



A new checklist for swimming pools evaluation: A pilot study[☆][☆]



G. Liguori^{a,*}, G. Capelli^b, E. Carraro^c, E. Di Rosa^d, L. Fabiani^e, E. Leoni^f, L. Marensi^g, C. Napoli^h, C. Pasquarellaⁱ, V. Romano Spica^j, C. Canossa^g, L. Dallolio^f, V. Di Onofrio^k, F. Gallè^a, S. Giampaoli^j,
SItI Working Group Movement Sciences for Health (GMSH)

^a Department of Movement Sciences and Wellness, University "Parthenope", Naples, Italy

^b Department of Movement Sciences and Health, University of Cassino, Cassino, Italy

^c Department of Public Health and Pediatric Sciences, University of Turin, Turin, Italy

^d Department of Prevention, Local Health Authority of Roma E, Italy

^e Department of Life, Health & Environmental Sciences, University of L'Aquila, L'Aquila, Italy

^f Department of Biomedical and Neuromotor Sciences, University of Bologna, Bologna, Italy

^g Department of Prevention, Local Health Authority of Genova 3, Italy

^h Department of Biomedical Sciences and Human Oncology, University of Bari, Bari, Italy

ⁱ Department of Biomedical, Biotechnological and Translational Sciences, University of Parma, Parma, Italy

^j Department of Movement, Human and Health Sciences, University of Rome "Foro Italico", Rome, Italy

^k Department of Science and Technology, University "Parthenope", Naples, Italy

ARTICLE INFO

Article history:

Received 30 June 2013

Received in revised form 19 September 2013

Accepted 20 September 2013

Available online 3 October 2013

Keywords:

Water recreational environments

Health risks

Safety regulations

Checklist

ABSTRACT

The swimming pool legislation is extremely various and uneven. This diversity is related to the different approaches of individual health authorities, attributable to the different social, economic and cultural conditions of each country.

In Italy the regulation about sanitary aspects for the construction, maintenance and control of swimming pools refers to the Agreement of January 16, 2003 among the Ministry of Health, the Regions and the Autonomous Provinces of Trento and Bolzano. The Agreement is not a jurisprudential act, but has the character of a document approved by constitutional organs of the same level, aimed to promote the harmonization of respective legislations or the attainment of unitary positions.

The controls and the related samples will be collected by Local Health Authority in compliance with criteria established by each region on the basis of specific control plans and supervision and in a manner and frequency that take into account the type of existing facilities inside the specific territorial areas, with particular attention to the critical points highlighted in the protocols of management and the self-prepared safety plans.

In this regard, the working Group of Movement Sciences for the Health (GMSH) of the Italian Society of Preventive Medicine and Hygiene (SItI), proposes a checklist to complete during inspections routinely conducted by Local Health Authorities in swimming facilities. The aim is to have a single tool that can homogenize supervisory activities, procedures and types of controls in different realities, both locally and nationally.

© 2013 The Authors. Published by Elsevier B.V. Open access under [CC BY-NC-ND license](http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Water recreational environments offer health and social benefits.

Studies of sport medicine attest that regular physical activity and sport practice increase the body's defences, limit the musculoskeletal and cardiovascular involution and stimulate the mental activities [1–4]. However, it is known that sports facilities can represent environments where microclimatic conditions, engineering structures, and intense physical activity can negatively affect users health conditions [5,6]. In particular, in swimming pools it is estimated that the frequency of accidents that cause trauma and injuries is higher than in other environments and probably underestimated [7–9]. Furthermore, the health risks assume a crucial importance considering that the safety of this environment is affected by numerous variables as the quality of water and surfaces, the number and health

[☆][☆] Paper presented at the 5th International Conference on Swimming Pools and Spa, Rome, Italy, 9–12 April 2012.

* Corresponding author at: Department of Movement Sciences and Wellness, University "Parthenope", Via Medina n. 40-80133 Naples, Italy. Tel./fax: + 39 0815474790.

