

## An overview of pool and spa regulations in Mediterranean countries with a focus on the tourist industry

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### ABSTRACT

The Mediterranean area is densely populated and a very popular tourist destination. This study aimed at gathering up-to-date information on current national pool and spa regulations. We formulated and duly distributed to 20 Mediterranean countries a questionnaire divided into two sections: for pool and spa facilities, respectively. The questionnaire was formulated in such a way that a positive answer would imply that the specific topic was addressed effectively. While all 20 countries responded to the swimming-pool-related questionnaire, only 11 of these countries reported the existence of spa-related regulations. When combining the response overall of all countries for pool and spa facilities together, of a grand total of 606 answers, 183 (30.2%) were positive. The positive answers in the pool section of the questionnaire were 29% of the total of 420 answers while positive answers in the spa section of the questionnaire were fewer (27.8% of the total of 176 answers). The countries were grouped by geographical area of the Mediterranean basin where they are situated. Also, the questions were grouped into broad thematic categories. The paper presents conclusions drawn on the basis of the data received according to these geographical and thematic groupings.

**Key words** | hygiene, Mediterranean area, regulations, spa, swimming pools, tourism

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### INTRODUCTION

Tourism is a flourishing industry and generates significant income in many areas and countries. The Mediterranean area is one of the most popular tourism destinations worldwide. The area attracts tourists because of its considerable geographical diversity, historical interest and colourful local lifestyle. The Mediterranean basin harbours 22 countries which, using geopolitical and social criteria, can be divided into four regions (Table 1).

One of the major attractions of holidaymakers is swimming, both in the sea and in pools and spas, with the latter becoming increasingly elaborate and attractive, offering sophisticated environments for pleasure and relaxation. Many experts in the field stress the importance of the application of informed risk management measures in order to reduce potential health risks deriving, alongside the potential

health benefits, from the use of such facilities (Zsofia & Kadar 2012). Pools and spas can present a considerable source of infection and other threats to human health. According to CDC (Centers for Disease Control) data (CDC 2008), 399 recreational waterborne outbreaks with more than 25,000 cases were registered in the USA between 1999 and 2008. Of this number, 292 outbreaks (73%) with 23,800 cases were attributed to swimming pools. An assessment study examined 180 drowning incidents that resulted in litigation from 1998 to 2008 to determine whether faulty pool maintenance and/or substandard lifeguard performance delayed retrieval and thereby contributed to the death of these persons. At fault were cloudy or dirty water; drain pipes that created underwater suction that trapped victims; inadequate fencing around pools through which small

**Table 1** | The 22 Mediterranean countries divided into four distinct regions

Code	Area	Countries
C1	The European Union (EU)	France, Italy, Greece, Spain, Cyprus, Malta, Slovenia
C2	Middle East	Lebanon, Syria, Turkey, Israel, Palestine
C3	North Africa	Morocco, Algeria, Tunisia, Libya, Egypt
C4	European-non EU	Montenegro, Bosnia-Herzegovina, Croatia, Albania, Monaco

children gained access; permitting small children to be at the pool without adult supervision; permitting dangerous exercises such as hyperventilation while underwater swimming, resulting in shallow water blackout; lifeguards not being attentive, being distracted by other persons, performing non-related chores, leaving their positions without proper relief, and failing to enter the water when told persons were submerged (Modell 2010).

Some Mediterranean countries have taken pioneering steps in the study of health problems derived from the use of pools. One of the first published studies regarding transmission of infectious diseases and proposing preventive alternatives was carried out in Egypt (Abd-Rabbo 1968). In Israel, as early as 1976, 10 cases of skin infections due to *Mycobacterium marinum* were reported. Most of the infections were contracted in natural bathing pools at Ein Feshka on the shores of the Dead Sea, south of Jericho. The lesions closely resembled those of cutaneous leishmaniasis prevalent in this region (Even-Paz *et al.* 1976).

Many studies followed, conducted by a number of countries in the area. A survey of the literature revealed that, of a total of 181 studies about pool management and safety published internationally between 1968 and 2013, 43 (24%) derived from the Mediterranean countries. Of the 181 studies, 66 were assessments of the pools focusing on bacteria, 60 focusing on parasites, 23 on viruses, 30 on fungi and two on vectors. The corresponding figures for the 43 Mediterranean assessments were 24 focusing on bacteria, eight on parasites, five on viruses, six on fungi and none on vectors.

