



Research article

Surfers as aquatics rescuers in Portugal and Spain: Characteristics of rescues and resuscitation knowledge

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ABSTRACT

The aim of this study was to analyze the rescues carried out by surfers from Portugal and Spain, their knowledge of rescue and resuscitation and their perception and risk behavior while surfing. An online survey was conducted in 2048 surfers from Portugal and Spain, with questions regarding the demographic characteristics, experience, perception and risk behavior of the surfers; rescues attended by the surfers and surfer's knowledge and experience in rescue and resuscitation. Concerning the number of rescues carried out by surfers, 78.5% of the participants had to carry out at least one rescue in their lifetime. A significant association was found between the years of surfing experience, the surfing level and the number of rescues carried out ($p < 0.05$). Thirty-five-point eight percent of the surfers never attended a cardiopulmonary resuscitation (CPR) course and 76.2% had no work experience as a lifeguard. Correspondingly, the vast majority of the surfers analyzed did not have the essential knowledge about rescue and resuscitation. This study provides evidence of the important role that surfers play in saving lives on Portuguese and Spanish beaches. The results suggest that the number of rescues conducted by surfers each year in Portugal and Spain is relevant to reducing the number of fatalities that occur along coasts.

1. Introduction

The recent declaration of the United Nation (UN) recognizes that drowning has been the cause of more than 2.5 million preventable deaths worldwide in the last decade and encourages all member states to develop drowning prevention plans to stop this scourge [1]. Drowning is a public health problem, causing more than 400 deaths per year in Spain [2] and in Portugal an average of 217 per year between 1992 and 2019 [3].

In this regard, Portugal and Spain have very attractive aquatic leisure conditions, including the warm climate, alongside the thousands of kilometers of coastline and beaches that invite bathing. However, not all beaches are supervised and, in general, those

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that are, tend to have a seasonal presence, which considerably increases the drowning risk [4].

Surfing as a leisure activity in Portugal and Spain has gained popularity over the last decade. According to the International Surfing Association (ISA), the estimated surfing population in both countries is around 500,000. Surfing is practiced throughout the year, so surfers can play an important role as bystander rescuers, especially outside patrolled beaches [5–7]. In this sense, previous studies have already shown that surfers represent an important form of bystander supervision to reduce drowning risk [5,7]. Surfers have experience in the water, know the main hazards associated with the risk of drowning, have a flotation device and are mostly competent swimmers [5].

Previous studies showed that the number of years of surfing experience or higher self-rated surf ability is linked to the ability to perform a rescue, as well as to the number of rescues performed [5,7]. Water rescue and first aid training are very important for people involved in water activities [8]. However, there is still no data on the frequency, conditions or geographic location of water rescues carried out by surfers from Portugal and Spain, according to their surf experience, first aid skills and lifesaving training.

Therefore, this study aimed to characterize the rescues carried out by surfers from Portugal and Spain, as well as to analyze their knowledge of rescue and resuscitation, and their perception and risk behavior. We hypothesize that surfers from Portugal and Spain might contribute significantly to rescues on the beach. Thus, this information could be very useful in increasing the effectiveness of surfers as bystander aquatic rescuers and in the development of national drowning prevention strategies in both countries. These strategies would ultimately aim to reduce the number of fatalities occurring along the Portuguese and Spanish coasts.

2. Materials and methods

2.1. Design of the study

A cross-sectional descriptive study was conducted. This research received ethical approval from the Ethics Commission of the Institute of Public Health of the University of Porto, Portugal (CE20134) and the Faculty of Education and Sport Sciences of

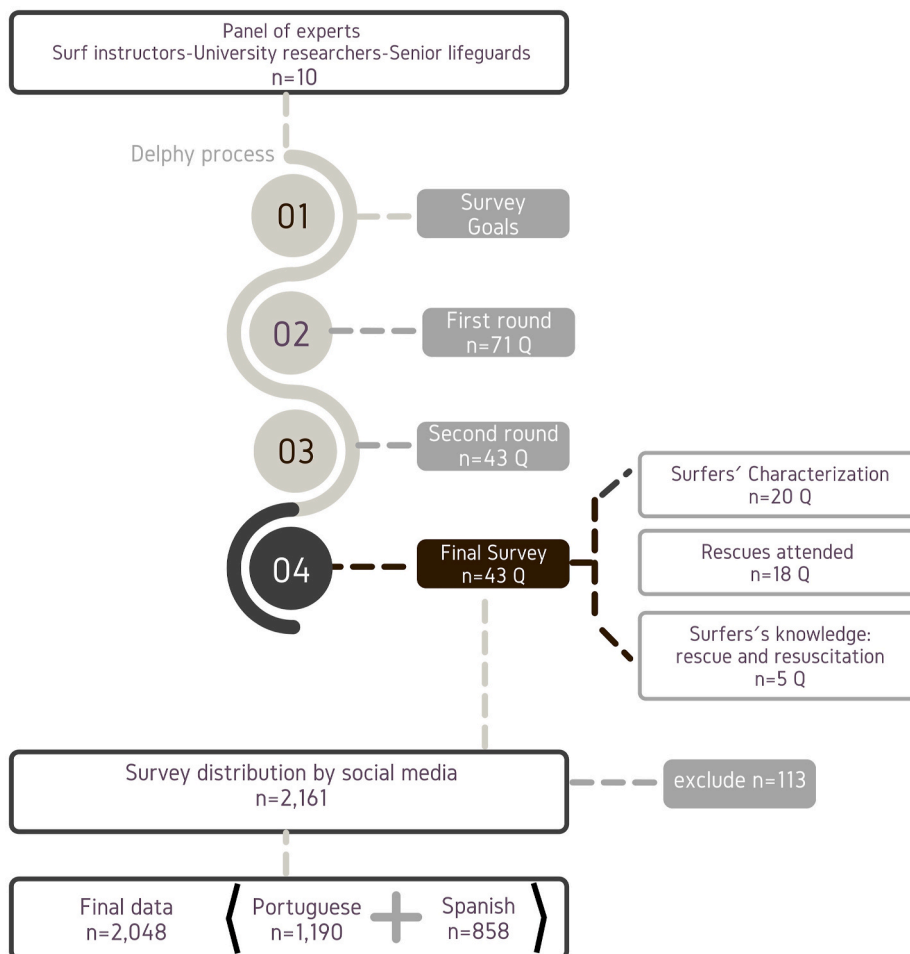


Fig. 1. Flow chart design.