E-mail addresses: giorgio.liguori@uniparthenope.it (G. Liguori), g.capelli@unicas.it (G. Capelli), elisabetta.carraro@unito.it (E. Carraro), diorosa58@gmail.com (E. Di Rosa), leila.fabiani@univaq.it (L. Fabiani), erica.leoni@unibo.it (E. Leoni), lorenzo.marensi@asl3.liguria.it (L. Marensi), christian.napoli@iss.it (C. Napoli), ira.pasquarella@unipr.it (C. Pasquarella), vincenzo.romanospica@uniroma4.it (V. Romano Spica), carlo.canossa@asl3.liguria.it (C. Canossa), laura.dallolio@unibo.it (L. Dallolio), valeria.dionofrio@uniparthenope.it (V. Di Onofrio), francesca.galle@uniparthenope.it (F. Gallè), saverio.giampaoli@uniroma4.it (S. Giampaoli).

conditions of the users, the correct functioning of all technological installations used for water treatment [10–12].

The health hazards can be reduced with the adoption of internal safety plans and the application of informed risk management measures as suggested by the WHO Guidelines [13]. Nevertheless, at present the swimming pool legislation is extremely various and uneven. This diversity is related to the different approaches of local health authorities, attributable to the different social, economic and cultural conditions of each country.

Within the sanitary norm primary interest is health. The health risks arising from the use of a swimming pool can be classified in order of severity and incidence: a) risks from drowning; b) risks related to sports or recreational activities; c) risks from microbiological agents; d) risks from chemicals; e) risks from physical agents.

Over the course of the past decade, green chemistry has demonstrated how fundamental scientific methodologies can protect human health and the environment in an economically beneficial manner [14]. This new technological approach can also be exploited in the swimming pools where, if possible, it may be substituted obsolete compounds with others that are equally effective but less toxic (e.g. disinfectants).

Therefore, the aspects that a legislative norm should discuss are various and interdisciplinary, which explains the large differences in regulatory approach that exist in different countries [15].

Currently in Europe there are no directives dedicated to public health issues that can be applied to swimming pools and similar environments, and for this reason local regulations and guidelines vary considerably in the countries [16–19]. In the United Kingdom, the Pool Water Treatment Advisory Group (PWTAG) established guidelines that regulate the chemical and bacteriological swimming pool water quality and its monitoring [20]. In Germany, the technical standards and requirements for the operation of the swimming pools are defined in DIN19643, updated in November 2012 [21]. Even in Austria a new regulation was enacted in October 2012, in order to establish the

requirements on water quality of swimming pools, whirl pools, whirl tubs and small natural swimming ponds [22]. In the United States the regulations vary considerably among different states and local health departments. Efforts are underway to develop a single Model Aquatic Health Code (MAHC) which should be completed by the end of 2013 and could represent a national voluntary guideline for the design, construction, operation and maintenance of swimming pools [23–25].

In Italy, the Legislative Decree 81/2008 (transposition of several European directives in occupational health), and its subsequent amendments and additions, requires the manager of swimming pool to draw up the document of risk assessment, which must include: a) potential sanitary risks, b) points or phases which may occur risks, c) preventive measures, d) monitoring system, e) corrective actions, f) verification of the safety plan and emergency, and g) updating of procedures [26].

The regulation concerning sanitary aspects for the construction, maintenance and control of swimming pools refers to the Agreement of January 16, 2003 among the Ministry of Health, the Regions and the Autonomous Provinces of Trento and Bolzano. The Agreement has the character of a document approved by constitutional organs of the same level, aimed to promote the harmonization of respective legislations or the attainment of unitary positions. Therefore, this Agreement is only a political demonstration of intent and not a norm [27]. It was implemented within the Inter-regional discipline of swimming pools on December 16, 2004 and requires the legal approval of each Region to become operational [15]. Table 1 shows the current regulatory framework in the 20 Italian Regions and the Autonomous Provinces of Trento and Bolzano.

The Agreement is certainly a milestone in Public Health official documents, giving well defined suggestions on the most effective way to perform prevention in recreational water environments, defining minimum sanitary requirements, technical and management needs.

As reported in this Agreement, the controls and the related samples will be collected by Local Health Authority in compliance with

Table 1
Regions and regulations.