Infections, injuries, health problems related to disinfection and occupational health were the primary concerns of

most of the studies. In a number of cases, general assessments in the area revealed poor quality both in the pool facilities and the water. An investigation of 60 public swimming pools in Greece (with the exception of hotel pools) revealed that, when the pools were assessed using a checklist, 67% of the surveyed public swimming pools were classed as 'Fail' (Blougoura *et al.* 2011). The hygienic profile of the water in Milan swimming pools showed that many pools exceeded the legal limits of microbiological concentration, while they showed a decrease over time in noncompliance with regard to physical/chemical parameters (Tesauro *et al.* 2010). In many countries in the area, problems associated with specific pathogens, construction problems, treatment and disinfection and inadequate staff training are described in the literature.

Among the EU (C1) countries, in Spain a swimming pool-related outbreak of pharyngo-conjunctival fever occurred in 59 children due to adenovirus type 4 (Artieda *et al.* 2009). Also in Spain, the characterization of microbial populations associated with natural swimming pools was attempted. The results suggest that wildlife was an important source of faecal pollution in the pools (Casanovas-Massana & Blanch 2012). The genotoxicity of water concentrates from recreational pools after various disinfection methods was examined in another Spanish study. The data demonstrated that all disinfected recreational pool water samples induced more genomic DNA damage than the source tap water. The type of disinfectant and illumination conditions altered the genotoxicity of the water (Liviach *et al.* 2010). In Greece, a total of 17% of swimming pool samples were positive for *Pseudomonas aeruginosa* (Tirodimos *et al.* 2010). A survey for the detection of enterovirus and adenovirus presence in swimming pools was carried out in Cyprus revealing, inter alia, poliovirus Sabin 1 (Bashiardes *et al.* 2011). In Italy, an outbreak of aseptic meningitis due to echovirus 30 associated with attending school and swimming in pools was reported (Faustini *et al.* 2006). In one environmental epidemiology survey in Italian indoor swimming facilities on the presence of fungi, a number of pathogenic species were constantly detected (Brandi *et al.* 2007), and in another the recovery of protozoa in pools characterized as suitable for swimming was highlighted (Bonadonna *et al.* 2004). Occupational health problems due to the presence of trichloromethanes in the air were reported by

workers in indoor pools in Italy (Fantuzzi et al. 2012). In France, the colonization of the deck surrounding a hospital physical therapy swimming pool with *Fusarium* spp. was reported (Buot et al. 2010).

Among the Middle East (C2) countries, Israel, Palestine and Turkey have been publishing data on pool-related injuries and outbreaks. In Israel, in summer 2010–2011, two outbreaks of *Pseudomonas folliculitis* affected bathers who used the swimming pools or whirlpools in two guest-room sites. The source of the infection was traced to the swimming pools or whirlpools which had not been chlorinated and monitored routinely (Cohen-Dar et al. 2012). Accidents were the subject of a number of studies in Israel. A case of vaginal evisceration resulting from sliding on a water chute was described (Avidor et al. 1998). A number of toxicological incidents in Israel during the summer of 2005 involved chlorine exposure in swimming pools (Lehavi et al. 2008). The risk and characteristics of self-reported skin diseases among hydrotherapists was also investigated in Israel. Forty-four per cent of the hydrotherapists reported the development of skin disease for the first time after commencing work at the swimming pool. The most common symptoms included pruritus and erythematous patches affecting mainly the extremities and trunk (Lazarov et al. 2005). In a survey in the West Bank of Palestine, *Salmonella* bacteria were isolated in 21 out of 23 pool samples (Al-Khatib & Salah 2003). In Turkey, non-intentional drowning incidents were investigated. A following, related secondary syndrome comprised those who drown during altruistic attempts to rescue a drowning person. Thirty-one ‘rescuers’ and 20 primary drowning victims drowned in 28 incidents in which 80% of drowned primary victims were children, and 48% of the ‘rescuers’ were children (Turgut 2012). Accidents in water parks were also investigated revealing that 73 patients (32%) were injured on waterslides, 16 (22%) were injured in pools and 34 (47%) were injured by slipping and falling on the wet surfaces (Söyüncü et al. 2009). The aetiology of foot intertrigo (Karaca et al. 2008) and other skin diseases related to the use of pools (Ertam et al. 2010) were the subjects of other studies in Turkey.

