



**HAL**  
open science

# Safety optimization in an accident-prone aquatic context: a qualitative study of drowning risk detection by public pool lifeguards

Vignac Elie, Bastien Soulé, Pascal Lebihain

► **To cite this version:**

Vignac Elie, Bastien Soulé, Pascal Lebihain. Safety optimization in an accident-prone aquatic context: a qualitative study of drowning risk detection by public pool lifeguards. *Journal of Safety Research*, 2022, 81, pp.239-248. 10.1016/j.jsr.2022.03.001 . hal-03415140

**HAL Id: hal-03415140**

**<https://hal.science/hal-03415140v1>**

Submitted on 22 Jul 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

**Title : Safety optimization in an accident-prone aquatic context: a qualitative study  
of drowning risk detection by public pool lifeguards**

**Élie VIGNAC (corresponding author) – Associate Professor**

Centre d'Études des Transformations des Activités Physiques et Sportives - CÉTAPS EA  
3832

UFR STAPS - Boulevard Siegfried

Université de Rouen-Normandie

76 821 MONT-SAINT-AIGNAN CEDEX

FRANCE

Email : [elie.vignac@univ-rouen.fr](mailto:elie.vignac@univ-rouen.fr)

Phone : +33 7 68 96 33 63

**Pascal LEBIHAIN – Associate professor**

Faculté des Sciences du Sport de Poitiers

Centre de Recherche en Gestion (EA 1722)

Université de Poitiers, France

**Bastien SOULÉ – Full Professor**

Laboratoire sur les Vulnérabilités et l'Innovation dans le Sport (L-ViS, EA 7428)

Université Claude Bernard Lyon 1, France

**Conflict of interest :** We do not have any conflicts of interest to declare.

# **Safety optimization in an accident-prone aquatic context: a qualitative study of drowning risk detection by public pool lifeguards**

## **Abstract**

*Introduction:* Drownings occur in French public swimming pools (PCP) in spite of constant supervision by qualified lifeguards. This study hypothesizes that organizational aspects may affect the mission of pool supervision and takes a systemic approach that views safety as an emergent property, and drowning as a multifactorial and long-term process that is not restricted to the end of an accidental sequence. *Method:* We conducted a qualitative survey at four municipal pools in France based on 30 semi-structured interviews. *Results:* The findings revealed that several interrelated elements influence the detection by lifeguards of bathers in distress: (a) their training, their conception of the profession, and the reasons that led them to enter this occupation; (b) their representations of the drowning risk and the evaluation of their ability to perceive such situations; (c) the question of regulation; and (d) the methods of dealing with this framework in daily operations, which involves trade-offs and appropriations at each level of the system. *Conclusions:* In order to identify the most significant influences, it seems relevant: (a) to shift the focus away from these professionals; and (b) to prioritize an analysis of the functioning of the risk management system as a whole, not just critical or post-accident periods. In order to reduce the risk to swimmers, it seems preferable to identify the source of the constraints that weigh daily on lifeguards in charge of pool supervision. The functioning of PSP's is the end result of joint regulation processes likely to influence, positively or negatively, the identified feedback loops. An analysis of the pool supervision can help to identify early warning signs of vulnerability (which can sometimes be acted upon at low cost), identify the practical implications, and make preventive recommendations.

**Keywords:** public swimming pool, pool supervision, drowning prevention, risk analysis, safety management

## **Introduction**

According to the World Health Organization (WHO), drowning is the process of experiencing respiratory impairment from submersion or immersion in liquid; outcomes are classified as death, morbidity and no morbidity. Most drownings in Public Swimming Pools (PSP) are due to insufficient swimming skills or loss of consciousness, combined with ineffective supervision (Avramidis, 2009; Griffiths & Griffiths, 2013; Bierens & Scapigliati, 2014; Vignac et al., 2015, 2016). This study focuses on the conditions under which pool supervision is carried out in France, to better understand the context of ‘loose’ supervision (Vaughan, 1999) and go beyond behavioral or human error explanations. To shift the focus away from lifeguards, we based on the hypothesis that institutional and organizational aspects strongly affect the mission of pool supervision. In line with this assumption, the study takes a systemic approach that views safety as an emergent property (Hardy, 2010; Leveson, 2004) and drowning as a multifactorial and long-term process (Vanpouille et al., 2017). To analyze the functioning of the risk management system as a whole, not just critical or post-accident periods, we conducted a case study through a qualitative survey at four municipal PSP. The findings of our interpretivist approach revealed that four major elements weigh on the detection by lifeguards of swimmers at risk: their training, their perception of drowning risk, the effectiveness of the rules in place, and the constraints involved in the daily operation of the facility. Practical implications have been drawn from these results. Some reinforce the relevance of previous preventive recommendations, while new perspectives are also highlighted.

## **Theoretical framework**

In French PSP, the law requires that pool supervision be constant. It must never be interrupted (Belhache, 2010) and lifeguards on duty must be dedicated exclusively to it. This obliges each facility manager to draw up a Supervision and Rescue Organization Plan (SROP) adapted to the specificities of their facility (Cranga, 2014). Considered the cornerstone of safety in PSP, this document outlines all the measures in place to prevent accidents related to aquatic activities and frames the emergency responses.

While it is in theory possible to ensure that at least one lifeguard is permanently on duty at the edge of a pool, research into the human factor underlines that this supervision activity is fallible (Brener & Oostman, 2002; Ellis, 2001; Mollard, 2014), due to the constraints of the sensory environment (e.g., noise, temperature), the often prolonged time spent supervising, the monotony of the task, or the frustration inherent in the rarity of critical events (Bibard, 2012; Mollard, 2014). In practice, both

cognitively and perceptually, good bathing supervision appears to be a real challenge (Lanagan-Leitzel et al., 2015).

In this study, we put forward a complementary perspective – organizational rather than individual – in order to analyze the effectiveness and efficiency of supervision in PSP (Vignac, 2018). A finding by Reason (1993) served as a starting point for our approach: reliability problems often stem from the fact that actors who circumvent safety rules assume they will be the only ones to do so. This has two crucial implications: the first is that behavior cannot be completely anticipated, understood, or controlled (Hollnagel, 2004); and the second is that the question of security must be approached from a systemic angle. In order to identify the progressive migration of a system towards accident, it seems relevant to understand active failures as inadequate feedback loops, rather than as the outcome of a more or less linear sequence of events (Hardy, 2010; Leveson, 2004). Without directly applying the STAMP model (Systems-Theoretic Accident Model and Processes; Leveson, 2004), we drew inspiration from the paradigm shift it reflects: instead of seeking to know how and why a particular accident occurred, we sought to understand how a system is maintained in a stable state on a daily basis, and from there, what creates disturbances. This approach views accidents as part of a complex dynamic process, characterized by inadequate feedback in an altered operating context (Hardy, 2010).