Regions	Measures swimming pools	Regulations	Other documents
Valle d'Aosta	No		
Lombardia	Yes	Number 8/2552 Resolution Regional Council, May 17, 2006	Explanatory circulars
Veneto	Yes	Number 1173 Resolution Regional Council, April 18, 2003	Regional Project Swimming Pools. 09 Operating module—Regional Plan controls
Provincia di Trento	Yes	Number 19 Provincial Law, November 15, 2007; Provincial government decree, June 8, 2009	
Provincia di Bolzano	Yes	Number 2360 Provincial government decree, June 28, 2004	
Friuli Venezia Giulia	Yes		Regional Law, July 22, 1996
Liguria	Yes	Number 7 Resolution Regional Council, January 11, 2013	Number 175–176 Resolution Regional Council, February 22, 2013
Emilia Romagna	Yes	Resolution Regional Council, July 18, 2005	
Toscana	Yes	Number 8 Regional Law, March 9, 2006; Number 23 Decree of the President of the Regional Council, February 26, 2010	
Marche	Yes	Number 1307 Resolution Regional Council, August 3, 2009; Number 1136 Resolution Regional Council, July 27, 2012	
Lazio	No		
Umbria	Yes	Number 4 Regional Law, February 13, 2007; Number 2 Regional Regulation, April 1, 2008	
Abruzzo	No		
Molise	Yes	Number 33 Regional Law, November 21, 2008; Regulation October 30, 2009	
Campania	No		
Basilicata	No		
Puglia	Yes	Number 35 Regional Law, December 15, 2008	
Calabria	Yes	Number 770 Resolution Regional Council, December 12, 2007	
Sicilia	No		
Sardegna	No		
Piemonte	Yes		Circular prot. n. 14066/27.001, October 18, 2006. Guidelines for Monitoring of Facilities Swimming
State of San Marino	Yes	Number 50 Decree, March 02, 2006	

the criteria established by each region on the basis of specific control plans and supervision and in a manner and frequency that take into account the type of existing facilities inside the specific territorial areas, with particular attention to the critical points highlighted in the protocols of management and the self-prepared safety plans.

In this regard, the working Group of Movement Sciences for the Health (GMSH) of the Italian Society of Preventive Medicine and Hygiene (SIIt), that since its founding has dealt with different aspects of prevention in recreational environments [28–30] and proposes a checklist to be completed during inspections routinely conducted by Local Health Authorities in swimming facilities. The aim is to have a single tool that can homogenize supervisory activities, procedures and types of controls in different realities, both locally and nationally.

2. Methods

The GMSH working group defined a checklist allowing to collect information about structural, technical and managerial characteristics of swimming facilities, in order to evaluate the state of swimming pools, during the periodic inspections of facilities. The checklist was compiled taking into account the questionnaire proposed in the Forth International Conference on Swimming Pools & Spa of Oporto, in 2011, and other checklists already used by Local Health Authorities in different Italian regions. In order to test the form, a pilot study was carried out in 7 Italian regions (Abruzzo, Campania, Emilia Romagna, Lazio, Liguria, Piemonte, Puglia). The document is divided into 10 sections: Swimming Pool Classification, Water Supply, Swimming Pool Type (use of swimming pool), Swimming Pool Size/Volume, Access and Attendance, Water Recirculation and Treatment, Structures, Staffing, Technological Installations, Self-monitoring and Risk Assessment.

This “new” tool was administered to the managers and/or staff of swimming pools during periodic inspections conducted by the inspector of the Local Health Authority, in collaboration with a Movement Sciences Graduates.

Collected data were entered into a Microsoft Excel spreadsheet. A descriptive analysis was undertaken to calculate the distribution and frequency of each variable.

3. Results

On a total of 35 collected checklists, 20 are from public and 15 from private structures. In any location the people can access.

Thirty swimming pools belong to sport facilities, 2 to gyms, 2 to rehabilitation facilities and 1 to a spa. Twenty-five swimming pools are indoor, 5 outdoor and 5 mixed type.

Table 2 shows the critical aspects emerged by the compilations of the various checklist sections. Sections from 1 to 4 do not present any particular critical points. The number and type of pools, the water supply, the size and volume of pools are information easy to obtain.