Among the African (C3) countries, in Morocco an unusual bilateral anterior dislocation of the shoulders at the start of a backstroke competition in a pool was reported

by hospital staff. The researchers stress the importance of warning the athletes about the possibility of accidents during training (Dlimi et al. 2012). In an assessment of water quality of some swimming pools in Alexandria, Egypt, *Cryptosporidium* oocysts and *Giardia lamblia* cysts were found in 10% of samples (Abd El-Salam 2012). In another study in Alexandria, Egypt, the high incidence of recorded itching and redness of the eyes followed by ear infections was attributed to exposure to excess chlorine (Abdou et al. 2005).

An interesting study for the tourist industry was carried out in Croatia, a non-EU European country (C4), regarding the improvement of pool quality before and after training of pool operators. Occupational health was also considered. After training, the proportion of unacceptable samples dropped by 24%, mostly due to acceptable free chlorine values (Bilajac et al. 2012). The effect of training on water quality is considered more and more important and certainly in the future more studies in the area will refer to this parameter. The international literature includes a study conducted in Nebraska, USA in 2005–2006. In controlling the water supply, inspections from non-municipal pools with shared-source water in two counties (one requiring certification) were compared for concurrent pH and free chlorine violations. Compared with locations that require certified operators, free chlorine and concurrent pH violations were twice as likely in locations without certification. As a result, pools without required operator certification might pose greater health risks (Buss et al. 2009). In Plano, USA, five environmental health specialists inspected 370 licensed commercial swimming pools. The environmental health specialists, who are all well trained and are certified pool operators by the National Swimming Pool Foundation, inspect each facility twice during the summer season. Violation rates have been variable across the programme, but improved operator training is proving successful in many areas. This has resulted in a higher level of service and swimmer safety (Vyles 2009).

Pool and spa facilities are similar in many respects but differ in a number of ways. According to PWTAG (2009), these days a typical swimming pool comes in all shapes and sizes, but nearly all of them, from the domestic to the Olympic, work in the same basic way. Anything with more than 5 cubic metres of water normally uses a combination of filtration and chemical treatment to clean continually

by recirculating a large volume of water. World Health Organization (WHO) Guidelines (WHO 2006) specify swimming pool types and define specifically 'natural spa' facilities containing thermal and/or mineral water, some of which may be perceived to have therapeutic value and, because of certain water characteristics, may receive minimal quality treatment. Another type is described as 'hot tub' and encompasses a variety of facilities that are designed for sitting in, rather than swimming. This last type is not considered separately in this paper.

### Scope of the study

The repeated reference to health problems deriving from the use of swimming pools could be related to regulations which either do not address all factors contributing to the swimmers' well-being or are not properly applied. In this study, an attempt was made to gather additional and up-to-date information on pool and spa regulations in the countries around the Mediterranean basin, so as to serve as a basis for a more focused assessment, and an occasion to offer better targeted comments and conclusions that can be of use for the tourist industry in the region as a whole.

## METHODS

### Preparing the questionnaire

A questionnaire was prepared and sent to public health authorities and experts of the 22 Mediterranean countries. In some countries more than one questionnaire was sent to different establishments. Nevertheless, the survey managed to obtain, sometimes after considerable persistence, one completed questionnaire per country. The expertise of the people answering the questionnaires was evaluated in light of their scientific credentials, and their contribution is acknowledged here. The questionnaire was based on the WHO Guidelines for safe recreational water environments (WHO 2006). Containing a total of 39 questions, the questionnaire was divided into two parts, the first seeking information on pool national regulations and the second on spas (Table 2). The questions were divided into five groups or categories: questions investigating (a) construction matters, (b) safety,

(c) water quality, (d) staff and (e) obligations addressed to the users. There was room for additions to the specified questionnaire information on pool (question 22) and spa (question 39) management. The obligation for the issue of an authorization for opening a pool was also investigated (question 1). The existence of a national regulation for pool (question 2) and spa (question 23) environments was investigated. Some respondents also sent copies of the relevant legislation. Twenty of 22 countries returned the questionnaires with answers. Syria and Morocco did not respond; it is not clear whether in these countries pool and spa guidelines do actually apply. For easier evaluation of the answers, the questionnaire was formulated in such a way that a positive answer would imply that the specific topic was addressed effectively.

### Approaches for the assessment of the information collected on pool regulations

According to the data collected, 20/22 Mediterranean countries apply regulations specific to pool facilities. The information collected was assessed in the following ways:

1. As a percentage of positive answers in the total 20 countries per question.
2. As a percentage of positive answers in the total 20 countries per category of questions. The questions are grouped into the five categories as follows: construction (questions 3–7), safety (questions 8–12), water quality (questions 13–14), staff (questions 15–17), users (questions 18–21).
3. As a percentage of positive answers per category of questions by geographical area (C1, C2, C3 and C4, as presented above).