Despite the risks inherent in the aquatic environment, a pool system is usually maintained in a state of equilibrium by virtue of several types of actions (Fig. 1). One of these is the users' swimming abilities, but safety is also the result of other interactions between the components of the system: a child who cannot swim receives special attention from parents or teachers; another swimmer can detect a person in distress on the surface or underwater; in some pools, a three-dimensional video detection system signals an abnormal underwater trajectory and/or immersion to the supervision staff<sup>1</sup> (Fig.1). This study focused specifically on lifeguard supervision, which is intended to prevent the system from migrating to a state prone to accident when (at least) one of these feedbacks fail: insufficient swimming skills, collapse in the water, loss of alertness of a parent or teacher.<sup>2</sup> We chose to explore the feedback loop *detection and interpretation of distress situations by lifeguards*, which is crucial for two reasons: first, it occurs over an extended period, from the arrival of users at the edge of the pool to their immersion; and second, it conditions the implementation of remedial actions (decision-making leading to intervention, then first aid or even resuscitation).

---

<sup>1</sup> In France, 129 public pools in 83 facilities are equipped with the Poseidon – MG International detection system (source: Poseidon company, April 2020) out of the approximately 6,000 pools in 4,000 facilities in the country (French Swimming Federation, 2019). In this study, none of the swimming pools we researched were equipped with this system.

<sup>2</sup> For example, in a metropolitan area of western France counting a population of 276,000 and 4 PSP, lifeguards reported 282 water rescues over a period of 32 months. These drowning sequences could have led to the death of the victim if no one had intervened (Vignac et al., 2019).

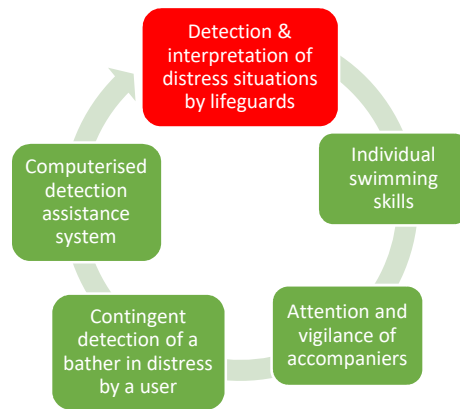


Figure 1. Feedback loops contributing to the safety equilibrium in PSP

More specifically, we investigated the external factors (Thornberry, 2014) impacting this particularly sensitive feedback loop at three levels (Le Coze, 2016):

- macro: organizational environment, regulations, economic considerations, employment structure, training and professional culture of lifeguards
- meso: organizational dynamics, division and planning of tasks, internal procedures
- micro: interpretation of instructions by actors, application as well as appropriation of rules, negotiations and adaptations.

Taking into consideration the relationships between the environment, the organization, and its actors makes it possible to view accidents and safety as social constructs (de Terssac & Mignard, 2011; Le Coze, 2016). From this point of view, ensuring safety depends less on prescribed procedures (indicating how to act) than on negotiations between the supervisors and the operators who shape safety measures. According to this approach, deviations (bypassing rules, tacit arrangements, informal adjustments, reinterpretations of directives and quality criteria, redefinition of instructions, etc.) are intended to supplement or adapt the planned functioning (sometimes incompatible with reality and field requirements; Bourrier, 1999, 2003). This raises the following questions: do the negotiated rules allow better safety performance (through adaptation and anticipation)? Or do they weaken it by jeopardizing the collective effectiveness of in-depth safety defenses (Le Coze, 2016)?

## Material/Method

A qualitative approach was favored to take into consideration the subjectivity of those involved in the complex focus of safety. Data triangulation was achieved through a combination of documentary analysis, participant observation, and semi-structured interviews within four PSP captured as case studies. This combination made it possible to understand the meaning and rationale of decisions made by partakers of this social construct, as well as their feeling and analysis about experienced professional situations.

#### *Presentation of the study area*

The sample consisted of four aquatic facilities managed by a single municipal area in France. Their cumulative annual frequentation is estimated to be close to 700,000 admissions. The four facilities have differing characteristics in terms of surface area, capacity, pool configuration, human resources, and type of attendance (Table 1). Despite the local nature of this study, such diversity echoes the plurality of facility profiles at the national scale. As such, it is likely to contribute to the transferability of our results (Pourtois & Desmet, 1997), since conclusions reached can be extended to contexts other than the one studied.

Table 1. The four aquatic facilities studied

		Complex A	Complex B	Complex C	Complex D
<b>Attendance type</b>	Fee-paying public and private activities	70%	70%	55%	65%
	Clubs, organizations, institutions, groups	20%	15%	15%	20%
	Schoolchildren	10%	15%	30%	15%
<b>Estimated annual attendance</b>		275,000	170,000	65,000	200,000
<b>Main practices and services</b>		Sport, leisure, wellness Indoor & outdoor pools	Sport, leisure Indoor pools	Sport Indoor pools	Sport, leisure Indoor & convertible pools
<b>Total number of staff</b>		53	19	14	21
<b>Number of pools</b>		5	3	2	4
<b>Construction period</b>		1960s	1970s	1970s	1970s
<b>Capacity</b>		2000	400	400	350

Most of the staff are public employees, while others are hired as contract workers for occasional and seasonal needs. Different professional skills coexist in these facilities: the teaching of swimming, leading fitness sessions or activities (e.g., baby swimming, aquabike, aquagym), and supervision by lifeguards. Other tasks such as upkeep and maintenance are carried out by technicians, while administrative staff handle public reception (e.g., cash desk, changing rooms). All aquatic facilities are overseen by the director of the municipal sports department, with each facility run by a site manager. These site managers are assisted by several pool managers (generally, experienced lifeguards with specific leadership skills).

### *Data gathering*

The documentary analysis was first carried out to familiarize with the institutional context. The SROP, bylaws, and internal procedures of each PSP in our sample were consulted, as were the memos at the level of the community sports department. Crozier and Friedberg (1977) stress the importance of pre-structuring the context of action before studying the organizational dynamics in depth. Beyond the formal functioning in terms of safety management, this analysis revealed some grey areas and a few contradictions between the rules and procedures in force.

In addition, for three years, the principal investigator participated as an observer in the community sports department meetings dealing with safety issues in PSP (organizational changes, implementation of



seasonal operation, programming of supervision after the renovation of a facility, crisis meetings following incidents, etc.). He was thus at the heart of the collective deliberations and decisions on safety, alongside the department's executives and the heads of the facilities. This method allowed us to identify the actors' priorities and the trade-offs made at different scales within the system studied.

Views on safety issues are generally dependent on occupational categories. Faced with multiple goals and constraints, a manager is in search of compromise, resulting in arbitrated safety, whereas a front-line operator takes a more practical and realistic approach, resulting in real-time safety (Le Coze, 2016). Effective risk analysis thus requires the participation of actors with diverse profiles and experiences (Mays & Poumadère, 1989; Périlhon, 1998). Consistently with this recommendation, the principal investigator conducted 30 semi-structured individual interviews. Recruitment was on a voluntary basis, after a short presentation of the research objectives. For the lifeguard population, approximately 50% of the staff were interviewed per site (n=20) in order to record their observations of their supervision activity as it takes place within their broader professional context. We also interviewed two-thirds of the pool managers (n=4), all the site managers (n=4), the head of the community sports department, and the elected representative (vice-president in charge of sports). Comprising both central and peripheral informants (Huberman & Miles, 1991), with a more or less direct link to supervision, but all exerting an influence on this issue, this sample is representative in terms of social processes at work in the studied safety system.

