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**TEAMS COORDINATION IN POLYCENTRIC SYSTEMS: INSIGHTS FROM PRE-HOSPITAL EMERGENCY TEAMS**

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**Sub-theme 53: Resilient Organizing: Managing in Extreme Contexts and Situations of Crisis**

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## **INTRODUCTION**

Although coordination has been a central topic in research for years, our understanding is still messy and fragmented (Okhuysen and Bechky, 2009). That drove scholars to further investigate coordination within a practice-based view to examine the micro-level of coordination, defined as a “*temporally unfolding and contextualized process*” (Faraj and Xiao, 2006, p. 1157; e.g. Bechky, 2006; Faraj and Xiao, 2006; Jarzabkowski et al., 2012; Peters and Pressey, 2016). These more recent studies provide a rich body of updated knowledge and important insights into how actors coordinate in their situated activities.

Among these practice-based contributions, some privilege extreme fields as they provide “*unique opportunities for a deeper understanding of the complexity of coordination in response to unexpected events*” (Schakel et al., 2016, p. 391). For instance, authors investigate coordination practices in police forces (Schakel et al., 2016), military squadrons (Godé and Lebraty, 2015), surgery teams (Vashdi et al., 2013) or a trauma centre (Faraj and Xiao, 2006).

Such extreme contexts can be characterized by simultaneously high levels of change, uncertainty and risk (Aubry et al., 2010; Bouty et al., 2012; Godé, 2016). The change occurs at a rapid and discontinuous tempo, pointing to the time-speed pressure handled by team members. The uncertainty leads teams to confront unforeseen situations that were considered unlikely or as foreseeable but unexpected and that cause surprise (Weick and Sutcliffe, 2007). Finally, facing high stakes and time pressure, the consequences of errors may be tragic, from symbolic (e.g., loss of leadership) to vital risks (e.g., fatal injuries in the course of action).

In investigating extreme contexts, these recent contributions provide important insights into how individuals and teams actually coordinate when they are confronted to the unexpected or/and when they have to switch from a practice to another. However, this body of research tends to underappreciate the multiple scales of macro-arrangements (Johns, 2006) that teams are daily involved in. The effect of macro-arrangements complexities on teams working and coordinating in extreme context is still to be investigated.

It is then interesting to make use of the Ostrom's contributions on polycentricity (for example, 1972; 1990; 2009). According to the author, we need to develop configurable approaches to study the individuals' efforts to cooperate and self-organize. Ostrom considers that the examination of micro-situational interactions makes sense in broader field settings, which allow taking into consideration multitype and multilevel arrangements. To her view, individuals and teams operate within polycentric systems that is "*many centers of decision making that are formally independent of each other [and, meanwhile] take each other into account in competitive relationships, enter into various contractual and cooperative undertakings or have recourse to central mechanisms to resolve conflicts. [...] To the extent that this is so, they may be said to function as a system*" (Ostrom et al., 1961, pp. 831-2).

We suggest that the polycentric view allows grasping the recursive influences between macro-arrangements and coordination practices in extreme contexts as it exposes processes and issues that may remain hidden with a more micro-level analysis.

In this article, we aim to dig into polycentricity to contribute with the following research question: how do polycentric systems influence teams' coordination practices in extreme contexts? We address our question in exploring coordination between pre-hospital emergency (PHE) teams. Our case is well suited with the research question as it involves multiple rescue teams which must coordinate with each other while they do not necessarily report to the same decision centre, neither do they follow the same rules, procedures and norms. These rescue

teams work under time-speed pressures, and are regularly face with unexpected events and exposed to multiple sort of risks. As such, they coordinate in extreme contexts.

The remainder of this article is structured as follow: the first section (1) reviews practice-based contributions on coordination which highlight extreme fields as significant for refining the coordination theory and (2) advances how the Ostrom's perspective on polycentricity allows examining the influences of the multiple scales of macro-arrangements on coordination practices. The second section presents method and case settings of PHE teams. The third section elaborates on findings, describing an action situation which involves multiple actors delivering a collective outcome: a hemiplegic patient must be transferred to the nearest hospital. Finally, the last section analyzes the case, highlighting pre-hospital macro-arrangements, coordination practices developed *in situ* within the "action arena" by PHE teams, and the recursive influences between them.

## **COORDINATION AND POLYCENTRICITY: PRACTICES AND MACRO-ARRANGEMENTS IN EXTREME CONTEXTS**

### ***Coordination practices in extreme contexts***

The practice-based contributions on coordination pay particular attention to practices enacted by actors. Practices describe "*the specialized activities that professionals pursue in their occupations*" (Bruns, p. 64). They are the manner of working to achieve a task (Bourdieu, 1990), emerging "*from an ongoing stream of activities and are enacted through the contextualized actions of individuals*" (Faraj and Xiao, p. 1157; Orlikowski, 2000). With this focus, coordination-as-practices researches provide micro-level insights into coordination by investigating how it is concretely enacted by agents through their daily and dynamic social activities (e.g. Faraj and Xiao, 2006; Bechky, 2006; Rico et al., 2008; Jarzabkowski et al., 2012; Peters and Pressey, 2016).

Among this recent body of researches, some investigate extreme contexts to delve deeper into the complexity of coordination unfolding. A recent work by Godé (2016) provides three task criteria to evaluate whether a discrete context can be qualified as extreme (see also Bouty et al., 2012). Specifically, a context is "extreme" if it is simultaneously marked by risk, evolutivity, and uncertainty. These three criteria respectively clarify the impact of situational changes that participants encounter, the nature of these changes, and their probability of occurrence. Risk refers to the potential damage inherent to and impending from a situation. Risk can be physical, media-related, symbolic, financial, legal, material etc. Exposure to risk affects the organization,

its groups and its members. Evolutivity refers to the level and pace of evolving changes with respect to the immediacy of action and emphasizes the rapid, dynamic and discontinuous aspects of the changes that individuals experience. The pace of changes differs according to situations. Some situations involve real time pressure and urgent implementation of collective action (Klein et al., 2006) while others do not require immediate action, thus allowing participants more time for strategic decision making, practice, discussion, and/or reflection. Finally, uncertainty refers to the probability and predictability of change. Uncertainty suggests that some situations can be more or less expected (and therefore more or less “foreseeable”) whereas other situations emerge unpredictably and come as a surprise to participants, who must rapidly adapt to face with the unforeseen (Cunha et al., 2006; Weick and Sutcliffe, 2007).

Extreme settings make teams’ practices of coordination transparently observable as they “*exhibit the properties of interest more richly than other settings*” (Weick, 2007, p. 64). They especially allow examining the way actors challenge macro-frameworks and generate other paths and practices to respond quickly to unexpected events (Bouty et al., 2012, p. 476).