### Approaches for the assessment of the information collected on spa regulations

According to the collected data, 11/22 Mediterranean countries apply regulations specific to spa facilities. These countries, using geopolitical and social criteria, can be divided into four regions (Table 3). The information collected was assessed in the following ways:

1. As a percentage of positive answers in the total 11 countries per question.

**Table 2** | Questionnaire regarding swimming pool and spa regulations in the Mediterranean countries**A. Swimming pool**

- 1 Is there an obligation to get a licence to operate a pool in your country?  
 2 Does a national regulation for pool environments exist?

**Construction (3–7)**

- 3 Are specifications on the design and construction of the pools included in the regulation?  
 4 Are there specific requirements regarding filtration?  
 5 Are there specific requirements regarding circulation and hydraulics?  
 6 Are there specific requirements regarding aeration and lighting for indoor pools?  
 7 Are there specific requirements regarding the facilities?

**Safety (8–12)**

- 8 Are provisions on the prevention of accidents in the pool environment (drowning and injury) included in the regulation?  
 9 Are there specific requirements regarding the type of disinfection and the level of disinfectant in the pool?  
 10 Is a pool safety plan required and applied?  
 11 Is the presence of lifeguards obligatory?  
 12 Are there specific requirements regarding cleaning?

**Water quality (13–14)**

- 13 Are provisions on the microbiological quality of the water included in the regulation?  
 14 Are provisions on chemical quality included in the regulation?

**Staff (15–17)**

- 15 Is special training for the pool staff obligatory?  
 16 Are provisions focusing on occupational health included in the regulation?  
 17 Is the management obliged to keep records on measurements and maintenance issues?

**Users (18–21)**

- 18 Do specific requirements apply to pools dedicated to special groups  
 19 Are provisions addressing ethical and/or social issues included in the regulation?  
 20 Are there specific requirements regarding the bathing load?  
 21 Is it obligatory for users to pre-shower before using the pool?

22 Please specify other requirements.

**B. Spa**

- 23 Does a national regulation for spa environments exist?

**Construction (24–28)**

- 24 Are specifications on the design and construction of the spa included in the regulation?  
 25 Are there specific requirements regarding filtration?  
 26 Are there specific requirements regarding circulation and hydraulics?  
 27 Are there specific requirements regarding aeration and lighting?  
 28 Are there specific requirements regarding the facilities?

**Safety (29–32)**

- 29 Are provisions on the prevention of accidents in the spa environment (drowning and injury) included in the regulation?  
 30 Are there specific requirements regarding the type of disinfection and the level of disinfectant in the spa?

(continued)



Table 2 | continued

31	Is a spa safety plan required and applied?
32	Are there specific requirements regarding cleaning?
<b>Water quality (33–34)</b>	
33	Are provisions on the microbiological quality of the water included in the regulation?
34	Are provisions on chemical quality included in the regulation?
<b>Staff (35–37)</b>	
35	Is special training for the staff using the spa obligatory?
36	Are provisions focusing on occupational health included in the regulation?
37	Is the management obliged to keep records on measurements and maintenance issues?
<b>Users (38)</b>	
38	Is it obligatory for users to pre-shower before using the spa?
39	Please specify other requirements.

- As a percentage of positive answers in the total 11 countries per category of questions. The questions are grouped into the five categories as follows: construction (questions 24–28), safety (questions 29–32), water quality (questions 33–34), staff (questions 35–37), users (question 38).
- As a percentage of positive answers per category of questions by geographical area (C1, C2, C3 and C4, as presented above).

## RESULTS

### Pool questionnaire – overall evaluation of the answers

With the exception of one African and one European non-EU country, in all 20 Mediterranean countries a licence is

Table 3 | The 11 Mediterranean countries applying special regulations for spa facilities regrouped according to geopolitical criteria

Code	Area	Countries
C1	EU	France, Malta, Greece, Spain, Slovenia
C2	Middle East	Turkey, Israel
C3	North Africa	Algeria, Tunisia, Egypt
C4	Non-EU European	Albania

required for the pool to operate. Seventeen of 20 countries have a national regulation. Of these, two countries apply the WHO Guidelines. In the three countries which do not apply a full-scale regulation, Bosnia-Herzegovina issued a number of technical specifications on building safety; in Lebanon, an Environmental Impact Assessment is necessary. Eighteen of 20 countries reported that there is an obligation to obtain a licence to operate a pool in their country (question 1). This is an additional requirement (dealing, e.g., with tax and accounting issues) above and beyond the application of health and safety regulations in the pool or spa facilities. In one country (Malta), a licence is needed for public and commercial pools. Croatia issued regulations for public pools only. In Algeria, the regulations govern aqua parks only.