Section 5 (Access and Attendance) shows that the load of swimmers is often unknown. A regulation on the behavior of the users always exists and it is showed at the entrance in 29/35 (82.8%) structures. Not always, though, there is the same attention in observing these regulations, especially the obligation to use the foot-washing and shower before entering the pool.

Section 6 assesses the operational conditions of Water Recirculation and Treatment. The examined swimming facilities are always provided with a recirculating system and a central water treatment, including pre-filtration (in almost all of the pools), filtration, disinfection with chlorine compounds, and the use of different products for flocculation, pH correction and prevention of algae formation. Table 3 shows the different processes of pre-filtration, flocculation, filtration and disinfection in the examined facilities. It was not always possible to collect data for this section because some plants were not always staffed by qualified technical personnel.

Data from Section 7 (Structures) mainly derive by the direct supervision of the inspector of the Local Health Authority, who personally examines the structural and hygienic characteristics of changing rooms, toilets, local of first aid, etc. The examined structures vary in size, construction materials, but always appear in accordance with the national regulation that states the structural features of sport facilities [31]. Their hygienic conditions are evaluated as “good” by the inspectors, but efforts are needed to harmonize criteria of the subjective evaluation.

A critical point of the checklist is identified in Section 8 (Technological Installations) which is unable to collect responses on many technical aspects, probably because of questions too specific for the

Table 2
Effectiveness and critical points of the checklist for swimming pools inspections.

Checklist sections	Questions included in the checklist without any critical points	Critical points highlighted by the inspection and checklist compilation
1 Swimming pool classification	- Public/private - Indoor/outdoor/mixed type - Sports facilities/Gyms/Rehabilitation/Spa	No critical points
2 Water Supply	Citizen aqueduct	No critical points
3 Swimming pool type (use of swimming pool)	Swimming/swimming school/recreational activities/whirlpools/other use	No critical points
4 Swimming pool size/volume	Size and volumes of pools	No critical points
5 Access and attendance	Regulation on behavior of swimmers is always present at the entrance	Load of swimmers often unknown; Regulation on behavior of swimmers is often not observed
6 Water recirculation and treatment	Information available about: - Recirculation time of water - Water treatment phases - Type of filters - Chemical products used - Residual chlorine and pH	Data recording not always made
7 Structures	Inspector examines personally the structural and hygienic characteristics of changing rooms, toilets, local of first aid, etc.	Efforts are needed to harmonize local regulations and criteria of subjective evaluation of the inspectors
8 Technological plants (illumination, air heating and conditioning, water heating, electrical equipment)		No response on many technical points
9 Staffing		Difficulty to define the qualification of personnel
10 Self-monitoring and risk assessment		Checklist highlighted very different situations in the various regions, due to the implementation or not of the National Agreement

Table 3
Water treatment in swimming pools.

Treatments	Swimming pools (%)
Pre-filtration	
Yes	100
No	0
Flocculation	
Yes	74.3
No	25.7
Flocculation	
Aluminum salts	38.5
Iron salts	61.5
Filtration	
Sand filter monolayer	77.1
Filter multilayer homogeneous masses	8.6
Filter multilayer heterogeneous masses	11.4
Diatomaceous earth filter	2.9
Disinfection	
Liquid chlorine and/or hypochlorite	74.3
Dichloroisocyanurate sodium + trichloroisocyanuric acid	11.4
Chlorine compounds + ozone	8.6
Hypochlorite + trichloroisocyanuric acid	5.7

swimming pool employers interviewed. In this section the most critical points appear those concerning the guaranteed minimum illumination values (48.6% of structures do not give responses), the existence of the air handling unit and the thermal power station (37.1% of structures do not give responses), the frequency of periodic cleaning of the heating systems, and the systematic measurement of relative humidity (37.1% and 40.0% of structures, respectively, do not give responses).

Section 9 (Staffing) highlights critical aspects due to the difficulty to define the qualification of the personnel: there are 11 (31.4%) non-response to the question: *Is there a pool operator certificate?* and 10 (28.6%) non-response to the question: *Is there a swimming pool operator with experience without certificate?* Furthermore, although 32 (91.4%) structures respond affirmatively to the question: *Is there staff for the provision of first aid?*, 13 (37.1%) do not give any response about the qualification of such personnel.