For example, analysing how medical teams coordinate in a US Trauma Centre, Faraj and Xiao (2006) demonstrate that coordination involves expertise and dialogic practices. Expertise coordination practices ensure expertise integration and flexible teamwork. The later, dialogic practices, operates to guarantee timely and situated responses to unexpected events. The authors especially emphasize that, when faced with uncertainty, organizations must create room for dialogic coordination practices, through which actors build sense-making and challenge protocols. In a close spirit, Godé and Lebraty (2015) investigate experience feedback as a way to foster team coordination and adaptation facing the unexpected. Building on the case of an aerobatic military team (the Air Force Aerobatic Team – AFAT) involved in competition, the authors demonstrate that experience feedback improves coordination and unforeseen events handling in promoting the articulation of communication, socialization and reflexive practices. More recently, Schakel et al. (2016) examine the challenge posed by unexpected switching between practices in fast-response organizations. Relying on multiple specialized police teams handling a Dutch National Police operation (named the Frisau operation), they state that fast-response teams experience some difficulties to switch from a practice to another as they are already committed (in terms of roles, routines, collective sense-making, material arrangements and field conditions) to a specific practice.

Altogether, these contributions approach coordination as a bundle of evolving and situated practices and underscore the articulation of the challenge extreme teams must take up to

coordinate. To a lesser extent, authors also notice the importance of complex macro-arrangements within which coordination practices are embedded in. For example, Godé and Lebraty (2015) highlight that the AFAT is part of the French Air Force: beyond their dedicated aerobatic missions, teammates are tightly engaged in military duties, attitudes and cultural values. The aerobatic team also deals with the Fédération Aéronautique Internationale (FAI) – in charge of publishing competition rules and procedures, organizing national and international Championships, naming the judges – and private sponsors which fund a part of their communication activities. These multiple partners create an intricately context which is underplayed by the authors in their study of coordination practices. Another example can be found in the Schaekel et al. (2016)'s contribution. The authors report a Police operation imbricated into a complex institutional and physical environment of which disconnections may challenge the coordination practices switching. The Frisau operation is described as a multidisciplinary Police operation which involves several Police units and specialists, reporting to three different teams (visual, technical, and helicopter). The article also mentions the role played by the Police chief, the National Police Agency and the Dutch Parliament after the Frisau operation failure. Although acknowledging that institutional disconnects have laid to underperforming outcomes, the authors do not question the influences of these macro-systems complexities on coordination.

In this article, we suggest that the polycentric perspective is an appropriated way to comprehend the multiple scales of micro and macro-arrangements the teams are involved in in their continuous efforts of coordinating in extreme contexts.

### ***Polycentricity and the IAD framework***

Introducing the concept of polycentric order in *The Logic of Liberty* (1951), Polanyi argues for another way of organizing work when tasks are complex and require multiple specialized experts to be performed. In her contributions, Ostrom relies on the Polanyi's view to characterize polycentric systems as “*multiple governing authorities at differing scales [...]. Each unit within exercises considerable independence to make norms and rules within a specific domain*” (Ostrom, 2010, p. 552). As such, the concept of polycentricity allows analyzing an interwoven system of power, decision-makings, motivations and rules that gathers different individual and collective settings, in complex multilevel interdependent relationships (Aligica and Tarko, 2012).

In a polycentric system, individuals that belong to formally independent decision structures get together to achieve joint actions. They are collectively involved in diverse ways of providing outcomes but individually report to different central authorities. Ostrom thus argues for building a more complex theoretical view – than “*a dichotomous world of the market and the state*” (Ostrom, 2009, p. 408) – to explain the puzzling of interactions and problem-solving actors are involved in. As she claimed during her Nobel Prize Lecture: “*the humans [...] have complex motivational structures and establish diverse private-for-profit, governmental, and community institutional arrangements that operate at multiple scales*” (Ostrom, 2009, p. 408). She considers that an appropriate analytical view is the one that provides a deeper understanding of the multiple actors and affiliations involved in the collective process of working and producing outputs. For example, examining the impact of governance arrangements for policing within 80 U.S. metropolitan areas, Ostrom and her-co-authors (for instance, Ostrom, 1972; Ostrom and Whitaker, 1973, Ostrom et al., 1978) study a series of case comparisons of Police departments to assess the performance of direct (e.g. patrols, traffic control, investigations) and intermediate (e.g. criminal laboratory facilities, communication dispatching) services to citizen. By digging into the way Police forces deliver these services on the ground, the authors distinguish bundles of human interactions and combinations of large and small producers. They demonstrate that “*metropolitan areas with large numbers of autonomous direct service producers achieve higher level of efficiency. Efficiency was also enhanced in those metropolitan areas with a small number of producers providing indirect services*” (Ostrom and Ostrom, 2014, p. 171).

Ostrom’s contributions thus reveal that polycentric systems are efficiently governed through a wide diversity of micro and macro-arrangements, which make them much more resilient and reactive in evolving contexts than a single top-down centralized institution. In order to explore the intricacy between micro and macro influences, and to take into account their recursive influences, the author builds a framework called “Institutional Analysis and Development” (IAD, Figure 1). The IAD framework “*is intended to contain the most general set of variables [...] to examine a diversity of institutional settings including human interactions within markets, private firms, families, community organizations, legislatures, and government agencies*” (Ostrom, 2009, p. 414). The author identifies a set of external variables that refer to contextual statements; they are resources and material conditions, social and cultural context as well as institutional rules. The external variables affect action situations and generate patterns of interactions. Recursively, these patterns of interaction influence the external variables.

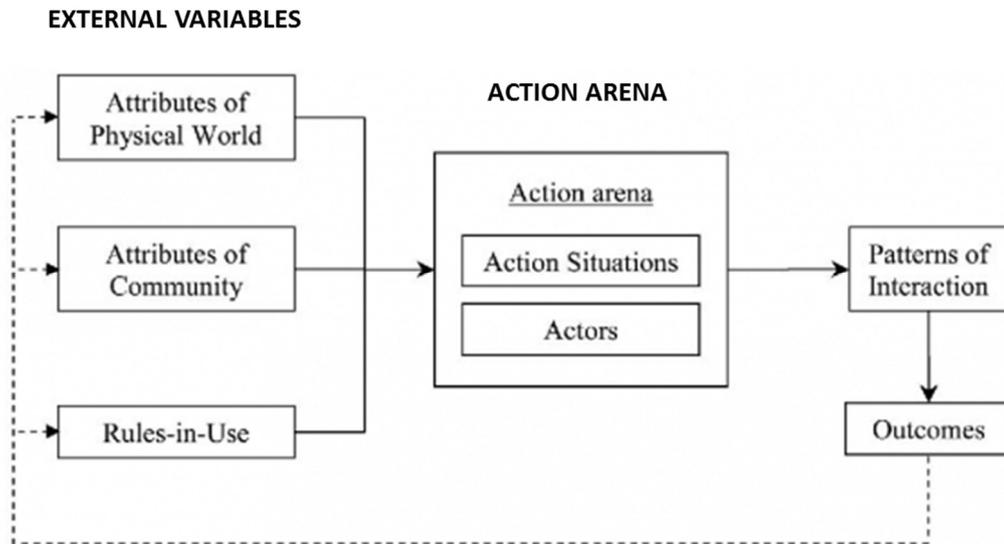


Figure 1. The IAD framework (adapted from Ostrom, 2005, p. 15)

The set of external variables is composed of:

- Attributes of physical world refer to the nature of resources and material conditions. They are human resources, finance, technology, time, etc. allocated to goods and services production. They significantly impact the way collective actions are deployed.
- Attributes of community are related to the social and cultural context. They are demographic and social criteria, norms, values, beliefs and preferences actors share (or not in case of internal heterogeneity).
- Rules-in-use refer to institutional arrangements. Ostrom identifies seven types of operating rules that specify: the position held by actors (Position); the process by which positions are assigned to actors (Boundary); the actions actors in positions must or must not take in various circumstances (Choice); how many, and which, actors must participate in a given collective (Aggregation); channels of communication among actors and what information must, may, or must not be shared (Information); rewards or sanctions to particular actions (Payoff) and the range of possible outcomes (Scope) (Ostrom, 2009). Ostrom relies almost exclusively on formal legal rules to explain these rule types. She examines how these rules, of any kind, are understood, given effect, or operationalized within a given community.

