressure scenarios. Therefore, the sample size was considerably larger than simply being the sum of the individuals who assisted us with interviews.

Data was analysed using standard qualitative methods: interview data was transcribed and coded, related data was grouped into categories, relationships between categories were analysed and the resulting categories and relationships were catalogued and ‘mapped’ into an explanatory framework that helped us better understand and model workplace pressure.^{47,48} The research leveraged the approaches of 2 key qualitative research schools, namely, narrative analysis and grounded theory. The data was initially collected in narrative form with the assistance of an open-ended interview guide that was designed to facilitate and focus discussions without restricting where they might lead. It was important for the research to gather rich accounts with extensive contextual detail. Moreover, both pressure and performance entail concrete and subjective elements and the interviews were intentionally left open to both. The theorization and model-building component of the research broadly followed the principles of grounded theory, with the aim, in the first instance, of developing a ‘taxonomy of pressure’.

Findings: Towards a Taxonomy of Pressure

Participants provided concrete descriptions of activities and scenarios that delineated their personal experiences of coming under pressure. Based on these descriptions, we were able to confirm that workplace pressures assume many forms and have diverse origins.

Working under pressure; I think there are several aspects as there are many variables. For example, it can be when we need to decide, of time, the roster, or we may have personal and family problems. When we are working under pressure, you also have very complex cases, in my case, surgery. (M39A-MED)

Participants described their individual performance, other people’s actions and the scenarios and settings in which pressure was situated. The management of crises demonstrated a collective, team-based element, which functioned within wider health and emergency systems. These contextualized descriptions formed the basis of the ‘taxonomy of pressure’ described in this article. It was possible to divide the different forms and sources of workplace pressure into 5 broad categories:

1. Pressures relating to personal qualities and individual circumstances of staff.
2. Pressures relating to having adequate training, skills and expertise.

Table 2. High-pressure scenarios.

High-Pressure Scenarios Captured in the Interviews

- Preparing for the eruption of Tungurahua volcano
- From Nepal to Ecuador and disaster preparation
- Hospital evacuation after an earthquake
- A day in the life of a paramedic
- Rescue in the Amazon region
- Double identity: fire-fighter and paramedic
- Under water rescue
- An oil refinery inferno
- Refinery worker dies from an electric shock
- Civil unrest
- Disaster preparation
- Delivering twins in the jungle
- A patient from the Amazon region in a critical condition
- A busy cardiac department
- A cholera epidemic
- Multiple simultaneous cardiac arrests in the Emergency Department
- Emergencies at the Galapagos Islands Hospital
- An operating theatre
- High-complexity cardiac surgery
- Problems in the operating theatre
- A post-surgical ward
- Emergency surgery following a car accident
- Neonatal intensive care

Elaborated: by the authors.

3. Pressures relating to the complexity and unique properties of presenting cases and individual scenarios.
4. Pressures relating to teamwork, collective and inter-personal factors in the workplace.
5. Pressures relating to structural and organizational arrangements.

Importantly, while it was possible to differentiate various classes of pressure, we found that it was essential to take a ‘whole-of-systems’ approach in order to understand pressure. Particularly, it was necessary to consider pressure in its wider context, to understand pressure and its consequences as a composite process that typically accumulate over time and is usually an element of a conglomerate of pressures that need to be considered to understand the impact of any particular pressure. Further, we found that although pressure could be assigned to a category, pressure ‘bled’ between categories, for example, personal problems can manifest as team-based dysfunction and poor administration that trigger stress and burnout in individuals.

Pressures Relating to Personal Qualities and Individual Circumstances

Workplace pressure is often (though not exclusively nor even predominantly) attributable to individuals who operate in the

workplace. Our data reveals that these ‘individual’ pressures can stem from the character, personality and disposition of particular staff members; their state-of-mind, level of mental and physical preparedness, sense of life fulfilment, professionalism and commitment to the job; the intrusion of personal pressure imported from extramural events and circumstances such as relationships and financial difficulties and the degree-of-fit between skills and the work to be done. Pressures relating to personal qualities and individual circumstances can be broadly classified as those stemming from:

1. Personality, character, beliefs and values;
2. Morale, state-of-mind, fatigue, burnout and personal toll;
3. Job fulfilment, acknowledgement and personal reward;
4. Career advancement and professional aspirations;
5. Extramural pressures, family, financial;
6. Training, experience, skills and expertise (see later);
7. Correspondence between personal capacity and role.

While it is often the case that pressure can have a corrosive effect on the workplace, it should not be assumed that this is always the case. To a certain point and in the right way, pressure can help to focus and motivate staff and, at the risk of sounding clichéd, pressure can sometimes bring out the best in people:

Pressure is giving me the strength to do what I am doing; I am talking about human life. I am giving everything that I have for nothing in exchange. (M45H-PAR)

As we can see from the above quotation, there is a sense in which pressure can bring out the altruistic nature of people and that this is experienced in positive and rewarding ways. The same is also apparent in the following case:

Saving a patient's life makes you feel great. You can do something marvelous. As a doctor, I have been in life and death situations that you will never forget, and it helps you to grow. (M39H-MED)

There is a sense that the work in high-pressure, critical care situations can entail a ‘calling’, something which is most commonly associated with religious sacrifice and service.

Many people want to belong to our brigade and often to do it following a calling. The volunteer must have the conviction of service, and commitment to the group. They always must be ready and understand that no personal issue can affect their service. (M45H-PAR)

Therefore, there is a sense that such work taps deep psychological and philosophical qualities in people where there is a reward in serving a higher purpose, a ‘calling’, and

making personal sacrifices to help others. In the following quote, we can also see hints of more ‘grounded’ altruism through ideas such as motivation, commitment, responsibility, and belief in what you do:

First you need to be motivated and committed to your work. You need to believe in what you are doing and that you like this specific field of medicine. Second, you must study and take full responsibility for your actions. (M42C-MED)

Less tangible individual qualities such as intuition are also valued and regarded as strength even though they may transcend a textbook approach. This is particularly relevant to crisis and emergency situations, where scenarios can be volatile and unfold rapidly:

... as I told you, not everything is written. Therefore, I would always prefer and recommend using the established protocols for each type of medical problem and adding solutions coming from your personal experience, if needed. The intuition you have as a professional helps you to gain an in-depth understanding of the patient's condition and the surrounding circumstances. (M51A-MED)

Of course, positive responses such as altruism are not the only way that individuals react to pressure. Flaws in character and personality can impact negatively on the workplace and contribute to the escalation of pressure, for example, by undermining teamwork:

Sometimes, doctors lack humility and don't know that everybody has a role. In a cardiac arrest without a nurse, you do not do anything, you cannot do it by yourself, the same thing if the nurse is alone, and she would not be able to do anything, as well. (F37H-MED)

Moreover, working under pressure can take its toll, the most obvious example of which is fatigue:

There are occasions that fatigue affects me. Some days are very hard. I feel fatigued and sometimes around 12 noon you just cannot continue, but I just washed my face and kept going. (F33H-NUR)

Moreover, fatigue is more than merely a physical problem that can be fixed with rest. Mental fatigue can also have important consequences and might not be as easy to fix:

My work produces physical and mental fatigue; you do not want to keep going with your job the next day because you had a rough day, tough situations, many patients waiting at emergency, doing surgeries all day and all the complications that could happen in those surgeries. (F46H-MED)

While pressure can have adverse consequences that compromise critical situations, even under the best of

circumstances ‘failure’ can and does occur and can feed back into the loop with sustained consequences long after the original scenario has resolved:

The thought of failure has affected me in the past. When I see a patient in cardiac failure or arrhythmias, one decision can make the difference, meaning that the patient could live or die, it is so hard! You know, years pass by, and you do not recover, and that has a significant influence, when you lose a battle... (M39H-MED)

The way that emergencies unfold can take their toll on staff, which can be deep long lasting. In the following example, the worker describes the first person to die under his care, which is a profound experience. However, the event was further compounded because the person who died was known to the worker and was a friend:

The cardiorespiratory arrest was due to a [electrical] burn in the heart and part of the lungs. It was something that affected me because it was the first time that a patient died in my hands. I also had to do the autopsy of the patient with the legal doctor who was employed at this zone, and it was where we realized that the heart had been carbonized. It was a tense evening, full of painful emotions because he was a worker who I saw every day. After this experience, which is very painful for many reasons, not only because I lost a friend, but also because it was the first time, I lost a patient in my hands. (M33A-MED)

To only focus on fatigue as a consequence of working in emergency situations and a source of pressure, risks seriously underestimating the impact of the pressures involved, as the last case indicates. The mental health consequences of repeated exposure to severe trauma go far beyond fatigue, to include distress, depression, ‘burnout’, post-traumatic stress disorder (PTSD) and possibly even suicide:

No matter how good a professional you are, or your real criteria, dedication, effort or even if you like your job, you can get tired. If you add personal problems and emotional circumstances, you could even sometimes get depressed. I have felt it, and I got over it by changing activities. However, I think there is a progressive burn-out of medical professionals that need to be taken into consideration. I can confess it as I felt fatigued. (M58A-MED)

To a certain degree, workers are aware of the potential physical and mental health consequences of emergency and crisis work, but it is possible that even those at the coalface may be underestimating the toll that such work can incur. Some workers take informal steps to manage their stress and to undertake some self-care:

I tried, when I am not on my night shift, to go to our country house to relax. Sometimes, we go on Saturday when I am not on call. We stay there, and we sleep there, and that helps me to relax on Saturdays. (F46H-MED)

Of course, this strategy depends on having enough resources and access to a place to retreat to and to engage in relaxing activities.

There is also evidence of a level of official awareness of the issues:

Fatigue is critical and is something we have discussed in strategies with the government. I can attend twenty-five to thirty-five patients daily without a break you are tired, you can miss some important details from the electrocardiogram, or from the medical record and it could have an enormous impact on the final clinical outcome. (M48C-MED)

What is not clear from the current research is whether there are any substantive proactive measures being taken to manage these important issues.

Pressures Relating to Training, Skills and Expertise

The ability to cope under pressure depends on the skills-base of individuals, teams and organizational systems. It is appropriate to think of skills as not simply applying to individuals, but also collectively. Teams and organizations also need to learn, adapt and continuously refine their operations.⁴⁹ The present research identified many factors that contribute to developing a suitable skill-base. These include professional qualifications, field experience and peer-based mentoring. Because of the broad applicability of this category, ‘training, skills and expertise’, we opted for a stand-alone section. In terms of individual and collective capacity development that contributes to the genesis and moderation of pressure, the present research identified the following important aspects:

1. Formal qualifications;
2. Continuous professional development;
3. Induction, in-service and on-the-job training;
4. Mentoring, peer and team support;
5. Supervision, debriefing and case review;
6. Experience and learning-by-doing;
7. Team building and collective capacity development;
8. Systems learning, development, testing and CQI.

Experience as a means of dealing effectively with difficult situations featured prominently in the data. Indeed, experience was arguably considered more important than formal qualifications, particularly when working under pressure. Formal learning was seen more as providing evidence of suitability for the work, but not necessarily being equipped.

... you must first study and demonstrate that you have become a reliable person, able to perform the medical process under changing conditions in time. You need to understand the meaning of experience in medicine and take this with the utmost responsibility. (M42C-MED)

When experience fails to provide the way forward, only then did workers resort to ‘first-principals’ such as those learned during formal training. But the seemingly infinite variety of high-pressure and emergency situations often meant that flexibility and innovation were always required and that textbook approaches were rare, without adaptation.

I knew what I had to do when the situations arose. I think experience helps you to bring out what you have inside, and then all ideas and experiences come to your mind and then knowledge, experience and successful interventions together underpin my decision-making. (M43H-PAR)

Considerable importance was attached to experience as the gold-standard means of developing high-level skills and expertise for which there is no substitute, perhaps the closest being simulation.

However, as long as you gain experience, you learn that those experiences help you to adapt yourself to the pressure of getting fast and good results with the patients. You improve your skills and performance; consequently, you improve the quality of the clinical outcomes. (M42C-MED)

The value attached to experience reveals the opposite that inexperience is considered potentially dangerous and this adds pressure to emergency situations.

There are always errors because they are new employees and they do not have enough training. (F40H-NUR)

This raises an important paradox: new workers must start somewhere, and teams will inevitably include novice workers and newcomers who are unfamiliar with the specific situation. Inexperienced team members need to be managed systematically. One safeguard that improves performance and modulates pressure is when more experienced team members take the lead and mentor novices and pass-on their skills.

For example: when there are no other medical doctors in the department, I assume the leadership role when we are in a reanimation procedure. Some nurses understand the medical language. However, there are others that have less experience and misunderstand orders. It affects the outcomes of reanimation proceedings negatively. (M30C-MED)

By definition, experience, skills and expertise are not qualities that workers possess from the outset. Skills require systematic stepwise development with arrangements to ensure this is done safely:

I assessed myself a lot when I started, and now there is a radical change in my practice. I had many doubts when I first came, I was training myself, I did not dare to do complicated surgeries, but

now I do it with a lot of confidence and decisiveness, and I do it well. (M53H-MED)

In the following example, participant M45H-PAR, a paramedic with extensive experience in rescue activities, was called to a lake where a person disappeared. The rescue group was immediately activated to perform search activities and the team included dive members who were undergoing training:

We worked at the lake; it was very dark, and the body of the victim with the diver appeared on the surface. The diver was in shock in a panic mode as he inflated the jacket, rising very rapidly to the surface. It was a dramatic moment. I made a mistake [sending a novice diver down]. It is necessary to do an extensive evaluation of this case. [M45H-PAR]

M45H-PAR had asked a new member of the diving group to conduct the dive. He realized that the team member to be selected for a mission must have extensive training and experience.