According to the answers, the national regulations address more or less effectively various aspects of pool management and safety. Sixteen countries (80%) have provisions specifying the design and construction of pools. In 16 countries (80%), the pool staff is obliged to keep records and have them available to secondary (state or other) control or requests from the tourist industry and the public. Records concern for instance disinfection, microbiological and chemical tests, the water pH and temperature, cleaning procedures, water loading by the users and other management matters. On the same level, 16 countries (80%) have

issued standards for the microbiological and chemical quality of the pool water. In 15 countries (75%), there are provisions on the prevention of accidents. Fifteen countries (75%) also require the presence of a lifeguard by the pool. Fifteen countries (75%) impose specific disinfection procedures and specify the level of disinfectant, and 14 (70%) specific circulation and hydraulics in the pools. In 13 countries (65%), there are specific requirements on filtration. Moreover, 16 countries (80%) have specific requirements for the facilities and provide specific guidance for cleaning the facilities; 16 countries require a safety plan to be available; in 15 countries (75%) it is obligatory for bathers to pre-shower before using the pool. There are also provisions setting out specific requirements regarding the bathing load; in 13 countries (65%), specific requirements apply to aeration and lighting for indoor pools, and special training for the pool staff is obligatory. On the other hand, in only 10 countries (50%) are there specific requirements for pools dedicated to specific groups of people. Provisions detailing occupational health issues are included in the regulations of even fewer countries, i.e., six (30%); and only three countries (15%) have regulations that include provisions addressing ethical and/or social issues (Figure 1). Figure 1 gives a good indication of the pattern, by country, of the spread of positive and negative answers across question categories. Notably, nine countries (Italy, Slovenia, Spain, Israel, Egypt, Libya, Tunisia, Albania, Montenegro) give

positive answers to all questions regarding safety, seven countries regarding construction, 16 countries regarding water quality, five countries regarding the staff and two countries regarding the users.

For question 15, concerning the obligation of special training for the staff, countries were asked to specify which categories of staff are obliged to receive special training. Some countries specify special training required for the lifeguards (Albania, Algeria, Cyprus, Slovenia, Monaco, Palestine, Spain, Montenegro), others for members of the staff carrying out chlorination (Albania, Greece, Montenegro, Spain, Tunisia), others for the pool general maintenance (Croatia, Cyprus), others for safety officers (Croatia, Cyprus, Greece) and others for providing first aid in case of accidents in the pool (Greece, Croatia) (Figure 1). Many countries reported that their national regulations include supplementary requirements for specific categories of pool (Table 4).

#### Pool questionnaire – evaluation of the answers per category of questions

The answers of the countries per category reveal that the national regulations tend to place most emphasis on issues regarding water quality (a total of 80% of positive answers) while safety measures and construction matters received 76 and 73% of positive answers, respectively.

Countries	Group of countries	Construction							Safety					Water Quality		The Staff			The users			
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
Cyprus	C1																					
France	C1																					
Greece	C1																					
Italy	C1																					
Malta	C1																					
Slovenia	C1																					
Spain	C1																					
Israel	C2																					
Lebanon	C2																					
Turkey	C2																					
Palestine	C2																					
Algeria	C3																					
Egypt	C3																					
Libya	C3																					
Tunisia	C3																					
Albania	C4																					
Bosnia-Herzegovina	C4																					
Croatia	C4																					
Monaco	C4																					
Montenegro	C4																					

Figure 1 | Distribution of answers of Mediterranean countries to questionnaire concerning pool national regulations (white, positive; black, negative; grey, unanswered).

**Table 4** | Specific requirements for pools dedicated to special groups per country

Country	Pools with specific requirements
Albania	Children, hydrotherapy, hotel and domestic pools
Croatia	Hydrotherapy pools
Greece	Children pools, private pools
Israel	Whirlpools (Jacuzzi), hydrotherapy pools
Italy	Thermae and spa
Malta	Single house pools/privately owned pools
Slovenia	Childrens' pools and pools for persons with disabilities
Turkey	Children and hydrotherapy pools

Not many national regulations focus on staff or users' obligations, as positive answers were 61 and 54%, respectively. Within each category there were issues which were poorly addressed in comparison with others in the same category. Occupational health, circulation and hydraulics, aeration and lighting seem to be a problem in most of the countries.