These resources, social contexts and rules affect what Ostrom calls the Action Arena, which comprises actors and action situations. An action situation is “*the social space where individuals interact, exchange goods and services, engage in appropriation and provision activities, solve problems, or fight*” (Ostrom et al., 1994, p. 28). During the action situation, actors adapt macro-

arrangements (material conditions at hand, social beliefs and rules-in-use) to solve collective problems and achieve their missions in the most effective way. In doing so, they create patterns of interaction. Feedbacks on these internal use patterns are able to impact macro-arrangements in return.

In this article, we argue that the Ostrom's polycentric view opens a new space to examine coordination practices when team members belong to different units, report to different decision-making centers but are collectively engaged in the same and extreme action. We consider that coordination practices, as manners of coordinating and working, are developed within the action arena, when actors are engaged in action situations. We also assume that coordination practices are affected by macro-arrangements, that are attributes and rules-in-use shared (or not) by the actors. The multilevel and multitype IAD framework allows investigating the recursive influences between macro-arrangements and internal practices in action arena.

## CASE SETTINGS AND METHODS

### *Case settings*

Our article develops a single extreme case study (Yin, 1994) based on a research agreement between our university and the “Manche” Fire Rescue Department (code 50 on the French Departments list). As we can see in the following Figure 2, the “Manche” presents a wide geographical diversity: lands, coasts, the channel that separates France and England, urban and rural areas and islands. As such, the “Manche” is an important tourist area (for example, the Abbey of Mont saint-Michel is one of the most visited tourist attraction in the Department and the country) and it organizes many public events (for example, 3 stages of the “tour de France” cycling race passed through the “Manche” during the observation time). Beyond these geographical and touristic aspects, the “Manche” is also a French strategic area as two important nuclear sites are located in.



*Figure 2. The “Manche” Department, France*

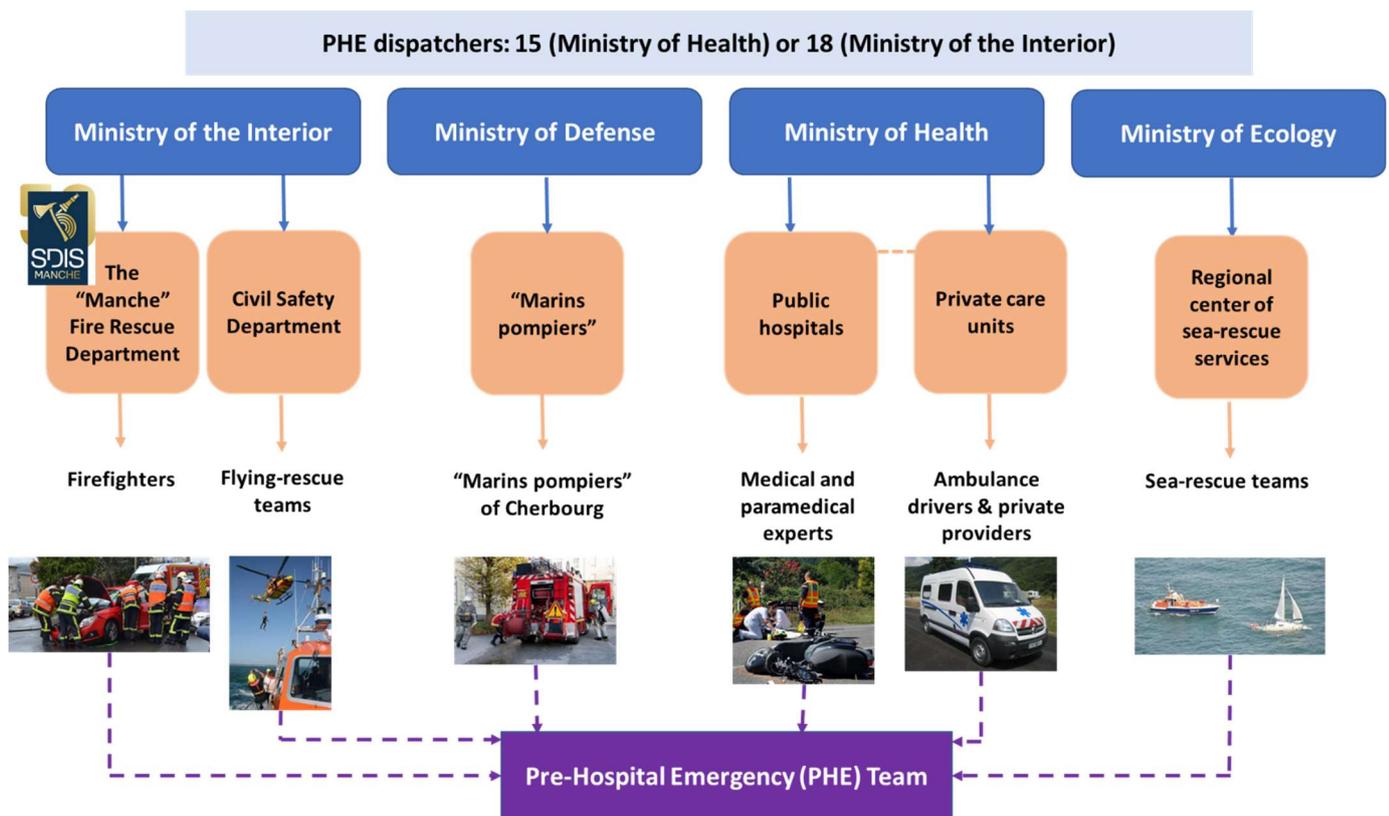
Due to this variety of contexts, events and challenges, the “Manche” Fire Rescue Department (FRD) handles multiple emergency interventions, from sea rescue operations (the connection between North Sea and Atlantic Ocean leads to a severe maritime traffic) to people assistance, by way of nuclear and post-nuclear emergency exercises. In this article, we investigate a specific type of teams, called pre-hospital emergency (PHE) teams, for which the “Manche” FRD takes part in its constitution.