Organizations that manage risks face specific issues that can make it difficult to obtain candid information (Fournier, 2001). However, the interviewer being himself a lifeguard (although not active during the research period), and welcome as an observer, ensured the collection of honest opinions in a context of trust, despite the sensitive nature of the subject (Freyssinet-Dominjon, 1997). This proximity with informants can in turn be considered an obstacle in terms of interpretation: the building of a conceptual framework prior to interviews, and the collective sense making of data intended to counterbalance such potential bias.

Each interview lasted on average an hour and a half and was conducted during the working hours of the interviewees, with the consent of their superiors. In addition to focusing on the risk of drowning (specifically prevention and pool supervision), the interviews more broadly tackled the daily complex, multifaceted activity of lifeguards. Their training, recruitment, and representation of the drowning process were also discussed. By doing so, the organizational, social, and economic context in which the activity is carried out was not overlooked (Hood et al., 1999). Before the survey, we designed an

interview grid consisting of nine main themes (which also served as analysis categories; Appendix 1), accompanied by follow-up questions. This grid was adapted for interviewees who do not intervene as lifeguards (by removing topics such as the technical aspect of supervision, for example). Theoretically anchored, initially based on conceptual elements and previous research (Lebihain, 2001; Soulé, 2004), the grid was tested, refined, and validated in a preparatory case study (since published: Vignac et al., 2018) in another western city of similar size with five facilities. We did not call upon an ethics committee to conduct this research because we obtained explicit permission from the relevant metropolis. In addition, the study was non-interventional and the anonymity of organizations, institutions, and individuals was preserved.

According to Pourtois and Desmet (1997, p. 121), saturation is reached “when no sufficiently new data emerge from the last interviews or observations to justify an increase in empirical material. In this case, we say that the sample is representative in terms of social processes.” In our case, data saturation (Glaser & Strauss, 1967) was achieved after 12 to 14 interviews with lifeguards; no new result emerged at this point. The remaining programmed interviews have nonetheless been realized to solidify the study.

#### *Data processing and analysis*

The qualitative information collected was transcribed in full to facilitate its analysis. After pseudonymization, a thematic content analysis based on the 9 analysis categories (AC) and 26 analysis units (AU) was carried out using Modalisa software (Appendix 1). In this regard, the interview grid was much more than a guide for conducting the interview; it was in fact a “set of questions to be asked that had been formalized, developed, subdivided and written up so that they could be used in an analytical grid anchored in the conceptual framework” (Mukamurera et al., 2006, p. 117). Due to its earlier amendments, the check of the residual material (i.e., the part of the corpus that was not retained during the initial coding), intended to ensure that the interpretations produced are not too heavily dependent on the theoretical framing, did not result in the creation of supplementary categories.

The data were collected and processed by the principal investigator. After this thematic coding (Huberman & Miles, 1991) rooted in a deliberative logic (Savoie-Zajc, 2004), the analysis and interpretation were carried out collectively by the team members (the principal investigator and his two co-authors). This intersubjectivity allowed for a broader vision thanks to the complementarity of the points of view. It ultimately ensured reliability through inter-judge validation of the meaning of the data. In the end, a plausible and coherent organization of the results and their interpretation, ensuring the

intelligibility of the phenomenon under study, made it possible to conclude a second form of saturation with regard to the different codified meanings (Huberman & Miles, 1991).

Thus, a range of techniques were used among those designed to make qualitative research transparent, rigorous, and trustworthy: theoretical anchoring of categories, data triangulation, saturation of both data and interpretations, inter-coder reliability, and search for residual material and contrary evidence (Mukamurera et al., 2006).

## **Results**

The findings revealed that several interrelated elements influence the detection by lifeguards of bathers in distress: (a) their training, their conception of the profession, and the reasons that led them to enter this occupation; (b) their representations of the drowning risk, of its distinctive features, and the evaluation of their ability to perceive such situations; (c) the question of regulation (the origin of the rules, the knowledge and understanding of these rules, and the rules' effectiveness in terms of guiding action); and (d) the methods of dealing with this framework, as well as other constraints, in the concrete and daily operation of swimming facilities, which involves trade-offs and appropriations at each level of the system.

### *1. Pool supervision: a mission not highly valued by lifeguards*

In France, the initial training of lifeguards focuses on leading aquatic activities and teaching. Safety is also a priority, with a clear emphasis placed on rescue intervention and victim care. Yet awareness of supervision issues (both theoretical and practical) is limited, and this is not the subject of a specific module in the curriculum. As a result, supervision is really learned in the field, in contact with experienced professionals: a conditional learning process that strongly depends on the local transmission of knowledge through the practices and commitment of colleagues. Supervision is also consigned to the background in the ongoing training of lifeguards (who must take a compulsory refresher course every five years); these courses are mostly geared toward the acquisition of knowledge relating to new sports activities and the quality of post-accident care. These priorities in terms of training also shape the way in which lifeguards prioritize their missions and preconceive drowning accidents and their warning signs. We found that the interviewed lifeguards were much more concerned with their ability to intervene and rescue victims adequately than with their ability to prevent an accident in the first place by detecting aquatic distress.

A second point revealed by the interviews is that many lifeguards enter the profession anticipating a high level of autonomy, a low level of hierarchy, and flexible schedules. All the staff interviewed generally considered their working conditions satisfactory, even very satisfactory. One aspect of flexible scheduling is that in order to benefit from extended periods of time off, some lifeguards sign up for long supervision slots (which are known to be potentially detrimental to supervision). This practice is generally accepted by the facility and the site managers in charge of planning, who are supposed to embody authority but are for the most part from the same sector and vocational field as the lifeguards.

Lastly, lifeguards are increasingly multi-skilled, responsible for several missions that interest them to varying degrees: they prefer to teach or train others (valuing the technical and pedagogical aspects of the profession, considered the most prestigious), whereas they are much less interested in organizing or leading aquatic activities and, least of all, in supervision. The latter is considered particularly tedious and thankless, due to the permanent tension between the boredom of waiting for a rare event and the heavy responsibility when the event occurs in case of failure. Lifeguards so little appreciate pool supervision that some, sometimes supported by site managers, avoid it by taking time off during peak periods (e.g., during the summer), adjusting their work schedules, or calling on temporary workers. Others consider supervision a suitable rest time between other missions that require more energy investment (e.g., leading activities or teaching). Pool supervision is only very exceptionally considered a priority by lifeguards; in many cases, it is exercised with a certain passivity, even nonchalance.