#### Pool questionnaire – response per category of questions by geographical area (C1, C2, C3, C4)

According to the answers, the member countries of the European Union (C1) returned the highest percentage of positive answers in all five question categories. All countries, regardless of their geographical position, place significant importance on the water quality. In all the other question categories, the Middle East countries seem to place less attention to the various issues than the rest. The weak percentage of positive answers in this geographical area can

**Table 5** | Percentage of positive answers per category of questions and the geographical region

Question category	C1 (%)	C2 (%)	C3 (%)	C4 (%)
Number of countries	7	5	5	5
Construction	88	45	75	76
Safety	85	53	85	72
Staff	70	42	67	60
Users	62	50	56	45
Water quality	100	75	75	60

perhaps be attributed to the fact that spas were established and used in early times in this area and so the relevant regulations are older than in the rest of the Mediterranean countries (Table 5).

#### Spa questionnaire – overall evaluation of the answers

According to the answers, 11 countries regulated especially for spa establishments or they use the same regulations as for swimming pools (France and Slovenia). Other countries do not possess national regulations; for instance, in Bosnia-Herzegovina the German or the Turkish standard is applied by the managers of private pools, and Monaco follows the French circular which is shortly due to become their national law. Some countries have issued requirements for specific matters. Spain issued a regulation on the monitoring of *Legionella* spp. Algeria applies a decree on prevention measures against panic and fire risks in facilities open to the public. Libya applies the WHO Guidelines for pool and spa. In Greece, a hydrological study is required which needs to include the expected health benefits to the user. In Israel, backflow prevention devices must be installed; operators must be present whenever the pool is open to the public; action must be taken if accidental release of faeces or vomit occurs in pool, and facilities must be accessible to handicapped bathers. In Slovenia, safety requirements apply for people accompanying disabled people or groups of children bathing. In Figure 2, the answers of the 11 countries per question are presented. In a few cases some questions were not answered. Figure 2 gives a good indication of the pattern, by country, of the spread of positive and negative answers across question categories. Notably, six countries (Malta, Slovenia, Israel, Egypt, Tunisia, Albania) give positive answers to all questions regarding safety, two countries regarding construction, 11 countries regarding water quality, two countries regarding the staff and nine countries regarding the users.

#### Spa questionnaire – evaluation of the answers per category of questions

The 11 Mediterranean countries that returned the questionnaire regarding spa facilities either have a national



Countries	Group of Countries	Construction					Safety				Water Quality		The staff			The users
		Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38
France	C1	Black	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Greece	C1	Black	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Malta	C1	Black	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Slovenia	C1	Black	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Spain	C1	Black	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Israel	C2	White	White	White	White	Grey	White	White	White	White	White	White	White	White	White	White
Turkey	C2	Black	White	White	White	White	White	White	White	White	White	White	White	White	White	White
Algeria	C3	White	Black	White	White	White	White	White	White	White	White	White	White	White	White	White
Egypt	C3	White	Black	White	White	White	White	White	White	White	White	White	White	White	White	White
Tunisia	C3	White	Black	White	White	White	White	White	White	White	White	White	White	White	White	White
Albania	C4	White	White	White	White	White	White	White	White	White	White	White	White	White	White	White

**Figure 2** | Distribution of answers of Mediterranean countries to questionnaire concerning spa national regulations (white, positive; black, negative; grey, unanswered).

regulation in place specific to spa management or apply the WHO Pool and Spa Guidelines (100%). These regulations address more or less effectively various aspects of spa management and safety. Five countries (46%) have provisions specifying the design and construction of pools, while 10 countries (91%) require spa operators to keep records; in six countries (55%) there are provisions on the prevention of accidents and roughly the same percentage have specific requirements regarding aeration, lighting and facilities; in seven countries (64%) special training of the staff is required. All 11 countries (100%) set specifications for the microbiological and chemical quality of the water, nine (82%) specific requirements regarding disinfection procedures and the level of disinfectant, and seven (64%) specific circulation and hydraulics in the spa. In nine countries (82%) there are specific requirements on filtration. Moreover, eight countries (73%) have a safety plan in place, and nine (82%) provide specific guidance for cleaning. In nine countries (82%) it is obligatory for bathers to pre-shower before using the spa. Provisions detailing occupational health issues are included in the regulations of even fewer countries, that is, just three (28%).