PHE teams cover a wide range of medical conditions and interventions, as well as physical locations. Their aim is providing to victims with an urgent and unscheduled care provision outside of the hospital, from minor injury to life threatening injury. They are engaged in care-giving both on-scene and in-transit to the hospital, and their missions can take place in urban, rural or maritime settings. PHE teams consist of a body of diverse prehospital practitioners, who are temporarily put together by emergency dispatchers. When a victim calls for rescue (the French emergency phone numbers are 15 and 18), dispatchers identify the injury level, establish a distant first intention diagnosis (in order to advance PHE teams intervention) and deploy appropriated resources to the incident. These resources concern the composition of PHE teams (firefighters, first-aiders, paramedics, nurses and/or doctors) and transport ways (by land vehicles such as car and ambulances, by helicopters and by boat). Resources are allocated with regard to their availability at the moment and the emergency case to handle.

From first-aiding to medical competences, PHE teams consist of diverse prehospital expertise that get together to achieve an emergency care provision operation. PHE team members do not all depend on the same structure, neither report to the same decision center. Concerning the “Manche” FRD case (see Figure 3):

- Medical and paramedical experts are managed by public hospitals localized all around the “Manche”, in coordination with the “Manche” FRD. Public hospitals are on the authority of the French Ministry of Health.
- Firefighters, given their first-aid skills, are usually the first responders to an emergency. In France, they are not solely in charge of putting out fires but take also action in rescuing people. Firefighters directly report to a territorial Fire and Rescue Center, which belongs to the “Manche” FRD. French FRDs are on the authority of the Ministry of the Interior. A specific type of firefighters, called “Marin-pompier” of Cherbourg, can also be allocated to an emergency. For their part, they are subordinated the French Ministry of Defense.

- Flying-rescue services handle wilderness, mountain and sea emergency, for which the unique hospital transport way is the helicopter. These teams report to the Civil Safety Department, on the authority of the French Ministry of the Interior.
- Sea-rescue services are involved in boaters or water-users in distress who require assistance. They report to the “Manche” regional center which is on the authority of the French Ministry of Environment, Energy and Sea (that is the Ministry of Ecology).
- Private care units include ambulance drivers and private providers. Concerning the latter, they usually work towards securing and guarding the emergency area. Private care units depend on private and autonomous health organizations, with agreement by public hospitals.



*Orange dotted line:* private care units are under contract to public hospitals.

*Purple dotted lines:* the PHE team composition (and actors involved in) depends on the nature of the incident to handle and the availability of transport modalities.

Figure 3. The PHE teams macro-environment and actors

PHE teams operate in extreme contexts (for an example, see Table 1). Once on-scene, they establish a complete diagnosis before stabilizing the patient. It is usual that the remotely diagnosis established by dispatchers differs from what PHE teams find on site. In that case,

team members must change and adjust their expectations, handling the situation in real time. Trauma, premature delivery, overdose, etc. are commonly treated on the road after a car crash, at home for a complicated birth, on the channel sea or in the middle of a rough neighborhood. Beyond uncertainties regarding the patient condition, PHE teams can face with unforeseen events related to the evolving situation within which they operate. Finally, PHE teams must secure a safe working area (in terms of car traffic for a car crash, or of structure resistance for a building fire, for example). To efficiently treat the patient, they should only approach casualties if it is safe to do so. However, the risk cannot be completely removed during interventions.

<b>The three attributes of extreme context</b>	<b>Example: Choke on food on board a ferry</b>
<p style="text-align: center;"><b>Evolutivity</b></p> <p>Rapid, dynamic and discontinuous aspects of changes</p>	The Ferry is far from the coast, the weather is bad, currents are dangerous, maritime traffic is substantial and there is no medical staff on board.
<p style="text-align: center;"><b>Uncertainty</b></p> <p>Potential unforeseen events</p>	The medical history of the patient is unknown and, as there is no medical staff on board, it's impossible to establish a diagnosis. Medical conditions of the patient can get worse than expected by the PHE team.
<p style="text-align: center;"><b>Risk</b></p> <p>Potential damages inherent to and impending from changes</p>	Vital risk for the patient who must be stabilized before being winched up into the helicopter.

*Table 1: Extreme context example in pre-hospital care context*

## **Methods**

We chose to adopt an ethno-methodologic approach (Garfinkel 1967) which allowed us to collect practical activities and circumstances, and to provide explanations on reflexive social practices (Coulon, 1996). From this ethno-methodologic approach, we built a case study as it is appropriated to investigate a contemporary and collective phenomenon, especially when boundaries between phenomenon and context are imprecise (Yin, 1994, p. 13).

We drew on the IAD framework to collect our datasets. According to Ostrom (2010), the IAD framework “*is intended to contain the most general set of variables [...] to examine a diversity of institutional settings including human interactions within markets, private firms, families, community organizations, legislatures, and government agencies*” (p. 414). We collected 18

pre-hospital action situations (to go to saturation of data collection) with a maximum variation in terms of related complexities: distance from the closest relevant hospital, teams composition (professionals and/or volunteers), night and day operations, localizations, week, week-end and holidays interventions, national and local social events, different kind of medical emergency.

For each action situation, one of us were embedded in the rescue team vehicle. The embedded researcher observed relationships between actors as well as individual and collective practices *in situ*. Following IAD framework guidelines (Ostrom, 2005), she interviewed involved actors right after the action situation (all the interviews have been recorded). We also collected procedures and guides used by actors and gathered the notes they wrote during and after operations, as well as radio communications between actors. Finally, we conducted interviews with the hierarchical referents of the actors engaged on the field.

Narratives have been written for each observed action situation (field-diary) and the recorded interviews have been transcribed. From this raw material, we completed a content analysis (Bardin 2003) of the interviews, observations and the field-diary using the qualitative software N-Vivo11. We structured the examination and coding of data-sets around the IAD external variables, action arena, as well as coordination practices.

In the following, we describe one specific action situation involving a hemiplegic patient, a general practitioner, a home care assistant, two emergency dispatchers, a PHE team and emergency nurse and care assistant. The PHE team consists of 3 firefighters who have been called due to a private ambulance deficiency. Although the GP and two dispatchers consider that the patient condition requires immediate medical care and hospital transfer, firefighters call this decision into question. However, they carry out their mission in a professional manner.

#### **FINDINGS: THE TRIBEHOU CASE**

The situation occurs in Carentan's swamps, at Tribehou. Tribehou is a small city of 530 inhabitants composed of many hamlets. They are served by small departmental roads. Due to the rainy weather, these roads are repeatedly flooded by swamps and can become inaccessible for several days. The nearest hospital is at 20mn of Tribehou.

During a medical visit (patient home), a general practitioner (GP) examines a patient who suffers from chronic diseases requiring home treatments (a home care assistant spends several hours per day with him). The medical examination reveals a general health deterioration requesting an immediate hospitalization to his viewpoint. Calling the emergency number 15, the GP reaches a PHE dispatcher and insists on the sudden deterioration of health of his patient,

which justifies in his opinion an urgent medical attention. The dispatcher put him through on the phone to the emergency regulation doctor, who uses to make decision regarding the medical coverage. Debating about the patient diagnosis during few minutes, they agree to schedule an ambulatory transportation. The dispatcher then looks for an available ambulance. As the emergency call occurs outside working hours, he first refers to the prefectural list of private ambulances being on call. Seemingly, none is able to get on the Tribehou sector in time. The dispatcher then turns towards the “Manche” Fire Rescue Department (FRD) with which an agreement has been signed to use its ambulance service when others are unavailable. This situation is called “ambulance deficiency” and administered following dedicated operational procedures. The FRD makes the decision to send an ambulance from the Carentan Fire and Rescue Center, as it is the nearest of the Tribehou sector.