## *2. Lifeguards' representations of risks*

Many drownings occur in supervised environments (Dalke, 2015) in the presence of rescuers and/or bathers who have been unable to identify the distress situation. Lifeguards are poorly trained in this respect. Moreover, not all of them have experienced critical situations. Consequently, they can develop heterogeneous, partly erroneous representations of the drowning process and of the distinctive signs of a person in distress. Our interviews revealed that many define a critical situation as follows: submersion/resurfacing phases (going back and forth between the surface and the underwater environment); adoption of an upright position, making it difficult to stay at the surface; muscular tetany and respiratory distress linked to panic; arm restlessness on the surface with sounds and/or screams.

The lifeguards we interviewed also considered that a drowning is easier to detect than a faintness in water (loss of consciousness due to trauma, hypoglycaemia, heart failure, thermal shock, syncope, etc.). Consequently, they view drowning as particularly unacceptable to happen on a lifeguard's watch, insofar

as it directly calls into question the supervision chain that is supposed to prevent it. Yet this reflects a rather incomplete view of the drowning process, as drowning can also be almost undetectable. In relation to water faintness, we observed a form of fatalism. The lifeguards believed that their duty while pool supervising is above all to detect the above-water phase of aquatic distress, then to intervene if necessary; implying that once the victim is underwater, it is less their responsibility, as it is known to be very difficult to locate a submerged body.

In fact, many interviewed lifeguards confessed that they feel ineffective while supervising a pool. Some stated that while they accept that the constant supervision required by regulations is indispensable, it is paradoxically impossible to carry out effectively. A recurrent, feared situation is described: a single lifeguard on duty, having to cope with diverse constraints, will inevitably result in a temporary suspension of supervision. The lifeguards also acknowledge that even if they are correctly positioned, focused, and vigilant, this does not guarantee the identification of a possible victim. Such testimonies illustrate lifeguards' realism regarding their own fallibility, which increases in the event of long periods of pool supervision<sup>3</sup>: most lifeguards admit that they are sometimes physically present, but mentally absent.

As surprising as it may seem, detection is largely a matter of luck, especially since the drowning process is rapid. Indeed, the absence of any notable accidents in certain facilities was explained by lifeguards as luck; some lifeguards reported near-misses while the survival of users held up very little.

### *3. Vague regulations lead to plural interpretations*

The French legal framework that regulates supervision is difficult to grasp both for lifeguards and for managers. There are abundant rules, making them difficult to check and to respect scrupulously. The high degree of generality leaves much room for interpretation, and some contradictions emerge. For example, the constant supervision of pools by lifeguards is a strict requirement of the French Sport Code. But it comes up against the principle of public service continuity, or the internal procedures of each facility, which involve ancillary missions: reception of and information to the public; minor repairs; installation, storage and lending of equipment; awarding swimming certificates; administrative tasks; enforcement of regulations; and so forth. Lifeguards have to deal with operating conditions that can be altered due to the very procedures governing their activity. Their accounts of past accidents and incidents detail various distractions, as well as the intrusion of ancillary tasks during supervision, which hamper the detection of

---

<sup>3</sup> Some of lifeguards mentioned periods of 6 hours of consecutive supervision per day, generating a state of physical fatigue, alteration of sensory faculties and mental weariness.

an aquatic distress situation. For example, the supervision system frequently slackens at the end of the day when a number of unavoidable tasks interfere with pool supervision: stowing away equipment, reminding users of the upcoming closure of the facility, evacuating the pools, and so forth.

Confronted with vague or conflicting requirements, many lifeguards complain that they have to improvise. The interviewees seem to lack control and certainty about what they are allowed to do or not to do: the number of lifeguards assigned to supervision, the duties of lifeguards' assistants and how they exert these, partial opening or total closure in the event of the absence of a replacement, and so forth. When in doubt, facility managers end up arbitrating on their own, independently finding solutions that are often in line with operating and exploitation priorities. Regulatory compliance (having a lifeguard on duty for each pool) then takes precedence over efficiency, as the SROP plays a key role in swimming pool operations. Ideally, this plan should be the output of a participatory process, adapted to the characteristics of each facility, known and mastered by all stakeholders. In practice, it is drawn up following a top-down approach that places particular emphasis on the managers' point of view. The lifeguards may recommend a bottom-up approach that takes into account their experience and daily constraints but, in fact, the plan is rarely co-constructed; managers fear the overly long and conflictual process if many points of view are expressed.

As with lifeguard training, each SROP focuses on the organizational response in case of emergency. While the aim of the SROP is to enable prevention and anticipation in order to avoid the occurrence of accidents, supervision is not very central – frequently it is even excluded. In fact, its real purpose is to structure an intervention (alert, rescue, first aid, evacuation procedure, coordination of rescue, etc.) rather than to formalize supervision practices and prevent accidents in the first place.

SROPs are generally poorly known and mastered by lifeguards. This is a source of vulnerability for the supervision system. Some interviewees had never consulted the SROP in their facility, while others had read it but forgotten its content. In any case, these official documents have a limited impact<sup>4</sup>. If they are too exhaustive and detailed, they are difficult for stakeholders to consult and understand, while generating excessive rigidity. On the other hand, if they are too vague, they create ambiguity that favors potentially harmful interpretations in terms of safety. Either situation gives rise to informal work-arounds that mean the day-to-day functioning frequently deviates from the formal guidelines.

---

<sup>4</sup> Not only do these documents differ depending on the site (in terms of quantity, level of detail, etc.), but there is generally no accessible summarized version that outlines the essentials for easier consultation. In fact, the interviewed managers experience methodological difficulties in formalizing clear and concise documents, which is a source of confusion in the implementation of each SROP.

In any case, the SROP offers decision-makers a great deal of slack in the way they organize safety, particularly in terms of the number of supervisory staff; for example, a site manager can open a swimming facility with several pools with a single lifeguard on a temporary basis. This ‘reduced’ operation legally allows a lifeguard to be removed from the supervision system so as not to interrupt the continuity of public service if he/she has to perform another task from time to time. Most of the lifeguards we interviewed criticized management for resorting to this reduced supervision (which is supposed to be exceptional and for short durations) for bad reasons (e.g., to reduce salary costs in a tight budget context). They argued that the procedure was routinized in day-to-day management when it is supposed to be exceptional. Many lifeguards expressed a desire to work in compliance with the rules and defended the existence of these safety guidelines, but surprisingly, not all systematically criticized the excessive recourse to reduced supervision. There are several likely reasons for this. First, it is a means to extract oneself from the devalued mission of pool supervision. Second, it clears the lifeguard from liability in the event of an accident. And third, accepting this ‘bending of the rules’ provides a bargaining chip in other negotiations with management.

On the lifeguards’ side, SROP can be a source of support in favor of their profession. On the managers’ side, it is proof of compliance with regulatory requirements and can act as an implicit transfer of responsibility to the lifeguards (who can be blamed for poor supervision in the event of an accident), and as managerial leverage to govern the operation of the facility by refocusing agents who deviate from the guidelines.