In this kind of rescue, previous knowledge, time of training, personal experience, as well as the last induction and previous voluntary work need to be considered. (M45H-PAR)

Pressures Relating to Case Complexity and the Unique Characteristics of Individual Scenarios

The next major source of pressure stems from the specificities of individual emergency scenarios and the complexity of the cases to be managed. The unique, volatile and unpredictable nature of many crises demands flexibility from individuals, teams and systems. Paradoxically, this complexity makes standardized treatment protocols invaluable, especially when time is of the essence, but also restrains their usefulness, because all cases are different. In terms of case and scenario complexity, the present research identified the following broad sub-categories that moderate pressure:

1. Capacity to assess the situation and mobilize a response;
2. Caseload, case complexity and technical requirements;
3. Scenario specifics: location, event, timing, scale and volatility;
4. Conflicting opinions and clinical judgement;
5. Capacity limits, escalation, calling for help, bailing out;
6. Families and significant others;
7. Correspondence between case complexity and systems capacity.

As the following respondent points out, there are many variables to be weighed up and taken into consideration, often under considerable time pressure.

In front of a complex patient case, there are variables; will you operate or not? Because the surgery must not do more damage to the patient; for example, in trauma, if you made the decision to operate it would save a patient's life if that decision is accurate and made at the correct time. Usually, the decision is made entering the surgery room or in the resuscitation room. Sometimes the most important decision is whether I go to the theatre or not. (F55H-MED)

At the core of this process is the pressure that stems from the patients themselves where the same interventions that may save a life can also be dangerous. At the very least the clinician is mandated to 'do no harm'.

Pressure in the medical field means that we as health professionals want the patient recover from their illness. The patient is pressure; if the patient is not doing well, that is a pressure for me. (F37H-MED)

In the face of complex situations time can be of the essence, and time pressure can compound the range of other pressures that the case entails.

Some patients have more complex medical concerns or medical conditions, and you need more time for examination. (M39H-MED)

At critical points, an orderly approach that is calm, efficient, effective and clinical is asserted to counteract what is essentially a chaotic event that can easily spin out of control:

When we have a patient in cardiac arrest a blue code is activated. It is assumed that the staff are qualified for the care, for the first aid and advanced procedures. My aim is to concentrate on a cardiopulmonary reanimation procedure and help the patient. There is such disorganization. There are so many people in an area just running from one place to another and shouting including clinicians when the reanimation procedures fail. (M30C-MED)

The health professionals' decisions, in this case, are based on standard procedures, and they call for assistance when the situation requires more specialized professionals. Clarity about roles is important for organizing the pressure into manageable chunks: classically this is first aid followed by definitive management. Of course, the first aider needs to be able to assess the situation, intervene appropriately and know when their limits have been reached and hand the case on to other professionals. As we noted in the first section, individual personality (ego and humility) of the first aider can impinge on the exact point when the decision to hand the case over occurs.

The way team member's experienced pressure was different from individual pressure as working in teams potentially adds to the complexity of the situation. The key point

here is that pressure (in the form of counter-productive panic) can be contagious, not least in the face of a deteriorating situation.

Teamwork is a predominant factor in your decision-making process under pressure. A good nurse can always make the difference in critical situations because if you arrive and must oversee the situation, you get anxious if you do not have enough support. An example of desperation is that you want to place an endotracheal tube and the tube could not enter, and you try hard and it does not get in. Then, you started to scream and get desperate, and if you are desperate, the team will get nervous, as well. (M61C-MED)

This latter quote reminds us that an important element of pressure often stems not from the complex case itself, but from the complexity of the team tasked to manage a complex situation. We will examine teams and team complexity as a source of pressure next.

Pressures Relating to Teamwork, Collective and Interpersonal Factors

Emergency and crisis work are often, though not always, done in teams. There are many potential advantages to teamwork in difficult situations: more hands, greater skills-base, peer support and greater capacity to respond to volatile situations. All these factors can moderate pressure, but this is not always the case. Sometimes dysfunctional teams can worsen the situation and exacerbate the crisis. The following were some of the characteristics of collective approaches that this research found could contribute to pressure, both positively and negatively:

1. Membership, individual qualities of team members;
2. Novice members, supervision and mentoring;
3. Leadership, authority and lines-of-authority;
4. Shared values and vision compatibility, bonding, cohesion, mutual respect;
5. Team dynamics, politics, rivalries, conflict management;
6. Team size, structure and role delineation;
7. Professionalism and inter-professionalism;
8. Situational awareness, team responsiveness and adaptability;
9. Teamwork, common ground, synergies, coordination, training and team development;
10. Exercises, rehearsals, systems stress-testing;
11. Workload-to-team capacity correspondence.

Team members argued that effective teamwork is facilitated through shared vision of what needs to be achieved and common ground as a basis for responding.

Teamwork is a coordination of ideas, and power to work for a common purpose. (M40H-MED)

This shared vision and common ground formed the basis for coordinating and leveraging otherwise disparate elements.

Teamwork is all working together for a common purpose, a macro objective. Each one provides a small part, which contributes to the main objective, a common goal; a team that can work together in multiple groups. (M43H-PAR)

Health professionals explained team cohesion as a high-level of understanding of each other's actions and coordination and communication to forge links between team members and create a sense of belonging to a team.

Forming and Maintaining Functional Teams

Not all teams are functional. Indeed, dysfunctional teams can greatly exacerbate the pressures people experience as part of their work.

All respondents had experience of what makes teams more or less functional. The following respondent recounts how a lack of familiarity with the skills of a newcomer to the team resulted in him being seriously injured:

I never worked with him before; he was driving, I did not know the way he worked, and as we did not have proper coordination, the ambulance jumped, and I folded down and broke my leg. (M39H-PAR)

While this case illustrates physical injury resulting from a lack of attention to teamwork, the following case illustrates the more insidious impact of fragmentation of teams and a lack of collaboration.

The lack of collaboration is what bothers me. When I see this kind of situation, I am exhausted. When that happens every day outside of schedules, staying longer shifts, covering staff that do not arrive or are sick then decision-making in these situations exhausts me. I come home tired; I cannot eat, and I just want to sleep. (F40H-NUR)

At the foundation of teamwork is to know the members well, as the following case underlines. Knowing the members capacities allows for coordination and roles to be logically assigned. Also important is to pair less experienced staff with experienced staff in order to facilitate oversight and skills development. The importance of introducing and managing inexperienced staff will be considered in more detail later in this article.

Earlier it was noted that flexibility is important because handling complex cases in a volatile situation is unique and inevitably requires adaptation of 'textbook' approaches. Likewise, teams and individuals who form those teams require flexibility in order to accommodate their idiosyncrasies.