Meanwhile, the GP writes a note for the PHE team, describing the patient health condition and providing some medical information, as well as a sealed letter intended for the hospital doctor (this latter being protected by medical secret). He then carries on with his medical visits, leaving his patient with her usual home care assistant who starts to pack some personal belongings for hospitalization.

The FRD ambulance is now ready and the PHE members are individually called via an identifiable “beep” that means “private ambulance deficiency”. A “departure voucher”, describing information gathered by the dispatchers, is automatically produced and gave to the PHE leader (a professional firefighter). He then checks the material, configures the ambulance with regards to the patient expected needs and gather his team. The Carentan rescue center comprises professional and volunteer firefighters who are used to work together. The PHE leader will be assisted by two volunteer firefighters (first-aiding qualified) for this mission; he knows them and, as he explains, “*I know how they work. The division of work is clear between us. When we are together, we are able to anticipate what must be done and we save time*”. The first volunteer is a municipal officer, in charge of street cleaning, and the second one is a retirement home care assistant. They are not on site at the time of the “beeping” but they are on call: they benefit from an agreement between their employers and the “Manche” FRD and are able to leave their organizations very quickly. As such, full team is ready to go 10 minutes after the “beep” call.

The three teammates go up into the ambulance. They wonder about the real nature of this call that is first identified as a deficiency of private ambulance (the typical “beep”) but could be a much more urgent assistance requirement. One of the team members agrees: “*You know,*

*sometimes... it's a little bit weird as... you can't be counted on the fact that it's just a problem of unavailability of private ambulance and consider that you have time to go on site, and all that stuff... Sometimes, it's a real and serious rescue mission, not just a transportation issue. Sometimes, things go really wrong for the patient!".* The PHE leader adds: *"General health deterioration? It's very unclear you know, we will have to diagnose one on site, in order to guarantee the best transportation possible"*.

On the way, team members exchange about previous missions. They describe some problems they recently faced with, the solutions they found and ask to each other some advices and answers. The PHE leader also takes advantage of this time to present the Fire and Rescue Center schedule and activities of the day.

Once at Tribehou, the ambulance driver asks for the patient's address. Giving it to him, the PHE leader suggests a route that he followed three weeks ago during a rescue mission in the same area. The driver makes the decision to choose another itinerary as he recently cleaned the streets and roads of this area and has a good knowledge of road impediments, flooded zones and shortcuts. The PHE leader trusts him.

Once on site, the PHE team is welcomed by the patient's home care assistant. While the two volunteer firefighters go near the patient, the PHE leader asks to the care assistant for general information and reads carefully the note left by the GP. He then starts to complete a standardized health scorecard and monitors his team members during the life support checking procedure (complete patient diagnosis). He also asks some questions to the care assistant regarding the patient's medical history, alternating between medical and rescue language: *"Hemiplegia? Since when? What did the doctor tell you exactly? What do you think of her health condition today? Have you noticed something unusual? What does it mean to you?"*. Once the life support checking procedure completed, the PHE leader returns to the ambulance to reach the emergency's regulation doctor by radio and pass him through information, using shared standards of radio communication. The doctor allows the transportation to the hospital. The PHE leader doesn't notice a real emergency for this patient case but, as he says: *"Anyway, he knows what it is, what the situation is. It's his business as a doctor, he knows what he does. And if he has had any doubts, he would have asked me thousands of questions!"*.

The PHE leader comes back to the patient house and asks to team members to use the stretcher to move the patient into the ambulance. There are few steps in the front door and it was impossible to park the ambulance right outside the door due to a garden gate. Although the

patient hemiplegia and excess weight, the home care assistant explains that she is not impotent and can be moved being seated. Teammates agree to use a sitting stretcher, following the usual protocol in this case, and place the patient into the ambulance. The PHE leader checks that everything is all right and well done before jumping into the ambulance with the rest of his team.

While driving to the hospital center of the “Manche”, the PHE leader updates the PHE team status using a transmission housing with which every ambulance is equipped. Status are related to the PHE team situation and localization: on the way to the rescue site, on site, on transfer to the hospital, on the way back to the rescue center. The language used for up-dating is highly simple and standardized (1 for on the way to the rescue site, 2 for on site, etc.). The up-dated status is automatically delivered to the PHE dispatcher on his tactical screen (red when the PHE team is on operation, green when it is available). At the same time, the PHE team hears a radio message delivers by another ambulance to the PHE dispatcher, informing him that it is unable to take charge of a hospital transportation. The PHE leader comments the radio message: *“Here it is, another case! That’s exactly what we’ve just done... I shouldn’t say that but, well... that’s not our job! There are private ambulance men for that! In our case, the GP did his job: he established the patient diagnosis, wrote a note for us and asked for an ambulance. The good question is: did the PHE dispatcher or, more broadly the medical regulation center, really look for a private ambulance? Look, at 1.15 pm the GP is at the patient home and we are called at 2.03 pm? And they didn’t find any private ambulance in 45 minutes? I don’t believe so. For sure they didn’t look for! Actually, it’s not a private ambulance deficiency situation. The past year, we achieved almost 150 operations such as today...”*. The other PHE team members agree and smile. They all know how the whole system works.

The PHE leader takes advantage of transportation time to review the mission with team members. He considers that life support checking procedures were necessary to efficiently operate on site, in order to make sure that the patient condition was the same than that expected and to drive her towards the appropriated hospital. Even when emergency interventions seem easy to handle, unforeseen events are able to appear and create surprise for PHE teams. It’s crucial to remain vigilant in order to deal with the unexpected. The complete patient diagnosis upon arrival is a procedure which allows remaining vigilant and attentive to potential surprise. As one of team members explains: *“There is nothing worse than routine. It’s the enemy of the rescuer”*. The ambulance driver agrees and notices that, as a volunteer firefighter for 28 years, he noted changes in terms of number and quality of missions. There were about 140 rescue

operations a year in the 90s, there are more than 1500 today. The rescue center owns 3 ambulances instead of one 25 years ago. Road injuries are fewer as roads and vehicles are more secure, but physical discomforts and suicides increase. To his viewpoint, one of the major issue is lack of information regarding the complexity of cases to be treated, although the easier radio access to the emergency regulation doctor. He also insists on the growing time allocated to hospital transfers, mainly due to closure of small-scale hospitals.

Once at Tribehou, the ambulance driver activates sirens and lights to avoid traffic, explaining: *“Even if we think that’s it’s not a real emergency, we can’t be absolutely sure. We have a target to reach”*. The PHE leader moderates his comments: *“Yes, but we know that it’s not a life-threatening case, so keep calm and drive safely!”*.