#### *4. Arbitration, compromise and informal work-arounds*

As previously mentioned, the systems described are conducive to finding strategies that work around the rule. In practice, lifeguards are occasionally diverted from their supervisory role to deal with day-to-day operational issues: going to the reception desk to get the information needed to properly prepare an activity session; consulting their work messaging system or the intranet on a computer; intervening in the machine room if the heating is poorly controlled; and so forth. These informal operations reduce or even suspend supervision. This often stems from inadequate work planning, particularly in the transition between tasks (e.g., teaching, activity sessions, supervision): for example, one lifeguard finishes a sports session, puts away the equipment, ensures customer relations, and possibly showers before taking over the supervision of a pool; another lifeguard, who is supposed to wait for the former to arrive, leaves the supervision post to start his or her own activity session on time. As a result, a pool may not be supervised for several minutes. Other recurrent situations include the failure to take into account the fact that

lifeguards sometimes need to relieve themselves, leading to very long supervision periods without breaks, lack of rotation of staff and/or information transmission time,<sup>5</sup> and so forth.

Internal communication within a facility can also be lacking. This occasionally forces actors to reorganize as a matter of urgency to ensure the continuity of public service: last-minute planning, uncommunicated changes, varying attribution of water lines to schools, unreplaced absent staff, and so forth. Last-minute adaptations are examples of informal fixes that attest to the flexibility of lifeguards. However, in such circumstances where trade-offs are necessary, supervision is often not prioritized. It is not considered 'sacrosanct,' but 'buffer' time that can be used to absorb overflows and unplanned organizational problems. In fact, it is common to cut back on obligations in this area faced with the challenge of providing better-quality sports activities or classes. In short, pool supervision is used as an adjustable variable to cope with the other constraints lifeguards must juggle.

Various ways of handling pool supervision aim to make it easier to endure over long periods, but these can contribute to degrading its quality. The spatial position of the supervision posts, due to particular weather conditions or to enable discussions between colleagues, is revealing in this respect. In the past, the location chosen by lifeguards for reasons of comfort has contributed to delaying the detection of a submerged body. Nevertheless, these changes in the working environment can also be interpreted in a positive way: several lifeguards stated that verbal exchanges with others – although this takes liberties regarding supervision rules – enables them to remain alert and avoid drowsiness. More problematic is the question of unplanned breaks taken by lifeguards in charge of supervision. Some did not seem to realize how serious the consequences of being away for a few minutes can be; others claimed to cope with this risk by warning colleagues of their temporary absence, trying to reduce its duration, keeping an eye on the pool during the break, equipping themselves with a walkie-talkie 'just in case,' and so forth. Nonetheless, some of the interviewees mentioned feeling a form of remorse or guilt when returning from a break.

While the interviews revealed that these informal adaptations of the rules clearly occur, many lifeguards deplore such behavior and are concerned about the possible consequences. In their view, the weak authority exercised by managers contributes to the normalization of deviation from the rules: gaps in supervision when one lifeguard takes over from another are more or less tolerated by managers, impromptu breaks go unquestioned, and coercive measures are scarce. The interviews confirmed that site

---

<sup>5</sup> Some lifeguards working within the same facility only cross paths briefly. This requires them to exchange information during periods of supervision, which is a source of distraction in the sense of Pia (1984).



and pool managers are aware that these informal operations are likely to have a negative impact on pool supervision, but that many 'gave up' enforcement because this had no real effect, and also because they wished to preserve social peace at work. This flexibility is probably excessive, but it allows the system to function and achieve its goals in a certain harmony. Too much interventionism would be a source of tension and/or could reduce professional engagement, although a number of interviewees (including lifeguards) mentioned that they felt the enforcement of the rules should be firmer. Some lifeguards go so far as to hope for the occurrence of a revealing accident that would make it possible to call the system into question.

In fact, both sides exploit compliance with the rules (even if they do not necessarily master these) and regularly raise security issues. Occasionally, the lifeguards wield the threat of not opening a facility if the supervision system is deemed insufficient and/or non-compliant. Lifeguards' autonomy and lack of managerial control can result in a disembodiment of hierarchical relationships, leading to a feeling of abandonment and isolation, especially among those working on the ground. At the same time, it is difficult for managers to sanction serious breaches (such as abandonment of post) since tensions arise as soon as the lifeguard's professionalism is questioned. This results in permanent tension between maintaining social peace and the search for efficiency, which can be viewed as laxity. For lifeguards, another complication is that raising issues related to safety can be embarrassing. They are afraid of being seen as overly demanding, highlighting problems for which managers do not really have a solution. This encourages a certain conformity in staff to not take up the issue, even when they identify a dysfunction; this is particularly the case for young lifeguards, who want to do their job well but do not want to make waves or risk standing out as a complainer.

To put the site managers' 'laxity' in context, they pointed out that they are assessed not only on the absence of accidents, but on the basis of operating results (attendance, revenue, expenses, user satisfaction, etc.). In an increasingly tight financial context, they tend to reduce costs (supervision is costly and consumes most of the human resources expenditure) and maximize lucrative opportunities (especially sports sessions). To this end, they deploy strategies to rebalance their requirements, including those of lifeguards. One of the site managers interviewed systematically organizes work schedules that relegate safety deployment. This is done in anticipation of the negotiations that will then take place with the lifeguards, whose safety demands are perceived as excessive or too restrictive given the management's operating objectives. This manager starts with a minimum level of pool supervision, knowing this will be revised upwards during negotiations and bring the system to a level of safety (in particular, the number of supervising lifeguards) deemed collectively acceptable.

For managers, there is a clear tendency to consider safety as a constraint that hinders the maximization of results and is not at the core of the service offer. In a context of understaffing, the priority is to ensure the sports sessions, even if this means reduced supervision, as the latter is viewed as a variable that can be adjusted. Some interviewees mentioned recurrent situations of supervision understaffing (e.g., only one lifeguard on duty for a 50-meter pool that could reasonably be supervised by – at least – two professionals).

## **Discussion**

Intertwined influences disturb the ‘detection and interpretation of distress situations by lifeguards’ feedback loop. Before making recommendations based on these results, this section aims to put our findings into perspective with previous research.

French lifeguards are left somewhat on their own in terms of critical event detection, as they cannot rely on dedicated training, tools, or techniques used in other countries (e.g., Canada and the United States). Drownings being rare events, lifeguards see limited interest in developing skills in respect to this aspect of their work (Duncan & Humphreys, 1989). Despite its critical nature, the task of supervision is repetitive, considered not stimulating, and thankless (Wolfe et al., 2005) in comparison with valued facets (swimming instruction, commercial sports sessions) of a profession that has undergone major changes since the early 2000s (Bernardeau-Moreau, 2011).

In addition, the way many lifeguards envision drowning accidents impairs the ability to detect them. Although the training and experience of lifeguards makes them particularly capable of detecting drownings in an artificial, experimental setting (Laxton, Crundall, Guest & Howard, 2021), it remains very difficult to quickly notice something that one is not looking for (Lanagan-Leitzel & Moore, 2010; Pia, 1984). Drownings are discreet, silent, rapid (20 to 30 seconds in the phase above water), mostly inconspicuous phenomena (Pia, 1974), whether on the surface (Vittone & Pia, 2006) or a fortiori underwater (Griffiths, 2006). A recent study (Carballo-Fazanes et al., 2020) based on the study of actual filmed drownings shows that people drown in less than two minutes, leaving little time for the rescuer to detect water distress. This study also highlights that in many cases, drownings are not preceded by any specific behavior.