The Role of Roles

The data demonstrated a strong importance attached to roles as a means of structuring the team and the work that the team does. Roles provide clarity in the workplace, which is especially important when people are working under pressure.

The professionals know what their role is, they know the situation, no matter if they are new or not. (F37H-MED)

Roles relate to professional background and discrete functions, but they also relate to levels of seniority and experience. By allocating roles, responsibility and lines of accountability become clearer. Roles give ‘ownership’ to the various aspects of a team’s work.

There are different roles for example: if you are the head or you are in the early stages as an observer within the reanimation team with various levels of responsibility for the decisions and the actions, as well. (M42C-MED)

While roles can lend clarity and structure to work, which can be valuable when working under pressure, they are not always problem free. In many senses a role is a territory, and territorial differences can introduce pressures into the workplace. Professional respect is required, boundaries need to be understood and observed and professional demarcation disputes can arise. Moreover, entrenched roles and boundaries can lend a certain rigidity to teams, which may not be helpful in rapidly evolving situations.

You assume and think about teamwork as an activity in which everyone will bring something, so you can help the patient. Consequently, you know what you must do, proceed, and listen to the person with the most experience. Because, he is the one, who will guide, it is going to be your support. I think you must meet the team before entering an activity. (F37H-MED)

Here again, we see the importance of knowing the capabilities, limits and indeed the personalities of the team.

Incorporating New Team Members

A recurring issue in the data concerned managing newcomers to the team. Intensely bonded teams may have difficulty accommodating ‘outsiders’, who initially seem more like intruders than dependable members of the family. Newcomers can arrive as novices with very few practical skills who need to learn the ‘trade’ of the team or they might be experienced staff who do not know in-house policies and procedures or team dynamics.

I mean many issues put me under pressure when a new employee comes to work. (F50C-NUR)

In terms of response and outcomes, the primary concern with newcomers is to ensure that there are safeguards against making errors. Communication and peer support are crucial in such a situation.

Just an example: we had a patient in cardiac arrest, and we began the resuscitation procedure; everything was well organized. However, a new nurse was there. She misunderstood the dose of benzodiazepine and gave an overdose to the patient. Therefore, we almost lost the patient. (M30C-MED)

Unhelpful rostering practices, frequent changes of personnel, staff shortages, juggling too many new team members increases both the risks involved and the pressure on the entire team. Perhaps the most valuable safeguard for ‘stress-testing’ the team and the system and for skills building is to rehearse generic scenarios in advance and often.

Some procedures have not been practiced enough. This is a disadvantage that staff rotates, and change shifts a lot. (F40H-NUR)

Leadership

Not only is leadership the glue that holds the team together, it also lubricates the way a team works. Leadership styles vary, and no role is perhaps more influenced by personality than that of the leader. Becoming an effective leader is an interesting question.⁵⁰ A feature of the data was that leaders need to be respected at a personal level. Participants clearly distinguished between being a leader and being a boss:

If you are the leader of the team, you must demonstrate you know what to do and therefore people can trust you. It is not the same being a leader as it is being a boss. The leader helps from behind if the situation requires. The boss is telling you what to do, however always far apart from the situation. (F37H-MED)

Trust and competence are fundamental to the respect extended to a leader, as the above quote shows. The quote also subtly implies that respect is mutual. While trust in the leader is explicitly articulated as a pre-requisite for respect, the idea of leading ‘from behind’ implies trusting and respecting other team members, being there to support them should they need help, but otherwise trusting their skills and the professionalism and letting them get on with their job.⁵¹ The leader plays a supporting role in a horizontal structure and is seen more as a different role among equals.

The final statement ‘we scarcely speak’ in other contexts might be read as indicating hostility. In this case nothing could be further from the truth. The statement says a lot about teamwork, that the team is so well developed that they can focus intensely on a complex, volatile and fast-moving situation knowing what other members will be doing and how

they will interact. For a team to arrive at this point requires bonding, trust and rehearsal.

Leadership is assisted (or undermined) by underlying personality traits, in the example below, maintaining a positive attitude and supplying a vision of where the work is heading are intended to facilitate the work of the team:

At that moment, I had a very positive attitude, I said: 'let's walk forward, let's do it, we can do it this is not going to last long, not forever', I looked for their concentration! I said: 'this is going to be fast; we will get the results.' I highlighted that the first intervention is the first step; the next part will be easier! (M42C-MED)

In summary, while there was extensive evidence that organizational and team leadership was essential, especially during volatile and emergency situations, we found that it was very important to distinguish between the types of leadership.

Pressures Relating to Structural and Organizational Factors

As we have seen, pressure can manifest itself in a variety of forms. Increasingly, the structure and processes of organizations, and bureaucracy increasingly adds a layer of pressure to the day-to-day work of clinicians. It is important to understand that these pressures are within the direct control of the organization to moderate or mitigate, but with increasing accountability, reporting and documentation, these tasks are becoming a bigger intrusion on the individual as they try to balance work and life. The following were some of the sub-themes this research identified that contributed to pressure, mostly negatively:

1. Workflow and workload;
2. Infrastructure, facilities and equipment;
3. Administrative demands;
4. Organizational and support systems;
5. Time pressures, deployment, rostering and workload;
6. Appointment procedures, employment conditions, recognition and remuneration;
7. Policies, procedures and medico-legal pressures;
8. Systems-to-functional need correspondence.

Either directly or indirectly, time was at the core of many concerns about workplace pressure. Directly, crisis situations require rapid responses and there is limited time to affect the best outcome. Indirectly workload can be considered as having insufficient time to carry out tasks to the required standard. Respondents reported needing enough time to understand patient concerns and follow the process of diagnosis, to prescribe treatment for the patient's medical problems, to monitor the steps of a medical

consultation and not to mention to comply with the bureaucratic demands of the 'system'.

Pressure exists because you get twenty minutes for a medical consultation. In twenty minutes, you will have another patient; then you must fill out the forms; you must do your paperwork on the computer. *You must interview the patient, and do your best in twenty minutes, with the interview, physical examination, diagnosis, and treatment. You need to solve the problem. (M38H-MED)*

The sense of pressure was exacerbated when workers felt that the bureaucratic hierarchy did not understand the need to relieve the pressure that a shortage of time exerts on staff.

Time is required for clinical practice, and this is something that neither the health authorities nor patient, not even the doctors understand properly. Time has a significant impact on all the aspects of the medical consultations and outcomes. (M44A-MED)

Time was precious when health professionals tried to fulfil the steps of the standard medical consultations and there was a risk that short cuts would be taken.