Once arrived at the hospital, the PHE team brings the patient to the emergency triage area. The patients privacy is not fully respected within the triage area. Patients are waiting for medical attention, often in the middle of a corridor, sprawled on gurneys. PHE team members are usually not comfortable with such conditions. The PHE leader shows: *“Look! You see that man? We drove him at the hospital this morning. He’s here, in the middle of the corridor, without any privacy. Everybody can see him... That’s disgusting!”*.

The driver goes back to the ambulance. Following specific procedures, he disinfects the ambulance as well as controls and puts tools away so that the team is ready to move again in case of another emergency. In the meantime, one of the team members remains with the patient, making sure she is comfortable, while the PHE leader waits for the emergency nurse. A care assistant comes to him to gather information required to welcome the patient. He gives to her the sealed letter written by the GP. She then calls the nurse and takes the patient in charge, waiting for the emergency doctor who will establish the final diagnosis.

The two PHE team members meet their colleague to help him with the ambulance cleaning. Few minutes later, an emergency nurse comes to them and explains that she didn’t find the time to read and sign the health scorecard (she calls it *“your sheet of paper”*). The PHE manager is displeased as he reported very carefully the patient health condition (from the medical care at home to her arrival to emergency) in the scorecard. Moreover, the scorecard is systematically reviewed by the chief of PHE staff who uses it as a monitoring artefact. It plays a key role to assess the PHE teams performance. However, the hospital emergency personnel usually don’t take the scorecard procedure seriously, tending to give non-consideration to its role.

The emergency mission is now over and, the ambulance is available again. Team members come back to their mission, noticing that it was far away from their core competence. PHE team members explain that they are skilled for medical distress, life-threatening cases and unexpected issues. They benefit from specific transportation, tools, protocols and check-lists to handle and report such emergency situations. Training, artefacts, rules are all designed to manage unexpected situations and serve the patient safety in the best possible way. They are especially necessary when missions occur under high time pressure and stress. PHE team members end this discussion in recalling the importance of experience feedback between them. One of the team member explains: *“It’s sometimes difficult to compartmentalize you know... When you come back home, you still think about what we’ve seen, what we’ve done... That’s why it’s crucial to spend time between us. We usually take time to speak about our day. It’s a way to debrief and release pressure”*. Taking the time to debate informally, exchange experience and discuss about solutions are the basics for improving safety and efficiency to their view.

#### **DISCUSSION: CASE ANALYSIS**

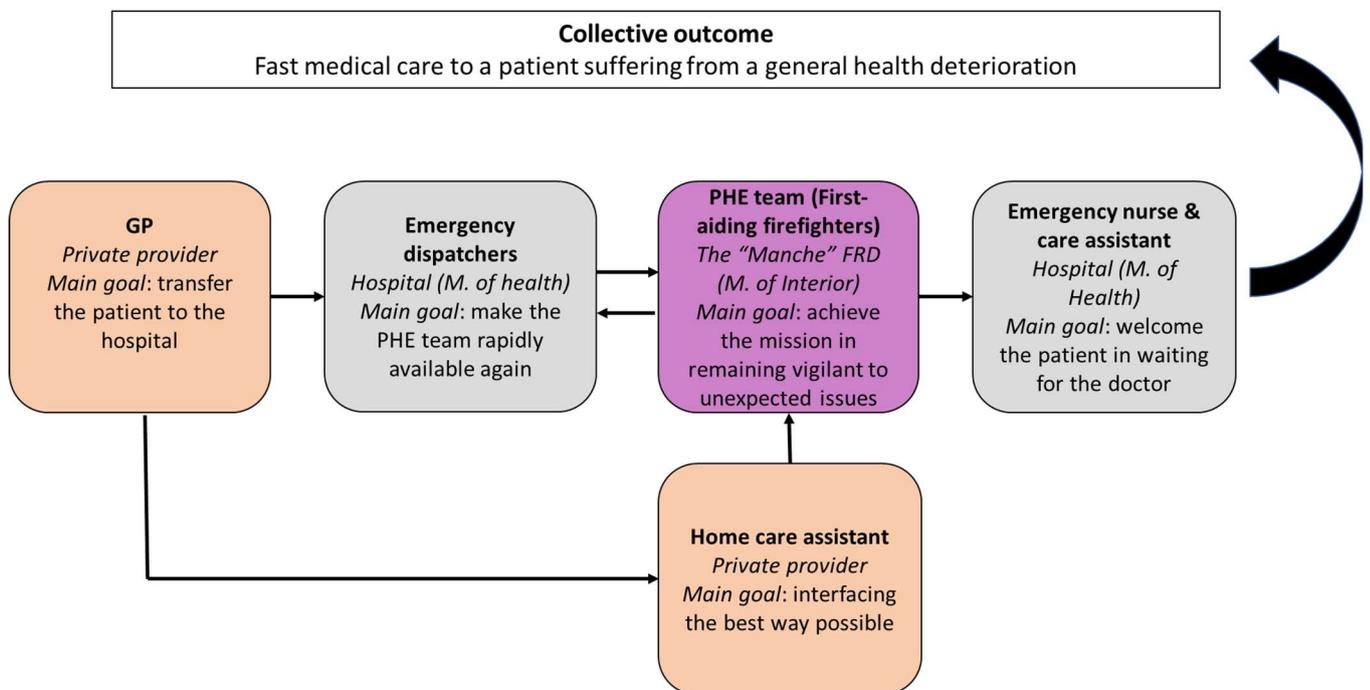
This article set out to answer the question: “how do polycentric systems influence teams’ coordination practices in extreme contexts?”. Our findings suggest that Ostrom polycentric view and IAD framework are a relevant approach to delve into macro and micro-arrangements of coordination as well as their recursive influences.

##### ***Pre-hospital emergencies: a polycentric system***

In our case, multiple actors efficiently achieve a collective outcome (fast medical care to a patient suffering from a general health deterioration) while they don’t report to the same decision center. Furthermore, our case highlights that the practitioners neither share similar individual objectives. In that sense, our case depicts a polycentric system. (Figure 4)

The GP is a private health provider. Considering that he is not able to take care of his patient at home anymore, he requests for hospitalization. His goal is to make her transferred at the hospital. He is helped by the patient home care assistant, who manages logistical considerations and makes the connection between GP instructions and the PHE team. Being employed by a private care unit, she provides interfacing the best she can. The emergency dispatchers called by the GP depend on the hospital (number 15, Ministry of Health). They are in charge of establishing a distant first intention diagnosis and deploying an ambulance to the patient home. They make the decision to send an ambulance and a PHE team consisting of three first-aiders. Their purpose is to quickly and efficiency manage the situation without assigning the PHE team

for too long to this case as it becomes rapidly available again in case of real emergency. Dispatchers use the “private ambulance deficiency” procedure and turn towards the “Manche” Fire Rescue Department (FRD) to call a PHE team of firefighters. We don’t exactly know if it is a real situation of deficiency or if the procedure has been used to “keep it simple” and save time. The PHE team seems to think that, especially as they are frequently assigned through this specific deficiency procedure. The PHE teams consist of one professional and two volunteer firefighters. They are all first-aiders and almost two of them have extensive experience in the field of emergency missions. They belong to the Carentan Fire and Rescue Center which is on the authority of the “Manche” FRD (Ministry of Interior). Although they question why they have been sent on this case instead of a private ambulance, they efficiently and professionally achieve the mission. They strictly apply the rules of procedure in completing the health scorecard and the patient diagnosis (life support checking procedure). They remain extremely vigilant to the patient condition in order to avoid a sudden health deterioration. Finally, once at the hospital, the PHE team interacts with emergency care assistant and nurse. Reporting to the hospital authority, they follow their own protocols and don’t take seriously those of firefighters. Especially, they don’t use the scorecard completed by the PHE manager which gathers information regarding the patient health condition (from the medical care at home to her arrival to emergency). They “welcome” the patient and wait for the emergency doctor for a diagnosis.