In Section 10 (Self-monitoring and Risk Assessment) the greater number of non-responses regards the existence of the procedure for periodic inspection of materials and equipment (46.9%), the presence of the procedure of emergency management (48.6%), and the possible actions in the event of a blood release into the pool (42.6%). Even the *Legionella* risk management is considered a critical issue. Only 13 (37.1%) of the facilities are provided with a control plan for *Legionella*.

4. Discussion

During checklists compilation various critical aspects emerged. The results show that in many cases answers to questions have not been provided. In some cases the lack of responses is due to the complexity of the questions and this represents a limitation of the checklist; in other cases the non response derives from deficiencies of the staff. Undeniably, the proposed checklist is a document too bulky and in some parts perhaps not too clear, particularly where information is requested on specific technological installations. A critical aspect concerning the personnel is the difficulty to define the qualification of the employers who often perform multiple tasks which would require different and specific skills. Even the low compliance with the regulation on the behavior of users must be held in due consideration for its importance in the hygienic management of swimming pools [32].

The collected data highlights very different situations region by region, due to the implementation or not of the National Agreement, in particular the adoption of internal safety plans based on the analysis and management of risks [13], including the innovative aspect of the control plan for *Legionella* that is an emerging problem for swimming pools and spa [33,34]. As structured, the document is currently difficult

to apply in the context of some regions where the absence of specific regional regulation does not oblige the operators of swimming pools to prepare the self-monitoring document and does not contemplate the educational and professional requirements of the staff responsible of the treatment plants (as established in other regions).

Then the document will be modified and improved also in the form to have a clearer and easier checklist to give. It might be necessary to specify two different checklists: a first check, for the opening of a new pool, including the structural and technological data, and the other for routine control, as there is data that are useless to ask at every time of inspection.

5. Conclusions

The absence of a unified national legislation is definitely the greatest difficulty to be overcome to have a unitary checklist and to be offered during routine supervisory activities in all Italian regions. From this experience, the GMSH aims to review, modify and simplify the document and propose it to the institutions as a possible common instrument for national supervision. Together, in the expectation that all Italian regions can have similar regulations based on the principles stated by the National Agreement, the GMSH aims to write guidelines to accompany this document that may be of help and clarification in all inspections on the Italian territory.

The use of this checklist is particularly suitable for the inspections conducted at the opening of the swimming facilities; for the supervisory inspections, however, it is estimated to use sufficiently only the sections more strictly related to management aspects. The "Checklist for Swimming Facilities" so structured could become a tool for the transversal evaluation of swimming pools that may help to integrate two aspects of great interest: health and sports.

Working project group

Milena Belletti (Local Health Authority of Bologna); Aldo Boero, Riccardo Chiapello (Local Health Authority of Cuneo 1); Davide D'Angelo, Chiara Tuccella, (Department of Life, Health & Environmental Sciences, University of L'Aquila, L'Aquila, Italy); Giuseppina Amispergh, Mauro Cosentino (Department of Prevention, Local Health Authority of Napoli 1 Centro); Roberto Mastronuzzi (Department of Studies of Institutions and Territorial Systems, Parthenope University, Naples, Italy); Laura Faccini, Tijana Lalic (Department of Biomedical, Biotechnological and Translational Sciences, University of Parma, Parma, Italy), Patrizia Pico (Department of Public Health, Local Health Authority of Parma); Anna Decorato, Francesco Di Gregorio, Vincenzo Laurita (Department of Prevention, Local Health Authority of Roma E); Federica Valeriani (Department of Movement, Human and Health Sciences; University of Rome "Foro Italico").

Conflict of interest

None declared.