Facilities, Equipment and Infrastructure

Even well-run teams can come under pressure due to a lack of facilities or support from partners.⁵⁰

The most significant problem that we have here is the shortage of space; nevertheless, as I said, space is small, but the heart is big trying to solve most of the cases that come here. (F45H-MED)

For example, while large medical facilities with surgical centres were open 24 hours, they were not sufficiently resourced to undertake procedures during nights, weekends or long holidays.⁵²

We did not have all we needed for the surgical procedure, and the pharmacy was not operating on the date of the emergency, and we suffered a lot because we wanted to help, but we did not have medications. I felt unable to help because most of what we needed was not obtainable. (F32H-NUR)

The sense of feeling 'let down' by failings in structural and organizational factors contributes to the sense of pressure workers at the coalface feel and does not help their morale.^{53,54}

Policies and Procedures

The topic of guidelines, policies and procedures is a vast discipline in and of itself.⁵⁵ Arguably, well written guidelines, policies and procedures are essential for the smooth

functioning of all organizations, but striking the right balance between clear-cut instructions and providing flexible support for unique situations is extremely challenging: inflexible procedures and heavy-handed approaches can suffocate staff and sometimes seem to be written more to provide legal protection for the administration than to assist in responding to health and safety problems and effective workflows.⁵⁶ The following quote provides insight into the pragmatics of everyday reality:

I based my decisions on judgments and protocols that arose from a situation. I based my decisions on protocols, written procedures in security manuals. However, not everything is written, and sometimes the conduct you follow is a middle point between you as a professional and the procedures. You could face unpredictable circumstances, which you are not prepared for, in that case. How could I say it? Personally, I used my intuition and experience to meet and manage many patients in severe situations. (M51A-MED)

Decision-making process is never purely technical; it is not as simple as choosing the correct procedure.^{57,58} Apart from being overly prescriptive, the value of policies, procedures and guidelines can also be overly complex and voluminous, and this too can place undue pressure on staff:

You cannot say that you can work with treatment protocols as fast as it is required at the beginning of your medical practice because you do not know about all the protocols and procedures. (M42C-MED)

External Forces

Earlier in the research we noted how the external circumstances of individuals, such as relationships, family and finances, can influence and compound the pressures experienced in the workplace.^{54,59} However, apart from pressures stemming from the private lives of individuals, there are many other external sources of pressure that can intrude into the workplace.⁶⁰

Decision-making can be modified by several factors like the relatives, doctors in superior position organized into a hierarchy, or by hospital policies. These factors modify your decisions and consequently, the treatment. (M30C-MED)

The role of family and significant others is another source of pressure that weighs on staff, not always in positive ways.⁵⁴ This double-edged sword is illustrated in the following quote where a sense of frustration that working hard unsuccessfully to save a life may be met, not with appreciation, but with a legal claim.

In a cardiac arrest, first, we must follow all the steps, all the procedures dictated by the pediatric academies. However, the

most important thing is to make any possible effort to save the patient. However, I am also facing the patient's death and probably a claim of the relatives. We must be prepared for everything. I must guide the team, and I think that I have achieved this. (F45H-MED)

The following quote also illustrates this dilemma and that this pressure affects practice, in some senses making it better but at the same time taking a toll.

You started to think, what was wrong? And, what happened? Was the patient taking a tablet per day? His relatives say that they will introduce a demand to the hospital, so, really, you are afraid. You are scared that your practice is not supported enough by the medical records for example because you were tired you do not make a correct decision with your patients. This is the reason why I tried to be in a different area, which is here, at the external consultation area, but it also has a risk, and the fear is always there. (M39H-MED)

Good records are clearly essential; however, outside actors also ensure that anything put in writing, especially when it is 'official' takes on a special legal significance and can have a chilling effect on responsive and tailored care.

Discussion

Workplace pressure is a key issue for a fast-moving modern workplace where efficiency and competition are core organizational drivers. Nowhere is this perhaps truer than for volatile, complex and emergency situations. The present research reveals workplace pressure as extremely complex and worthy of careful research and constant rethinking. Using detailed interviews with key informants recruited using purposive sampling from across Ecuador, we were able to compile a rich and comprehensive qualitative database that draws on a wide range of critical care and emergency experience. Based on these interviews, it was clear that workplace pressure arises from a composite of factors that collectively impinge on the workplace. For this reason, we regard pressure-related workplace errors as the tip of the iceberg that needs to be considered against this complex 'ecology of pressures' in order to be best understood. While any one of the sources of pressure under other circumstances might be easily managed, the multilayered and cumulative nature of workplace pressures requires highly developed skills and systems for a cohesive workforce and a robust workplace.

As a result of our analysis we were able to classify sources of workplace pressure into 5 broad domains: factors that stem from the personalities and circumstances of individual workers; factors related to the complexity of cases and scenarios; factors related to the skills-base of individuals, teams and systems; factors relating to interpersonal relations and teams; and factors related to systems and organizations. These domains and the factors assigned to them can be seen in

Table 3. A taxonomy of factors that modulate workplace 'pressure' in complex, volatile and emergency situations.

Dimension 1: Personal qualities and individual circumstances
Personality, character, beliefs and values
Morale, state-of-mind, fatigue, burnout and personal toll
Job fulfilment, acknowledgement and personal reward
Career advancement and professional aspirations
Extramural pressures, family, financial
Training, experience, skills and expertise
Correspondence between personal capacity and role
Dimension 2: Factors related to training, skills and expertise
Formal qualifications
Continuous professional development
Induction, in-service and on-the-job training
Mentoring, peer and team support
Supervision, debriefing and case review
Experience and learning-by-doing
Team building and collective capacity development
Systems learning, development, testing and continuous quality improvement
Dimension 3: Case complexity and the unique characteristics of individual scenarios
Capacity to assess the situation and mobilize a response
Case load, case complexity and technical requirements
Scenario specifics: location, event, timing, scale, volatility
Conflicting opinions and clinical judgement
Capacity limits, escalation, calling for help, bailing out
Families and significant others
Correspondence between case complexity and systems capacity
Dimension 4: Teamwork, collective and interpersonal factors
Membership, individual qualities of team members
Novice members, supervision and mentoring
Leadership, authority and lines-of-authority
Shared values and vision compatibility, bonding, cohesion, mutual respect
Team dynamics, politics, rivalries, conflict management
Team size, structure and role delineation
Professionalism and inter-professionalism
Situational awareness, team responsiveness and adaptability
Teamwork, common ground, synergies, coordination, training and team development
Exercises, rehearsals, systems stress-testing
Workload-to-team capacity correspondence
Dimension 5: Structural and organizational factors
Workflow and workload
Infrastructure, facilities and equipment
Administrative demands
Organizational and support systems
Time pressures, deployment, rostering and workload
Appointment procedures, employment conditions, recognition and remuneration
Policies, procedures and medico-legal pressures
Systems-to-functional need correspondence

Elaborated: by the authors.

the pressure table (Table 3). Our analysis led us to view these component elements as modulators of pressure, sometimes serving to increase pressure and at other times able to moderate it, but invariably related to it. In short, their net effect depends on the overall balance of interlinked, multi-layered pressures from all 5 domains.