#### Spa questionnaire – response per category of questions by geographical area (C1, C2, C3, C4)

According to the answers of the 11 countries with special requirements for spa establishments, the African countries (C3) gave the highest percentage of positive answers in all

five categories of questions. C4 includes one country only, which responded with a positive answer to all questions and thus this geographical area yields 100% in all categories. All countries, regardless of their geographical position, attach substantial importance to the water quality and, accordingly, all answers were positive (100%). The EU countries (C1) seem to attach less importance than the rest to all other categories (Table 6).

## DISCUSSION

The use of swimming pools and similar recreational water environments – and the resulting social interaction, relaxation and exercise – is associated with benefits to health and well-being (WHO 2006). At the same time it is recognized that the expansion of pool- and spa-based recreation is accompanied by an increase in health risks.

**Table 6** | Positive answers per category of questions and the geographical region for countries applying special regulations for spa management and safety

Question category	C1 (%)	C2 (%)	C3 (%)	C4 (%)
Number of countries	5	2	3	1
Construction	36	56	80	100
Safety	65	75	75	100
Staff	43	67	78	100
Users	60	100	100	100
Water quality	100	100	100	100

Global travel has evolved dramatically during the past two centuries, with ever-increasing speed, distance and volume. In general, travellers are considered to be vulnerable to pathogens and various other hazards during their time away from home. Nevertheless, in their excellent review, [Chen & Wilson \(2008\)](#) stated that travellers have dynamic interactions with microbes and places. Travellers can carry microbes and their genetic material, and can play a multitude of roles with respect to microbes. Travellers can be victims, sentinels, couriers, processors and transmitters of microbial pathogens ([Chen & Wilson 2008](#)). In other words, travellers can become infected and then infect others. In some instances, this can lead to multiple generations of spread or sustained transmission in a new area. In this regard, the use of recreational waters and particularly of pool and spa facilities is an important factor.

WHO published the Guidelines for Safe Recreational Water Environments for the Protection of Public Health ([WHO 2006](#)). In the Guidelines, frequent hazards associated with the use of swimming pools and similar recreational water environments are physical (heat, cold, sunlight and drowning) while other hazards derive from the water and air quality. The purpose of the Guidelines is to ensure that pools and similar environments are operated as safely as possible as well as to provide a framework for policy-making and local decision-taking. The chapters discuss aspects related to drowning and injuries, the water's microbiological and chemical quality, pool management and indoor pool air quality. In this respect the WHO Guidelines were used as guidance for the formulation of this study in order to be inclusive and enjoy broad consensus. The relevant questionnaire that was sent to local experts and authorities was designed in such a way that positive answers represent good practice. Its questions were divided into five categories, investigating (a) construction matters, (b) safety, (c) water quality, (d) staff and (e) obligations addressed to users. The lack of a European Directive on the quality of pool and spa waters added interest to the responses, as the seven EU countries presented substantial variation in a number of important factors.

It should be noted here that while 20 out of the 22 Mediterranean countries responded to the swimming-pool related questionnaire, only 11 of these countries reported the existence of spa-related regulations. When combining

the response as an overall of all the countries, in all categories of questions concerning pool and spa facilities, in 606 answers, 183 (30%) were positive only ([Figures 1 and 2](#)). When answers concerning pools and spa are assessed separately, the positive answers in the pool part of the questionnaire were 29% of the total of 420 answers received from 20 countries. As for the positive answers in the spa session of the questionnaire, the positive answers were fewer (28% of the total of 176 answers received from 11 countries only).

The encouraging results of this survey are that all 20 Mediterranean countries address, to a greater or lesser extent, all the variances set out by the WHO Guidelines for good management and safe use of swimming pools in their regulations, although it should be stressed that there is certainly room for improvement. Prevention of accidents and water quality appear to be the issues that receive the greatest attention in the countries overall (80% in both categories). Disinfection, which is considered to be a key issue in the good management of pools, is not sufficiently addressed; 25% of the relevant questions received negative answers. Issues related to circulation and hydraulics do not appear to be adequately addressed (30% negative answers).