References

- [1] C.E. Garber, B. Blissmer, M.R. Deschenes, B.A. Franklin, M.J. Lamonte, I.M. Lee, D.C. Nieman, D.P. Swain, Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise, *Med. Sci. Sports Exerc.* 43 (2011) 1334–1359.
- [2] I. Galán, R. Boix, M.J. Medrano, P. Ramos, F. Rivera, R. Pastor-Barriuso, C. Moreno, Physical activity and self-reported health status among adolescents: a cross-sectional population-based study, *BMJ* (Open 3) (2013).
- [3] P. Kokkinos, Physical activity, health benefits, and mortality risk, *ISRN Cardiol.* (2012) 718789, <http://dx.doi.org/10.5402/2012/718789>.
- [4] M.K. Handzlik, A.J. Shaw, M. Dungey, N.C. Bishop, M. Gleeson, The influence of exercise training status on antigen-stimulated IL-10 production in whole blood culture and numbers of circulating regulatory T cells, *Eur. J. Appl. Physiol.* 113 (2013) 1839–1848.

- [5] V. Bougault, L.P. Boulet, Airway dysfunction in swimmers, *Br. J. Sports Med.* 46 (2012) 402–406.
- [6] C. Mandin, M. Derbez, S. Kirchner, Schools, office buildings, leisure settings: diversity of indoor air quality issues. Global review on indoor air quality in these settings, *Ann. Pharm. Fr.* 70 (2012) 204–212.
- [7] P. Barss, H. Djerrari, B.E. Leduc, Y. Lepage, C.E. Dionne, Risk factors and prevention for spinal cord injury from diving in swimming pools and natural sites in Quebec, Canada: a 44-year study, *Accid. Anal. Prev.* 40 (2008) 787–797.
- [8] M. Giustini, P. Ade, F. Taggi, E. Funari, Incidenti in aree di balneazione, *39 Annuario Istituto Superiore Sanità*, 2003. 69–76.
- [9] Quaderni per la salute e la sicurezza – Le piscine – ISPESL, 2006.
- [10] Z. Barna, M. Kádár, The risk of contracting infectious diseases in public swimming pools. A review, *Ann. Ist. Super. Sanita.* 48 (2012) 374–386.
- [11] L. Bonadonna, G. Donati, R. Brancesco, Rischi e caratteristiche di qualità igienico sanitaria degli impianti natatori, *Notiziario ISS* 17 (2004) 3–7.
- [12] E. Leoni, P. Legnani, E. Guberti, A. Masotti, Risk of infection associated with microbiological quality of public swimming pools in Bologna, Italy, *Public Health* 113 (1999) 227–232.
- [13] World Health Organization, Guidelines for Safe Recreational Waters Vol 2, Swimming Pools, Spas and Similar Recreational Water Environments, Geneva, 2006.
- [14] P.T. Anastas, M.M. Kirchhoff, Origins, current status, and future challenges of green chemistry, *Acc. Chem. Res.* 35 (2002) 686–694.
- [15] L. Bonadonna, G. Donati, Piscine ad uso natatorio: aspetti igienico-sanitari e gestionali per l'applicazione della nuova normativa, Istituto Superiore di Sanità, 2007. (Rapporti ISTISAN 07/11).
- [16] K. Pond, Current issues associated with swimming pools, spas and similar recreational water environments, Third Swimming Pool and Spa International Conference, London, 17–20 March 2009 (paper 7.2), March 17–20 2009.
- [17] L. Dallolio, M. Belletti, A. Agostini, M. Teggi, M. Bertelli, C. Bergamini, L. Chetti, E. Leoni, Hygienic surveillance in swimming pools: assessment of the water quality in Bologna facilities in the period 2010–2012, *Microchem. J.* 110 (2013) 624–628.
- [18] S. Giampaoli, F. Valeriani, V. Romano Spica, Thermal water for recreational use: overview of international standards, *Ig. Sanita Pubbl.* 68 (2012) 863–873.
- [19] S. Giampaoli, L. Bonadonna, V. Romano Spica, Nature-like swimming ponds and bathing: public health issues for congruous guidelines, *Ann. Ig.* 23 (2011) 435–442.
- [20] Pool Water Treatment Advisory Group (PWTAG), Code of practice, the management and treatment of swimming pool water, <http://www.pwtag.org/standards2013.php>, (accessed 3 April 2013).