In some senses, dividing pressures into 5 domains risks underestimating how inter-related these pressures are. Pressure can constitute a vicious cycle, the presence of 1 pressure source can increase susceptibility to, and impact of, another. Pressures can 'bleed' into each other and be part of a chain reaction such as when financial pressures at home can lead to reduced performance at work, which can lead to conflict within the team, which can lead to poorer outcomes. Pressure can also be cumulative, for example, when bad experiences lead to sustained deteriorations in morale or post-traumatic stress. Thus, despite being categorized into different classes, we argue that pressure should be understood in ecological terms, that is, multifactorial, inter-related and contextual.

Several factors related to workplace pressure stood out as especially important to participants in this study. The first is time. Time pressure recurred in the data in a range of guises: as the need to respond quickly in a crisis⁶¹; as having insufficient time to meet demands of the job⁴³; as working long hours^{62,63}; as not having sufficient time to recuperate; as having valuable time diverted into bureaucratic tasks; as being new to the job and needing time to gain experience^{44,64}; as not having time in a crisis to read the protocols and procedures⁶⁵; as a system of rostering staff time on-duty and so on.⁶⁶⁻⁶⁸ Time was also a surrogate for other issues such as not having enough staff, having a heavy workload,^{44,69} and so on, all of which could be solved by having more time. Indeed, time itself was often equated with pressure.

The next issue that stood out was the need to be flexible.⁷⁰ The need for flexibility is inherent in responding to fast-moving, volatile and emergency situations, but it sits in 'constructive tension' with the need to impose order over chaos.^{13,71,72} Clearly a core business of workers in an emergency is to gain control as a means of stabilizing and resolving difficult situations. In this case, it is the pressure itself that drives performance towards resolution.

The next prominent factor was teamwork.^{40,73,74} Even in remote solo practices teamwork often came into play, for example, through the assistance of community members⁵⁰ but also in a contrary sense in that the lack of a key team members often taken for granted elsewhere limited possibilities for responding to emergencies.^{42,50,75}

The final factor that stood out was support. Functional responses typically required well-organized behind-the-scenes support,⁷⁶ including supply chains, maintenance, communications,^{77,78} training⁷⁸⁻⁸¹ and back-up and referral services.^{51,82,83,85} Moreover, moral⁵³ and professional support for staff,⁸³⁻⁸⁵ including supportive leadership^{23,51,85} was emphasized by participants.

Conclusions

This research aims to catalogue factors that modulate workplace pressure. It was found that pressure is best understood in an ecological sense because pressure is multifactorial and rather than there being a sole source of pressure at any one time or one person being responsible. Instead, there is often a tipping point against a complex background of pressures where pressure can escalate, and the situation deteriorates. The focus should be to impose control over an already or potentially chaotic situation. Sometimes pressure can be a constructive and productive force. The system and its personnel are tasked with monitoring the pressure ecology of pressure and managing it productively.

What this article attempts to do is to list and classify the multifactorial nature of pressure in order that it be easier to understand and as a basis for interventions. In this sense, the classification foregrounds a range of pressure points which might be useful for further work, including perhaps as a basis for monitoring, evaluation, auditing and moderating workplace pressures.

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References

- de Vries EN, Ramrattan MA, Smorenburg SM, Gouma DJ, Boermeester MA. The incidence and nature of in-hospital adverse events: a systematic review. *Qual Saf Health Care*. 2008;17(3):216-223.
- Zavala AM, Day GE, Plummer D, Bamford-Wade A. Decision-making under pressure: medical errors in uncertain and dynamic environments. *Aust Health Rev*. 2018;42(4):395-402. doi:10.1071/AH16088
- Edmondson AC, Lei Z. Psychological safety: the history, renaissance, and future of an interpersonal construct. *Annu Rev Organ Psychol Organ Behav*. 2014;1(1):23-43.
- Harvey A, Bandiera G, Nathens AB, LeBlanc VR. Impact of stress on resident performance in simulated trauma scenarios. *J Trauma Acute Care Surg*. 2012;72(2):497-503.
- Pottier P, Dejoie T, Hardouin JB, et al. Effect of stress on clinical reasoning during simulated ambulatory consultations. *Med Teach*. 2013;35(6):472-480.
- Croskerry P. To err is human—and let's not forget it. *CMAJ*. 2010;182(5):524. doi:10.1503/cmaj.100270
- Gershon RRM, Barocas B, Canton AN, Xianbin Li, Vlahov D. Mental, physical, and behavioral outcomes associated with perceived work stress in police officers. *Crim Justice Behav*. 2009;36(3):275-289.
- Kroes WH. *Society's Victims, the Police: An Analysis of Job Stress in Policing*. Springfield: Thomas; 1985.
- LeBlanc VR. The effects of acute stress on performance: implications for health professions education. *Acad Med*. 2009;84(10):S25-S33.
- Seys D, Scott S, Wu A, et al. Supporting involved health care professionals (second victims) following an adverse health event: a literature review. *Int J Nurs Stud*. 2013;50(5):678-687.
- Wu AW. Medical error: the second victim. The doctor who makes the mistake needs help too. *BMJ*. 2000;320(7237):726-727.
- Zavala Calahorrano A., Plummer D., Day GE., Bamfore-Wade A. A framework for analyzing performance under pressure in diverse healthcare settings in Ecuador. *Prehosp Disaster Med*. 2017;32(S1):S109-S110. doi:10.1017/S1049023X17003156
- Guastello SJ. Nonlinear dynamics of team performance and adaptability in emergency response. *Hum Factors*. 2010;52(2):162-172. doi:10.1177/0018720809359003
- Tyreman S. Trust and truth: uncertainty in health care practice. *J Eval Clin Pract*. 2015;21(3):470-478. doi:10.1111/jep.12332
- Piquette D, Tarshis J, Sinuff T, Fowler RA, Pinto R, Leblanc VR. Impact of acute stress on resident performance during simulated resuscitation episodes: a prospective randomized cross-over study. *Teach Learn Med*. 2014;26(1):9-16. doi:10.1080/10401334.2014.859932
- Stacey D, Légaré F, Col NF, et al. Decision aids for people facing health treatment or screening decisions. *Cochrane Database Syst Rev*. 2014;1:CD001431.
- Banatvala J, Rao M. Aviation and public health. *BMJ*. 2013;346:f593.
- Helmreich RL, Merritt AC, Wilhelm JA. The evolution of crew resource management training in commercial aviation. *Int J Aviat Psychol*. 1999;9(1):19-32.
- Sexton JB, Thomas EJ, Helmreich RL. Error, stress, and teamwork in medicine and aviation: cross sectional surveys. *BMJ*. 2000;320(7237):745-749.
- Prince C, Salas E. Training and research for teamwork in the military aircrew. *Cockpit Resour Manag* 1993;337-366.
- Caruso CC. Negative impacts of shiftwork and long work hours. *Rehabil Nurs*. 2014;39(1):16-25. doi:10.1002/rmj.107
- Dean M, Oetzel JG. Physicians' perspectives of managing tensions around dimensions of effective communication in the emergency department. *Health Commun*. 2014;29(3):257-266.
- Doerhoff R, Garrison B. Human factors in the NICU: a bedside nurse perspective. *J Perinat Neonatal Nurs*. 2015;29(2):162-169. doi:10.1097/JPN.0000000000000105
- Källberg AS, Göransson KE, Florin J, Östergren J, Brixey JJ, Ehrenberg A. Contributing factors to errors in Swedish emergency departments. *Int Emerg Nurs*. 2015;23(2):156-161. doi:10.1016/j.ienj.2014.10.002