An admission of lifeguards’ ineffectiveness regarding their ‘ability to detect’ was identified: they do not

seem able to monitor properly, and state that they are mainly present at the edge of the pool to intervene in the event of a problem. Most also conveyed the idea that supervision is not very useful, pointing to the inevitability of drowning as a residual risk that is not easily reducible, while putting its frequency into perspective (in relation to the number of swimming pool users).

Choices made in terms of facility management (opening hours, programming of activities, staff schedules, missions of lifeguards, formal organization, incentives for cooperation, etc.) impact the way supervision is carried out. Managers have to deal with imperatives such as operating objectives and human resource management that sometimes lead them to temporarily downsize the supervision system, especially in the case of low attendance. In practice, lifeguards thus inherit decisions taken at higher hierarchical levels, contributing to the fragility of the supervision chain (this is the trickle-down effect mentioned by Vaughan, 1997). This pattern resembles a formalization of deviation from the rules, which Vaughan (1999) referred to as the phenomena of normalization of deviance. The plural set of rules are furthermore subject to negotiation to defend plural interests and regulate power.

According to their own interests and preferences, lifeguards appropriate their profession by granting themselves room for maneuver through ‘minor arrangements.’ The actual functioning of PSP is the end result of joint regulation processes (Reynaud, 1999) likely to influence (positively or negatively) the identified feedback loops. Our analysis highlights informal practices that turn out to be a compromise between several challenges: continuity of operation, the ability of pool supervisors to sustain supervision over long periods, minimizing operating costs, preservation of the lifeguards’ autonomy, and preference for more appreciated missions. We can actually observe in PSP what de Terssac and Mignard (2011) call ‘action safety:’ a “capacity to make the decision to abide by a safety rule or not and to adjust it to the context.” Resulting from stakeholder arbitration at different levels, it can have beneficial as well as harmful consequences on risk management. All of this undermines the objective of constant and exclusive pool supervision: the suspension of supervision, while mostly partial and of short duration, is frequent. Abandonment of one’s post, synonymous with the total suspension of supervision, is also reported but is much rarer. The autonomous regulation mechanism put forward by Reynaud (1999) takes precedence over the control of management, rather lax while the informal counter power of the lifeguards is, on the other hand, quite significant. Playing into this may be the fact that exerting control over lifeguards and calling them to order can prove problematic: as a group they are deeply attached to their independence, which is the core of a fiercely defended professional identity (Richet & Soulé, 2008).

Both supervision and its intended aim – its capacity to detect aquatic distress – are of a rather random

nature. This makes the level of safety variable due to a multitude of parameters. From one lifeguard to another, from one configuration to another, from one moment to another, supervision does not offer users the same guarantee of safety, and therefore the same chance of survival without after-effects in the event of a hazardous incident.

Establishing safety in a concrete way (de Terssac & Mignard, 2011) in PSP is challenging. If accidents are ultimately infrequent, and fatalities relatively rare (Vignac et al., 2015), this is due to the coexistence within these facilities of relatively effective, but in fact poorly coordinated feedback loops. These occur at different levels and are linked in a contingent way. Beyond the risk of the drowning of pool users, the fault lines in the system have consequences on the health and well-being of lifeguards: deviation from the rules is a factor in work distress, as situations that jointly give rise to deviant behavior and orders for compliance are uncomfortable. Nevertheless, deviance is standardized in the facilities studied. Furthermore, the results of this study show that the studied system mostly operates on the basis of a single-loop organizational learning process<sup>6</sup>. This places actors in an unsatisfactory situation, both in terms of work well done, and regarding inter-individual relations. On the other hand, deviation from the rules can also be described as an organizational step in a process of change.

## Recommendations

An analysis of the pool supervision in place can help to identify early warning signs of vulnerability, which can sometimes be acted upon at low cost. Safety in PSP being a systemic product, we formulated recommendations for the different stakeholders (public authorities, managers, lifeguards, and users) in order to reduce the risk of drowning to a level as low as reasonably possible (see Table 2).

Table 2

Actors	Perspectives for safety optimization in PSP
Legislator and public authorities	Integrate into the initial and ongoing training of lifeguards a module on supervision with a clearly defined content: the emphasis must be on the prevention of drowning accidents (warning signs of a potential drowning, supervision techniques like visual scanning strategies, positioning, maintaining vigilance, impediments to detection) and not only on the care of the victim.

<sup>6</sup> Looking at how risk management systems learn from their mistakes, Lukic et al. (2010) distinguished two main organizational learning processes. The single-loop process focuses on correcting the superficial aspects of safety problems (e.g., through technical advice, changes in training practices). This process tends to neglect the systemic nature of accidents. The double-loop learning process replaces the single-loop process when a dysfunction cannot be solved quickly and simply. This process allows for a broader understanding of the root causes of failures, including organizational values and culture.

	<p>Adopt surveillance standards and clarify the notion of “constant supervision” (minimum number of lifeguards depending on the area to be supervised, maximum consecutive surveillance time, etc.).</p> <p>Set up an effective national cell for the recording of accidents and incidents occurring in aquatic facilities, fed by a common online reporting procedure encouraging double loop learning. Communicate the conclusions of such analyses to the staff of each facility on a regular basis.</p>
PSP operators	<p>Revalue the supervision mission, give this function the same importance as other ones, even a greater weight.</p> <p>Focus on the effectiveness of surveillance procedures rather than on their mere effectivity (proactive anticipation of accident-prone situations).</p> <p>Carry out collaborative <i>in situ</i> tests<sup>7</sup> for the detection of submerged dummies in order to optimize the effectiveness of the supervision system.</p> <p>Delegate to the staff assigned to non-safety missions such the ancillary tasks to ensure that situations are not created that could cause lifeguards to suspend surveillance or make safety compromises.</p> <p>Alternate frequently between surveillance, pedagogy, and animation missions through a rotation system, while ensuring that lifeguards have sufficient time to transition from one mission to the next.</p> <p>Include breaks, take into account physiological rhythms and needs in the planning of the work.</p> <p>Involve all stakeholders in the creation/update of the SROP (through a collaborative, bottom up approach).</p> <p>Write a clear and concise SROP, known and mastered by all partakers (including the temporary workers)</p> <p>Ensure that the SROP is in line with real practices at work and the collectively designed operation.</p> <p>Take into account local specificities in the drafting of the SROP (attendance, types of public, dangerous areas).</p> <p>Regularly update the SROP to incorporate the latest adjustments.</p> <p>Focus on preventing drowning accidents and not only on the care of accident</p>

<sup>7</sup> For example, we have evaluated the ability of 4 volunteered professional lifeguards to detect a submerged manikin, in artificial conditions. 108 tests were carried out in 2 PSP and 4 variables were controlled (distance, depth, supervision station, attendance). Our results show that a rapid drowning detection is not exclusively linked to the individual detection capabilities of the lifeguards, but rather emerges from the tight coupling between the lifeguard perception and his/her working environment.

	victims in the SROP. Develop participatory methods for identifying, assessing and managing risks Encourage formal communication between the lifeguards and managers on the topic of safety; prompt lifeguards to report inadequacies or borderline functioning. Systematize experience feedbacks <sup>8</sup> .
--	--

To conclude, while this study shows that there is room for improvement in current pool supervision procedures and practices in France, it is important to remain realistic about the level of residual risk that can actually be achieved, given the complex constraints on this task. The intention is not to ‘demonize’ the sports facilities discussed; it should be kept in mind that learning to swim in public pools results in saving lives in other aquatic environments. On a societal scale, these facilities are therefore ultimately effective tools for preventing the risk of drowning.