*Figure 4. The Tribehou case: a polycentric system*

**Macro-arrangements and coordination practices within the action arena**

The IAD framework allows understanding how these multiple practitioners, who pursue different purposes and report to different decision centers, efficiently coordinate to deliver a collective outcome.

External variables refer to macro-arrangements. In our case, attributes of physical words concern firstly the 9 medical and paramedical practitioners involved in the medical assistance process and, secondly, the time pressure they feel to perform a mission that is not considered as a priority (this is not a life-threatening emergency). The GP is a skilled and experimented rural physician who has medical visits to achieve. Many other patients are waiting for him and he doesn't have enough time to stay close to his patient. Emergency dispatchers also run out of time: they must handle this patient case without assigning the PHE team for too long. They are used to organize hospital transfers. They send a team of firefighters on site as they are aware of their rapidity and professionalism. For its part, the PHE team aims at efficiently handling this case to become rapidly available again. Team members are highly skilled in medical distress and life-threatening emergencies; they want to go back at the Carentan Fire and Rescue Center to wait for a real emergency call. Finally, hospital care assistant and nurse take charge of emergency triage. The PHE team patient is not a priority, unlike other many victims they "welcome" each day. They must quickly manage this case as they could be available again in case of a real emergency. It is important to notice that technologies and material artefacts support time pressure handling. The transmission housing used by the PHE leader allows dispatchers following the mission advancement and quickly re-allocating human resources when it is required. The GP note and sealed letter, the PHE scorecard and the nurse "welcome" report also aim at gathering clear and accurate records to both guarantee the patient safety and store useful and workable knowledge.

Attributes of community highlight the key role played by sharing values and beliefs in our case. All the actors involved in the action situation are in accordance with the final outcome that they have to achieve. They all agree that this patient case is far away from their preference and core competence, but they also make every effort to transfer her at the hospital in the most safety possible way: the early diagnosis is established three times (by the GP, the emergency regulation doctor, the PHE team) and a final and more complete one will be done by the emergency doctor few time after the patient arrival at the hospital. Although time pressure and diversity of expertise and individual goals, they all share the core values of medical or paramedical professionalism in action: apply knowledge and expertise to practice, put into effect procedures

to protect patients and improve care, work constructively with colleagues and show respect for patients.

Finally, rules-use enable to explain how practitioners understand, give effect and operationalize formal rules. In our case, there are many formal and standardized rules followed by practitioners. They mainly concern procedures and agreements and support enforcement and monitoring functions. For example, the agreement between the “Manche” Fire Rescue Department (FRD) and the hospital is used by the emergency dispatchers to rapidly assign a team of firefighters on site. They understand an agreement originally dedicated to private ambulance deficiency, as a way to handle time pressure when the case is not a real emergency but requires a professional and quick achievement. They give effect to this agreement in beeping the PHE team members (using the typical “beep” that is easily identified by practitioners as an ambulance deficiency) and calling them to action. The latter are not fooled but they perform their mission anyway. The “private ambulance deficiency” agreement is a formal procedure supporting enforcement in our case. The scorecard is another relevant example regarding the monitoring function of formal rules. The PHE leader completes it throughout the mission. His first concern relies on one of the core PHE teams’ values: putting into effect procedures to protect patient and improve care. Keeping accurate and legible records is a way to guarantee patient safety and medical care quality. However, the scorecard is also understood as a monitoring artefact by the PHE leader. He knows that it is systematically reviewed by the chief of PHE staff to assess team performance. The PHE leader gives effect and operationalizes the scorecard in scrupulously completing it on the one hand, and in checking that the other practitioners (the emergency nurse in our case) sign it (for lack of reading).

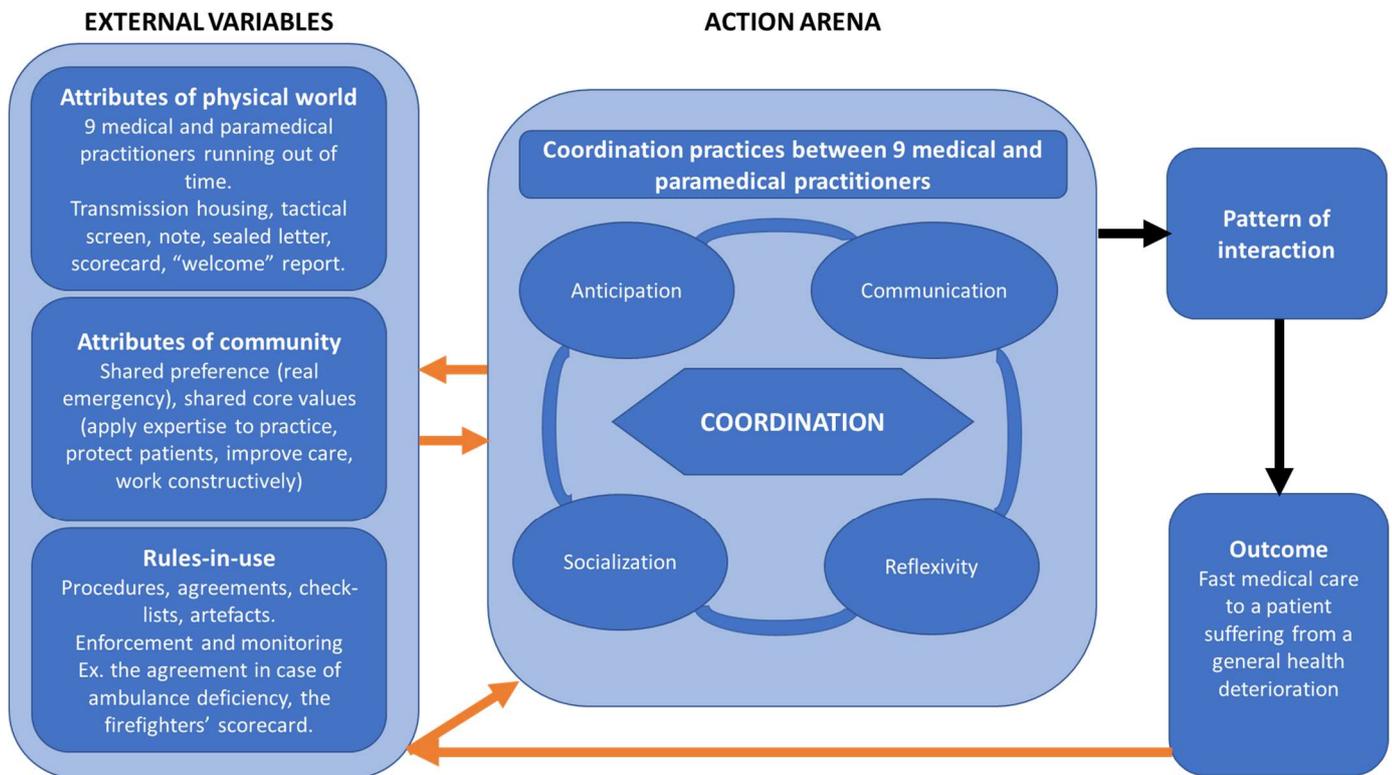
According to Ostrom, micro-arrangements take place within the action arena, when actors are engaged in action situations. We consider that is where coordination practices, as manners of coordinating and working, are developed. In our case, four coordination practices operate in combination to perform coordination. Among these four practices, three of them – communication, socialization and reflexivity – have been already pointed out by literature as key for coordination in extreme context (Godé and Lebraty, 2015, Godé, 2016). Anticipation practices highlight the importance of automatism and adjustments when practitioners run out of time to achieve their missions.