25. Moon J, Betts S, Anderson JR. Individual differences and workload effects on strategy adoption in a dynamic task. *Acta Psychol.* 2013;144(1):154-165. doi:10.1016/j.actpsy.2013.05.011
26. Pirret AM, Neville SJ, La Grow SJ. Nurse practitioners versus doctors diagnostic reasoning in a complex case presentation to an acute tertiary hospital: a comparative study. *Int J Nurs Stud.* 2015;52(3):716-726.
27. Rathlev NK, Chessare J, Olshaker J, et al. Time series analysis of variables associated with daily mean emergency department length of stay. *Ann Emerg Med.* 2007;49(3):265-271.
28. Adhikari P. Errors and accidents in the workplaces. *Sigurnost.* 2015;57(2):127.
29. Bucknall T, Thomas S. Nurses' reflections on problems associated with decision-making in critical care settings. *J Adv Nurs.* 1997;25(2):229-237.
30. Diamond S. *The Bhopal Disaster: How it Happened.* New York, USA: New York Times; 1985:A1.
31. Tobin GA, Whiteford LM. Community resilience and volcano hazard: the eruption of Tungurahua and evacuation of the faldas in Ecuador. *Disasters.* 2002;26(1):28-48.
32. Baker DP, Amodeo AM, Krokos KJ, Slonim A, Herrera H. Assessing teamwork attitudes in healthcare: development of the TeamSTEPPS teamwork attitudes questionnaire. *Qual Saf Health Care.* 2010;19(6):e49-e54. doi:10.1136/qshc.2009.036129
33. Baker DP, Salas E. Principles for measuring teamwork skills. *Hum Factors.* 1992;34(4):469-475.
34. Barrett J, Gifford C, Morey J, Risser D, Salisbury M. Enhancing patient safety through teamwork training. *J Healthc Risk Manag.* 2001;21(4):57-65.
35. Teaming Edmondson. *How Organizations Learn, Innovate, and Compete in the Knowledge Economy.* Hoboken, NJ: John Wiley & Sons; 2012.
36. Risser DT, Rice MM, Salisbury ML, Simon R, Jay GD, Berns SD. The potential for improved teamwork to reduce medical errors in the emergency department. The MedTeams Research Consortium. *Ann Emerg Med.* 1999;34(3):373-383.
37. Salas E, Fowlkes JE, Stout RJ, Milanovich DM, Prince C. Does CRM training improve teamwork skills in the cockpit?: two evaluation studies. *Hum Factors.* 1999;41(2):326-343.
38. Sandahl C, Gustafsson H, Wallin CJ, et al. Simulation team training for improved teamwork in an intensive care unit. *Int J Health Care Qual Assur.* 2013;26(2):174-188.
39. Tannenbaum SI, Mathieu JE, Salas E, Cohen D. Teams are changing: are research and practice evolving fast enough? *Ind Organ Psychol.* 2012;5(1):2-24. doi:10.1111/j.1754-9434.2011.01396.x
40. Umebayashi T. *Improving Attitudes and Perceptions About Teamwork Among Health Care Professionals with a TeamSTEPPS Approach.* Minneapolis, MN: Dissertation; 2015.
41. Wahr JA, Prager RL, Abernathy JH, et al. Patient safety in the cardiac operating room: human factors and teamwork: a scientific statement from the American heart association. *Circulation.* 2013;128(10):1139-1169.
42. Lubbert PH, Kaasschieter EG, Hoorntje LE, Leenen LP. Video registration of trauma team performance in the emergency department: the results of a 2-year analysis in a level 1 trauma center. *J Trauma.* 2009;67(6):1412-1420.
43. Flowerdew L, Brown R, Russ S, et al. Teams under pressure in the emergency department: an interview study. *Emerg Med J.* 2011;29(12):e2.
44. Flowerdew L, Brown R, Vincent C, Woloshynowych M. Identifying nontechnical skills associated with safety in the emergency department: a scoping review of the literature. *Ann Emerg Med.* 2012;59(5):386-394.
45. Russ AL, Zillich AJ, Melton BL, et al. Applying human factors principles to alert design increases efficiency and reduces prescribing errors in a scenario-based simulation. *J Am Med Inf Assoc.* 2014; 21(e2):e287-296. doi:10.1136/amiainjnl-2013-002045
46. Kvale S, Brinkmann S *InterViews: Learning the Craft of Qualitative Research Interviewing.* Los Angeles: Vol Thirdition: SAGE Publications; 2015.
47. Glaser BG, Strauss AL, Hawthorne NY. *The Discovery of Grounded Theory: Strategies for Qualitative Research.* Chicago: Aldine De Gruyter; 1967.
48. Layder D. *New Strategies in Social Research: An Introduction and Guide.* Cambridge: Polity Press; 1993.
49. Honts C, Prewett M, Rahael J, Grossenbacher M. The importance of team processes for different team types. *Team Perform Manag.* 2012;18(5/6):312-327. doi:10.1108/13527591211251104
50. Driskell JE, Goodwin GF, Salas E, O'Shea PG. What makes a good team player? personality and team effectiveness. *Group Dyn: Theory Res Pract.* 2006;10(4):249-271. doi:10.1037/1089-2699.10.4.249
51. Bohmer R. *The Instrumental Value of Medical Leadership Engaging Doctor Improving Services.* London: Kings Fund; 2012.
52. Morey JC, Simon R, Jay GD, et al. Error reduction and performance improvement in the emergency department through formal teamwork training: evaluation results of the MedTeams project. *Health Serv Res.* 2002;37(6):1553-1581.
53. Casali GL, Day GE. Treating an unhealthy organisational culture: the implications of the Bundaberg hospital inquiry for managerial ethical decision making. *Aust Health Rev.* 2010; 34(1):73-79. doi:10.1071/AH09543
54. Mudaly P, Nkosi ZZ. Factors influencing nurse absenteeism in a general hospital in Durban, South Africa. *J Nurs Manag.* 2015; 23(5):623-631. doi:10.1111/jonm.12189
55. Geraghty M. Achieving six-hour stays in EDs: the last four years have seen significantly shorter stays in emergency departments. Avoiding "target fatigue" could be a challenge for the future. *Kai Tiaki Nurs New Zeal.* 2013;19(8):17.
56. Currie G, Humpreys M, Waring J, Rowley E. Narratives of professional regulation and patient safety: The case of medical devices in anaesthetics. *Health Risk Soc.* 2009;11(2):117-135. doi:10.1080/13698570902784257
57. Higgs J. *Clinical Reasoning in the Health Professions.* Vol. 3. Amsterdam: BH/Elsevier; 2008.
58. Tversky A, Kahneman D. Judgment under uncertainty: heuristics and biases. *Science.* 1974;185(4157):1124-1131.