- [21] German standard DIN 19643, Treatment of water of swimming pools and baths. Part 1: general requirements, <http://www.beuth.de/en/2012> (accessed 3 April 2013).
- [22] Minister of Health, Republic of Austria, Regulation on hygiene in baths, hot tubs (whirlpools), saunas, hot air and steam baths and small ponds for swimming (Pool Hygiene Regulation 2012-BhygV 2012), *Federal Law Gazette II* (28 September 2012), n. 321.
- [23] J.S. Yoder, M.C. Hlavsa, G.F. Craun, V. Hill, V. Roberts, P.A. Yu, L.A. Hicks, N.T. Alexander, R.L. Calderon, S.L. Roy, M.J. Beach, Surveillance for waterborne disease and outbreaks associated with recreational water use and other aquatic facility-associated health events, Centers for Disease Control and Prevention (CDC), United States, 2005–2006, *MMWR Surveill. Summ.* 12 (2008) 1–29.
- [24] Model aquatic health code, <http://www.cdc.gov/healthywater/swimming/pools/mahc/> (accessed 3 April 2013).
- [25] M.J. Beach, M.C. Hlavsa, Protecting a nation of swimmers: using surveillance, disease, and outbreak data to change public health policy and influence regulation, Fifth International Conference Swimming Pool & Spa. Rome, April 9–12, 2013, p. 130, (Abstract Book. ISTISAN Congressi 13/C1, 2013).
- [26] Italian Republic, Number 81 Legislative Decree, April 9, 2008. Implementation of Article 1 of the Number 123 Law, August 3, 2007, concerning the protection of health and safety in the workplace.
- [27] Agreement of January 16, 2003 among the Ministry of Health, the Regions and the Autonomous Provinces of Trento and Bolzano on the hygienic aspects for the construction, maintaining and control of swimming pools.
- [28] G. Liguori, C. Napoli, V. Romano Spica, Working Group, “Movement Sciences for Health”, World Health Organization guidelines for swimming pools and similar recreational water environments: Italian translation by the SItI working group “Enhancing health and physical activity”, *Ig. Sanita Pubbl.* 65 (2009) 507–516.
- [29] C. Napoli, G. Amagliani, M. Arpesella, L. Bonadonna, G. Brandi, R. Briancesco, G. Capelli, V. Di Onofrio, G. Fantuzzi, C. Frangella, F. Gallè, E. Leoni, G. Liguori, C. Mammina, L. Manzoli, C. Pasquarella, G. Privitera, V. Romano Spica, World Health Organization (WHO) Guidelines for coastal and fresh waters: Italian translation by the society of hygiene, preventive medicine and public health (SItI) Working Group, *Ig. Sanita Pubbl.* 67 (2011) 351–364.
- [30] C. Napoli, S. Giampaoli, F. Gallè, C. Frangella, V. Di Onofrio, L. Bonadonna, V. Romano Spica, G. Liguori, Working Group, Movement Sciences for Health, Linee Guida dell'Organizzazione Mondiale della Sanità per la sicurezza dell'acqua negli edifici: traduzione a cura del Gruppo di Lavoro SItI - Scienze Motorie per la Salute, *Ig. Sanita Pubbl.* 68 (2012) 613–624.
- [31] Norme CONI per l'impianistica sportiva. Approved by resolution of the National Council of CONI, Number 1379, June 25, 2008.
- [32] C. Pasquarella, L. Veronesi, C. Napoli, S. Castaldi, M.L. Pasquarella, E. Saccani, M.E. Colucci, F. Auxilia, F. Gallè, V. Di Onofrio, S. Tafuri, C. Signorelli, G. Liguori, Swimming pools and health-related behaviours: results of an Italian multicentre study on showering habits among pool users, *Public Health* (2013) 614–619.
- [33] E. Leoni, P. Legnani, M.A. Bucci Sabattini, F. Righi, Prevalence of *Legionella* spp. in swimming pool environment, *Water Res.* 35 (2001) 3749–3753.
- [34] C. Napoli, F. Fasano, R. Iatta, G. Barbuti, T. Cuna, M.T. Montagna, *Legionella* spp. and legionellosis in southeastern Italy: disease epidemiology and environmental surveillance in community and health care facilities, *BMC Public Health* 10 (2010) 660.