- Anticipation practices allow practitioners to make fast decisions and actions. They are mainly based on in-depth knowledge of agreements, procedures, check-list and artefacts. They provide them with a stable formal structure that is automatically put into

practice regarding cases to handle. These automatism can be viewed as general patterns of interactions interiorized by PHE practitioners. They allow them to save time in anticipating the actions of their colleagues and adjusting actions to patients' needs. For example, volunteer firefighters automatically recognize the typical "beep" for ambulance deficiency. They don't spend time to interpret it and quickly join the rescue center. The agreement between their employers and the "Manche" RFD helps them to save time, without having to justify their sudden non-attendance to work.

- Communication practices refer to ways of relating to and acting upon urgent situations. Our case points out that PHE practitioners combine standardized and natural languages to communicate. The former is related to a technical body of words and numbers (medical and emergency terms, status transmission, etc.), whereas the later reflects more informal and situated ways of communicating. For example, the PHE leader alternates medical and emergency languages to gather useful health information from the patient home care assistant. PHE teams also take time to exchange feelings and experiences between them, before and at the end of the mission.
- Socialization practices are related to emotional and social relationships. They mainly draw on empathy and shared core values. Empathy for the patients they take care is a feeling shared by PHE team members. They attach a great importance to privacy and medical secret. For example, the PHE leader is respectful to medical secret and do not try to read the GP sealed letter. He is also offended by the way patients are handled within the triage arena. The emergency common values allow team members to build a shared and accurate understanding of what their work and roles are within the team and the PHE system as a whole. Moreover, teammates know each other, they are used to work together, to exchange about their experiences and working stories. As such, they gradually learn to know and trust each other.
- Reflexive practices are about being recursive in going back both on oneself and on the team to examine collective commitments and weaknesses. It is an ability to move forward with regard to actions and the awareness of the conditions of our acting. In our case, reflexive practices are developed through informal debriefing sessions during transportation: backward (to home patient), team members informally return on their emergency missions achieved the day before, and how they handled them; forward (to hospital), they debrief their missions and point out lessons learned. These debriefings are concentrated on patient safety: general health status, diagnosis, potential deterioration, transportation and medical care attention at the hospital.

The following figure 5 pictures the intricacy between macro-arrangements and coordination practices.



*Figure 5. The Tribehou case: Intricacies between macro-arrangements (external variables) and coordination practices (action arena)*

***Influences between macro-arrangements and coordination practices (in progress)***

The picture 5 highlights four orange arrows which depict the influences connections between macro-arrangements and coordination practices within the action arena. These influences are two types:

- Recursive influences between macro-arrangements and coordination practices affect collective outcomes. They are “short-term” influences as they play in interaction in the course of the emergency mission. On one hand, anticipation, communication, socialization and reflexive coordination practices allow PHE teams to both interpret and operationalize the system within which they operate. On the other hand, attributes of physical world, community and rules-in-use impact the way practitioners concretely anticipate, communicate, socialize and debrief in their daily working: automatisms, words, language, relationships, times and subjects of debriefing are different from a mission to another.

- Once the emergency mission achieved, the outcome may affect macro-arrangements and coordination practices. They are “long-term” influences as they require investigating and calling-into-question the short-term recursive influences. These long-term influences draw on retrospective assessments of the outcome. They rely on in-depth examination of what have been done to perform the mission.

## CONCLUSION (in progress)

The Ostrom’s polycentric perspective opens a new space to examine coordination when team members report to different decision-making centers, pursue different purposes but are collectively engaged in the same collective outcome. More precisely, the Ostrom’s view allows delve deeper into the recursive influences between macro-arrangements and coordination practices in extreme contexts as it exposes processes and issues that may remain hidden with a more micro-level analysis.

Our field study and analysis of the Tribehou case expanded our understanding of the dynamics of coordinating in extreme contexts in different ways. First, it opens the black box of the action arena. As a conceptual unit constitutive of the IAD framework, Ostrom does not go deeper into the action arena, simply stating that it comprises actors and an action situation in interaction. In this article, we contribute in answering to the question of “how” these interactions concretely unfold. The action arena represents the space of coordinating, within which practitioners develop four types of coordination practices (anticipation, communication, socialization and reflexivity) to both interpret and operationalize the system within which they operate. Second, our case analysis allows questioning the “exogeneous” nature of IAD framework external variables. In fact, we consider that attributes of the physical world, community and rules-in-use are endogenized to the framework by virtue of the two types influence connections (short and long-terms) we reveal. Third, our findings advance our understanding of coordination in extreme context in demonstrating the role played by complex macro-arrangements within which coordination practices are embedded in. Extreme contexts are specific regarding more classical organizational settings. We suggest that they are marked by many formal and standardized rules, dedicated skills and artefacts, respect for the hierarchy, esprit de corps, community core values and high teams commitment. Such macro-arrangements offer a structure of action to teams which dynamically deal with to achieve their missions. As such, they ineluctably affect the form and content of practices developed *in situ*. Finally, our article offers some important considerations for practice regarding teams in organizations as a deep understanding of recursive influences offers considerable potential for improving performance

of private organizations. As a growing number of organizations face extreme contexts and need to perform challenging outcomes and unexpected issues, future research on polycentric coordination is sorely required.

Our *in-progress* findings suffer from limitations. Especially, they are inextricably tied to our qualitative approach. Although our unique “Tribehou” case provides a rich dataset for generating deeper understanding of recursive influences between macro-arrangements and coordination practices, we need to elaborate on a multiple cases analysis to assess our first findings relevance. Moreover, other approaches, such as quantitative analysis, could lead to distinct insights. A qualitative methodology may be less suitable than quantitative approach for generalizing results and testing a theory.

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