The study considers variations of response (positive or negative) within each category of questions. Concerning construction issues, adequacy of lighting and aeration in indoor pools received the least positive response (60% positive answers); with regard to safety matters the application of a safety plan and the presence of lifeguards received the least positive response (70% positive answers); for matters concerning the staff the poorer response concerned occupational health (30% positive response). Occupational health gets increasing awareness among scientists working in this field internationally. Among others, a Swiss study demonstrated an increasing risk of irritative symptoms in pool staff up to a level of 0.2–0.3 mg m<sup>-3</sup> of trichloramine in the air in different indoor swimming pools ([Parrat \*et al.\* 2012](#)). Relevant studies published by the Mediterranean countries are very limited ([Fantuzzi \*et al.\* 2012](#); [Villanueva & Font-Ribera 2012](#)). Finally, only 15% of national regulations are reported as addressing ethical issues as regards the category concerning users.

When focusing on the results by geographical area some interesting conclusions can be drawn. It is striking that in

the EU countries 12% of answers concerning construction were negative. Construction deficiencies cause injuries which, according to WHO Guidelines, comprise the most important hazard in the pool environment. The EU countries' national regulations need also to focus more on the role of users in the transmission of infections: 38% of the relevant questions received negative answers from the EU countries.

The proportion of positive answers by the African countries is more or less similar to that of Europe, but in the non-EU European countries there is a noticeable difference. Questions concerning staff received 40% negative answers while in many countries instructions for the public using the pool are limited. Water quality seems to be subject to only minimal control, as only 60% of the relevant answers were positive. Nevertheless, there are noticeable variations between the non-EU European countries with, for instance, Monaco having very effective regulations but overall, in this area, the proportion of positive answers is relatively low (Figure 1).

Comparing the four broad geographical areas considered in our investigation, the Middle East countries seem to have the least effective regulations of all, in almost all categories. Some countries (e.g., Israel) have issued excellent regulations, but overall many countries in the region need to improve their regulations in order to protect bathers' health (Figure 1).

As for spa waters, in all 11 regulations there is considerable room for improvement. As stated above, compared with the positive answers for pools the positive responses for spa waters are generally at a lower level. This is perhaps due to the fact that some spa establishments are much older than swimming pool facilities. The fashion for bathing in spa waters began in the Mediterranean area much earlier than the fashion for bathing in swimming pools, which only took off in a big way with the boom in the tourist industry in the 1960s.

It is a matter of concern that only 45% of the regulations include provisions for design and construction. Poor design and construction, as already noted, contribute to accident rates. The prevention of accidents was an area that received only 54% positive responses, a particularly low level. This is particularly concerning as spa waters are often aimed at elderly and sick users. Under the same category the positive

responses to the question regarding staff training were low, with just a third of the answers being positive, further contributing to the deficit in safety in spas.

## CONCLUSIONS

For pool and spa regulations in the Mediterranean countries there appears to be an urgent need for adjustment in a number of key areas.

1. **Spa regulations:** there is urgent need for regulations addressing the specific requirements of spa facilities to be issued in all Mediterranean countries. Spa environments are very popular and their value in the tourist industry expands particularly with the ageing of the European population.
2. **Indoor air quality:** very few national regulations deal with the microbiological and chemical quality of the air in the pool facility.
3. **Staff training:** this is vital to generating improvement in all other categories.
4. **Tropical diseases:** countries in the tropical zone need to add specific requirements that address the transmission of tropical diseases.
5. **Occupational health:** this issue appears to be poorly addressed, or absent altogether from most national regulations.
6. **Ethical matters:** these have arisen because of the presence in the pool of people of differing nationality, religious background and customs. The presence of tourists makes this issue even more urgent. For the time being, none of the regulations in the area provides relevant guidance or instructions.
7. **Special groups of users:** the pool environment, which is generally beneficial to human health, may be hazardous when not used with care and in accordance with the users' abilities and needs. Only seven countries reported specific requirements in their regulations for children, persons with disabilities, and for hydrotherapy pools.
8. **The tourist industry:** given the fact that the region as a whole receives a great number of tourists, the employment of a member of staff (i.e., a lifeguard) fluent in an international language would be desirable. Instructions

regarding the use of the facilities, safety warnings and water quality information displayed in an international language would be best practice.

In pool and spa environments hazards may give rise to health effects after short- as well as long-term exposure. When the local populations are present along with multinational swimmers ethical problems are more acute, due to cultural, social and religious differences between people using the same facilities. Accordingly, it is imperative that standards in the Mediterranean countries are improved in order to enhance preventive and remedial measures.

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