## **Limits**

There are two main limitations to our study.

Depending on the situation, external and internal factors influence supervision to a greater or lesser extent, which should lead to caution in interpretation. The results produced through a case study cannot be generalized, even if similar trends have been found in other periods (Lebihain, 2000) and in quite similar contexts (Vignac et al., 2018). With this in mind, it seems preferable to evoke the transferability of findings (rather than their generalization) to comparable sites and facilities in France.

Insisting on supervision and the risk management system pushes to "set aside" the user. The relationships that the lifeguards develop with the public could also have been studied, insofar as the user can prove to be a valuable partner in safety (detection of persons in danger, transmission of the alert, even intervention). This security resource must therefore be studied in greater detail with a view to optimizing its potential, instead of considering users only in terms of what they do not do, refuse to do, or do inadequately.

---

<sup>8</sup> See Vignac et al. (2019) for a method dedicated to the collection of incidents in PSP and their exploitation for preventive purpose.

**Funding**

This study was partly funded by the French National Research and Technology Association.

**Conflict of interest**

The authors have no conflict of interest to declare.

## References

- Avramidis, E. (2009). *The 4W model of drowning for lifesaving of non-aquatic and swimming activities* [Leeds Metropolitan University]. <http://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.497771>
- Bahr, R., & Krosshaug, T. (2005). Understanding injury mechanisms: A key component of preventing injuries in sport. *British Journal of Sports Medicine*, 39(6), 324–329.
- Belhache, C. (2010). *Le droit des baignades. Traité Pratique*. Berger-Levrault.
- Bernardeau-Moreau, D. (2011). Les identités professionnelles des agents de la filière sportive territoriale. Entre référence technique et modèle gestionnaire. *Staps*, 2, 43–59.
- Bibard, L. (2012). Quand la perte de sens met a mort l'organisation. *Revue Internationale de Psychosociologie et de Gestion Des Comportements Organisationnels*, 18(46), 317–330.
- Bierens, J., & Scapigliati, A. (2014). Drowning in swimming pools. *Microchemical Journal*, 113, 53–58.
- Bourrier, M. (1999). *Le nucléaire à l'épreuve de l'organisation*. Presses universitaires de France.
- Bourrier, M. (2003). Facteurs organisationnels: Du neuf avec du vieux. *Realites Industrielles-Annales Des Mines*, 19–22.
- Brener, J., & Oostman, M. (2002). Lifeguards watch, but they don't always see. *World Waterpark Magazine*, 5, 14–16.
- Carballo-Fazanes, A., Bierens, J.L.M., and the International Expert Group to Study Drowning Behaviour (2020). The Visible Behaviour of Drowning Persons: A Pilot Observational Study Using Analytic Software and a Nominal Group Technique, *International Journal of Environmental Research and Public Health*, 17, no. 18: 6930. <https://doi.org/10.3390/ijerph17186930> :
- Cranga, J.-C. (2014). Conception et mise en œuvre du Plan d'Organisation de la Surveillance et des Secours. In *Surveillance des piscines publiques* (Jurisport (Dalloz), pp. 83–90). Pascal Lebihain.
- Crozier, M., & Friedberg, E. (1977). *L'acteur et le système*, Paris : Seuil.



- Dalke, S. (2015). *Twenty years of immersion death in lifeguarded environments in Canada, epidemiology, policy*. World Conference on Drowning Prevention, Penang, Malaysia.
- de Terssac, G., & Mignard, J. (2011). *Les paradoxes de la sécurité: Le cas d'AZF*. (Le travail humain). Presses Universitaires de France.
- Duncan, J., & Humphreys, G. W. (1989). Visual search and stimulus similarity. *Psychological Review*, 96(3), 433.
- Ellis, J. (2001). *First on-site study of vigilance show lifeguards can't possibly see everything all of the time*. Poseidon MG International.
- Fournier, P. (2001). Attention dangers : Enquête sur le travail dans le nucléaire. *Ethnologie française*, 31, 69-80. <https://doi.org/10.3917/ethn.011.0069>
- Freyssinet-Dominjon, J. (1997). Méthodes de recherche en sciences sociales. *Les Fondements de La Démocratie*, 81.
- Glaser, B. G., & Strauss L. A. (1967). *The discovery of grounded theory : Strategies for qualitative research*. New York: Aldin Publishing Co.
- Griffiths, R. C., & Griffiths, T. J. (2013). Internal Noise Distractions in Lifeguarding. *International Journal of Aquatic Research & Education*, 7(1), 56–71.
- Griffiths, T. (2006). *Disappearing dummies*. Aquatic Safety Research Group.
- Hardy, K. (2010). *Contribution à l'étude d'un modèle d'accident systémique, le cas du modèle STAMP: Application et pistes d'amélioration* [École Nationale Supérieure des Mines de Paris]. <https://pastel.archives-ouvertes.fr/pastel-00566270/>
- Hollnagel, E. (2004). Barriers and accident prevention: Or how to improve safety by understanding the nature of accidents rather than finding their causes. *Hampshire: Ashgate*.
- Hood, C., Rothstein, H., Baldwin, R., Rees, J., & Spackman, M. (1999). Where risk society meets the regulatory state: Exploring variations in risk regulation regimes. *Risk Management*, 1(1), 21–34.