59. Plsek PE, Greenhalgh T. Complexity science: the challenge of complexity in health care. *BMJ*. 2001;323(7313):625-628. doi: [10.1136/bmj.323.7313.625](https://doi.org/10.1136/bmj.323.7313.625)
60. Mishra S. Decision-making under risk: integrating perspectives from biology, economics, and psychology. *Pers Soc Psychol Rev*. 2014;18(3):280-307
61. Pflanz SE, Ogle AD. Job stress, depression, work performance, and perceptions of supervisors in military personnel. *Mil Med*. 2006;171(9):861-865.
62. Funke GJ, Knott BA, Salas E, Pavlas D, Strang AJ. Conceptualization and measurement of team workload: a critical need. *Hum Factors*. 2012;54(1):36-51. doi: [10.1177/0018720811427901](https://doi.org/10.1177/0018720811427901)
63. Yang N, Elmatite WM, Elgallad A, Gajdos C, Pourafkari L, Nader ND. Patient outcomes related to the daytime versus after-hours surgery: a meta-analysis. *J Clin Anesth*. 2019;54:13-18. doi: [10.1016/j.jclinane.2018.10.019](https://doi.org/10.1016/j.jclinane.2018.10.019).
64. Brehmer B. Dynamic decision making: human control of complex systems. *Acta Psychol*. 1992;81(3):211-241. doi: [10.1016/0001-6918\(92\)90019-A](https://doi.org/10.1016/0001-6918(92)90019-A)
65. Donchin Y, Gopher D, Olin M, et al. A look into the nature and causes of human errors in the intensive care unit. *Crit Care Med*. 1995;23(2):294-300. doi: [10.1097/00003246-199502000-00015](https://doi.org/10.1097/00003246-199502000-00015)
66. Groopman JE. *How Doctors Think*. Boston: Houghton Mifflin; 2007.
67. Parenmark F, Karlström G, Nolin T, Fredrikson M, Walther SM. Reducing night-time discharge from intensive care. A nationwide improvement project with public display of ICU outcomes. *J Crit Care*. 2019;49:7-13. doi: [10.1016/j.jcrc.2018.09.022](https://doi.org/10.1016/j.jcrc.2018.09.022)
68. Violanti JM, Aron F. Sources of police stressors, job attitudes, and psychological distress. *Psychol Rep*. 1993;72(3):899-904.
69. Byrne A. Mental workload as a key factor in clinical decision making. *Adv Health Sci Educ Theory Pract*. 2013;18(3): 537-545. doi: [10.1007/s10459-012-9360-5](https://doi.org/10.1007/s10459-012-9360-5)
70. Hagemann V, Kluge A, Ritzmann S. Flexibility under complexity. Marks A, ed. *Employee Relat*. 2012;34(3):322-338. doi: [10.1108/01425451211217734](https://doi.org/10.1108/01425451211217734)
71. Goldman E, Plack M, Roche C, Smith J, Turley C. Learning in a chaotic environment. *J Workplace Learn*. 2009;21(7):555-574. doi: [10.1108/13665620910985540](https://doi.org/10.1108/13665620910985540)
72. LeBlanc VR, McConnell MM, Monteiro SD. Predictable chaos: a review of the effects of emotions on attention, memory and decision making. *Adv Health Sci Educ Theory Pract*. 2014; 20(1):265-282.
73. Kilner E, Sheppard LA. The role of teamwork and communication in the emergency department: a systematic review. *Int Emerg Nurs*. 2010;18(3):127-137.
74. McKeon LM, Cunningham PD, Oswaks JS. Improving patient safety: patient-focused, high-reliability team training. *J Nurs Care Qual*. 2009;24(1):76-82. doi: [10.1097/NCQ.0b013e31818f5595](https://doi.org/10.1097/NCQ.0b013e31818f5595)
75. Zsombok CE. Naturalistic decision making research and improving team decision making. *Nat Decis Mak* 1997;111-120.
76. Zavattaro SM. Expanding goffman's theater metaphor to an identity-based view of place branding. *Adm Theor Pract*. 2013; 35(4):510-528. doi: [10.2753/ATP1084-1806350403](https://doi.org/10.2753/ATP1084-1806350403)
77. Aboumatar HJ, Carson KA, Beach MC, Roter DL, Cooper LA. The impact of health literacy on desire for participation in healthcare, medical visit communication, and patient reported outcomes among patients with hypertension. *J Gen Intern Med*. 2013;28(11):1469-1476.
78. Riggins SH. *Beyond Goffman: Studies on Communication, Institution, and Social Interaction*. Vol. 96. Berlin: Mouton de Gruyter; 2010.
79. Neily J, Mills PD, Young-Xu Y, et al. Association between implementation of a medical team training program and surgical mortality. *J Am Med Assoc*. 2010;304(15):1693-1700.
80. Nielsen PE, Goldman MB, Mann S, et al. Effects of teamwork training on adverse outcomes and process of care in labor and delivery: a randomized controlled trial. *Obstet Gynecol*. 2007; 109(1):48-55.
81. Shapiro MJ, Morey JC, Small SD, et al. Simulation based teamwork training for emergency department staff: does it improve clinical team performance when added to an existing didactic teamwork curriculum? *Qual Saf Health Care*. 2004;13(6):417-421.
82. Berg M, Black G. A Canadian perspective on clinical governance. *Clin Govern Int J*. 2014;19(4):314-321. doi: [10.1108/CGIJ-10-2014-0031](https://doi.org/10.1108/CGIJ-10-2014-0031)
83. Renaud K. Clinical and information governance proposes; human fallibility disposes. *Clin Govern Int J*. 2014;19(2): 94-109. doi: [10.1108/CGIJ-01-2014-0001](https://doi.org/10.1108/CGIJ-01-2014-0001)
84. Flynn D, Ford GA, Stobbart L, Rodgers H, Murtagh MJ, Thomson RG. A review of decision support, risk communication and patient information tools for thrombolytic treatment in acute stroke: lessons for tool developers. *BMC Health Serv Res*. 2013;13(1):225.
85. Carmeli A, Tishler A, Edmondson AC. CEO relational leadership and strategic decision quality in top management teams: the role of team trust and learning from failure. *Strat Organ*. 2012;10(1):31-54.