- Huberman, M.A., & Miles, M.B. (1994). Data management and analysis methods. Dans N.K Denzin & Y.S Lincoln (Eds), *Handbook of Qualitative Research* (pp. 428-444). London/New Delhi : SAGE Publications.
- Lanagan-Leitzel, L. K., & Moore, C. M. (2010). Do Lifeguards Monitor the Events They Should? *International Journal of Aquatic Research & Education*, 4(3), 241–256.
- Lanagan-Leitzel, L. K., Skow, E., & Moore, C. M. (2015). Great Expectations: Perceptual Challenges of Visual Surveillance in Lifeguarding. *Applied Cognitive Psychology*, 29(3), 425–435.
- Laxton, V., Crundall, D., Guest, D., & Howard, C. J. (2021). Visual search for drowning swimmers: Investigating the impact of lifeguarding experience. *Applied Cognitive Psychology*, 35(1), 215-231.
- Le Coze, J.-C. (2016). *Trente ans d'accidents. Le nouveau visage des risques sociotechnologiques*. Octarès.
- Leveson, N. (2004). A new accident model for engineering safer systems. *Safety Science*, 42(4), 237–270.
- Lukic, D., Margaryan, A., Littlejohn, A., 2010. How organisations learn from safety incidents: a multifaceted problem. *Workplace Learn.* 22 (7), 428–450.
- Mays, C. M., & Poumadère, M. (1989). Decentralizing Risk Analysis in Large Engineered Systems: An Approach to Articulating Technical and Socioorganizational Dimensions of System Performance. *Risk Analysis*, 9(4), 453–461.
- Mollard, R. (2014). Limites de la surveillance humaine chez les maîtres-nageurs sauveteurs. In *Surveillance des piscines publiques* (Jurisport (Dalloz), pp. 41–50). Pascal Lebihain.
- Mukamurera, J., Lacourse, F., & Couturier, Y. (2006). Des avancées en analyse qualitative: pour une transparence et une systématisation des pratiques. *Recherches qualitatives*, 26(1), 110-138.
- Périlhon, P. (1998). L'analyse de risques. Méthode organisée et systémique d'analyse des risques. *Prévention Active*.
- Pia, F. (1974). Observations on the Drowning of Nonswimmers. *Journal of Physical Education, The YMCA Society of North America, Warsaw, Indiana*, 71(6), 164–181.

- Pia, F. (1984). The RID factor as a cause of drowning. *Parks & Recreation*, 19(6), 52–55.
- Pourtois, J.-P., & Desmet, H. (1997). *Épistémologie et instrumentation en sciences humaines* (2e éd.). Sprimont : Mardaga Éditeur.
- Reason, J. (1993). *L'erreur humaine*. Presses des MINES.
- Reynaud, J.-D. (1999). *Le conflit, la négociation et la règle*. Octarès.
- Richet, C., & Soulé, B. (2008). *Des maîtres nageurs à l'épreuve de la délégation de service public: Rapports de force et de grandeur au travail*.
- Savoie-Zajc, L. (2004). La recherche qualitative/interprétative en éducation. Dans Th. Karsenti & L. Savoie-Zajc, *La recherche en éducation : étapes et approches* (pp. 123-150). Sherbrooke : Éditions du CRP.
- Thornberry, C. L. (2014). *Extending the Human-Controller Methodology in Systems-Theoretic Process Analysis (STPA)* [MIT]. <http://sunnyday.mit.edu/papers/thornberry-thesis.pdf>
- Vanpouille, M., Vignac, E., & Soulé, B. (2017). Accidentology of mountain sports: An insight provided by the systemic modelling of accident and near-miss sequences. *Safety Science*, 99(part A), 36–44. <https://doi.org/10.1016/j.ssci.2016.11.020>
- Vaughan, D. (1997). The Trickle-Down Effect: Policy Decisions, Risky Work, and the " Challenger" Tragedy. *California Management Review*, 39(2), 80–102.
- Vaughan, D. (1999). The dark side of organizations: Mistake, misconduct, and disaster. *Annual Review of Sociology*, 271–305.
- Vignac, E. (2018, April). *Evaluation de la capacité des MNS à détecter un mannequin immergé. Combien de temps faut-il pour voir ?* 5ème colloque national Sport et Sécurité. La surveillance des piscines publiques, Université de Poitiers, France.
- Vignac, E., Lebihain, P., & Soulé, B. (2015). Tracking Fatal Drownings in Public Swimming Pools: A Retrospective Multiscale Investigation Within France. *International Journal of Aquatic Research and Education*, 9(2), 184–200. <https://doi.org/10.25035/ijare.09.02.09>

- Vignac, E., Lebihain, P., & Soulé, B. (2016). Quantification of degraded supervision of bathing in 108 French public swimming pools. *Injury Prevention, 23*(4).
- Vignac, E., Lebihain, P., & Soulé, B. (2019). Learning from Incidents to Reduce the Risk of Drowning in Swimming Pools: Implementation of Experience-Based Feedback Regarding Near-Misses in Four Public Facilities in France. *International Journal of Aquatic Research and Education, 12*(1). <https://doi.org/10.25035/ijare.12.01.07>
- Vittone, M., & Pia, F. (2006). It doesn't look like they're drowning': How to recognize the instinctive drowning response. *On Scene (Journal of US Coastguard Search and Rescue), Fall 2006, 14*.
- Wolfe, J. M., Horowitz, T. S., & Kenner, N. M. (2005). Cognitive psychology: Rare items often missed in visual searches. *Nature, 435*(7041), 439–440.

### Appendix 1: Categories of analysis, units of analysis and interview themes

Categories of analysis (CA)	Units of analysis (UA)	Interview themes
CA 1: the actor	Experience of the actor	Professional trajectory of the interviewee
CA 2: the profession	Attractiveness of the profession	Reasons for entering the profession, projection of the professional future and image of the lifeguarding profession
	Components of the profession	What the profession involves, taking into account the historical aspect concerning the profession in the actor's discourse
	The job in the local context	What the specific job involves, taking into account the influence of the local context in the way the profession is perceived
	Initial and ongoing training	Adequacy of training to the concrete needs of the occupation
	Working conditions	Local working conditions (advantages, disadvantages)
CA 3: the risks	The users	Risks originating in users' behaviour and possible roles in the safety system

	Design and layout of the facility	Cindynogenic potential of the infrastructure
	Occupational risks	Risks inherent in the exercise of the profession of lifeguard
<b>CA 4: drowning incidents</b>	Accidentality	Inventory of the accident situations (quantitative aspects) and social acceptability of risks
	Accident mechanisms	Explanation of accident-related phenomena, view of the main risk factors for swimming pool users
	Experience of accidents	Past experience of accidents and near-misses (including outside the studied context)
	Feeling of control over the accident	Attitudes/behaviour in the face of risks and accidents
	Experience feedback	Methods for providing feedback on a given experience and their place in the organization
<b>CA 5: regulations</b>	The rules	Influence of the regulatory context on safety
	The SROP	Design, function and role of the SROP
	Informal aspects of safety	Understanding of the concrete role of each individual and the collective in safety
<b>CA 6: safety</b>	Communication	Internal communication and its impact on safety
	Hierarchical relationships	The nature of relationships with management or subordinates
	Governance and safety impacts	Governance strategies of the aquatic facility and their impact on safety
	Effectiveness of safety measures	Assessment of the effectiveness of the safety system
	Specific safety actions	Mechanisms/strategy for stable safety systems and recovery capacity
<b>CA 7: pool supervision</b>	The role of supervision	Place/function of supervision in the system
	Limitations of supervision	Obstacles to supervision or phenomena that may alter it
<b>CA 8: safety improvements</b>	Safety improvements	Possible improvements to the service offer in terms of safety, identification of the issues to be addressed as a priority
<b>CA 9: safety as one of a range of tasks</b>	Safety priorities for lifeguards	Assessment of priority of safety actions relative to the pool supervisor's other tasks