Pontevedra, University of Vigo, Spain (12-0320). All participants were informed about the aim of the study and gave their informed consent indicating their willingness to participate in the survey.

2.2. Data source and participants

Data was collected through an online and anonymized survey targeting Portuguese and Spanish surfers. The survey is included as supplementary material. This survey was available in two languages, Portuguese and Spanish, and was provided to the participants through web pages and forums. Surfers from other countries were also accepted, but only surfers who lived in Portugal or Spain were included. Tourists were excluded since they were not familiar with Portuguese and Spanish beaches. Therefore, they could create a bias that would not help to characterize the reality of these two countries in terms of the research response.

The questionnaire was designed by the authors aiming to focus on three topics: characterizing the participants, determining their training and knowledge in rescue and resuscitation, and identifying their experiences as surfer rescuers. This was distributed to ten Portuguese and Spanish experts in the field with more than 10 years of surfing experience, who, through a three-round Delphi process, established the items of the survey. More specifically, the panel of experts were all adults with completed higher education. They all had a long connection to surfing and, in addition, were very experienced surf coaches, University professors with published research and experienced lifeguards. All of them were contacted directly by the authors, who explained the objectives of the study to them through individual meetings. They provided their inputs for the questions but also assisted in the survey reliability testing.

In the first round, a set of 71 questions was proposed. After this round, 28 questions were eliminated on the basis that the expert panel considered them to have little relevant content, off-target, or too confusing. In the second round, the survey encompassed 43 questions, both open and closed-answer questions. It included 1) Surfers' characterization, including demographic characteristics, surfing level and experience, and risk perception and behavior; 2) rescues attended by the participants of the survey and 3) Surfers' knowledge and experience in rescue and resuscitation (Fig. 1).

The survey was created using Google Forms and distributed online on social media platforms, namely Facebook, WhatsApp, Twitter and Instagram, on the most popular portals of the surfing community in Portugal and Spain, and via the electronic newsletters of the Portuguese Surfing Federation (FPS) and the Spanish Surfing Federation (FES). This approach was chosen with the aim of achieving the largest number of responses and a profile of participants as heterogeneous as possible. The inclusion criteria were surfers over 16 years old and maintaining a regular practice of at least once a month. The survey was launched online on April 6th, 2020 and the last answer used was received on June 10th, 2020. All the responses have been processed and analyzed anonymously.

2.3. Statistical analysis

All analyses were conducted using the statistical package IBM SPSS for Windows (version 25.0. Armonk, NY: IBM Corp). Descriptive results for the variables included in the questionnaire are presented as absolute frequencies (F) and relative percentages (%) of responses. The association between these variables was analyzed using the Pearson Chi-square test. Effect sizes were calculated using Cramer's V and classified as small ($V = 0.10-0.29$), medium ($V = 0.30-0.49$), or large ($V > 0.50$) effects [9]. For all analyses, the significance value was set at $p < 0.05$.

3. Results

3.1. Surfers' characterization

3.1.1. Surfers demographics

A total of 2161 surfers answered the survey. Responses from non-resident surfers in Portugal and Spain and/or from surfers under the age of 16, as well as duplicate responses, were excluded. After these culling procedures, a final sample of 2048 surveys was used for analysis, of which 1190 (58.1%) were Portuguese and 858 (41.9%) Spanish. The majority of survey respondents were male (90.7%; $n = 1858$) and the mean age was 33.9 ± 10.1 years old (range of 16–75 years). Most respondents (71.2%) identified themselves as surfers, 39.2% as bodyboarders and 18.1% as longboarders. In addition, 85.2% of the respondents surfed at least once a week in the 12 months prior to the survey.

3.1.2. Surfers' experience

Thirty-seven point six percent of the participants had more than 20 years of experience, 28.5% had between 11 and 20 years of experience and only 1.2% had less than one year of experience. Regarding the self-perception of surfing level, most of the participants considered themselves to be intermediate (44.8%) and advanced (46.5%). A significant relationship was found between the years of experience as surfers and the self-perception of surfing level ($\chi^2 = 713.493$; $p < 0.001$; $V = 0.341$, medium). The more years of surfing experience, the higher the level of self-perceived surfing. It was assumed that the level of self-perceived surfing was related to the surfer's ability to ride the waves.

3.1.3. Surfers' perception and risk behavior

Participants were asked about their swimming skills, as well as their perceptions and risk behavior during their practice as surfers. Most of the surfers responded that they could swim more than 500 m in a pool without stopping (45.6%). It should also be mentioned that if the swim is performed in the sea with waves of 2 m or greater, 23.5% mentioned they could swim the same distance comfortably

and 40.4% that they could swim the same distance but with some difficulties.

In addition, 98.9% considered knowing the beach where they usually surf; 93.2% knew how to identify a rip current; 87.2% could get out of a rip current without help and 80.5% felt safe in the sea with waves of two or more meters.

Furthermore, 90.2% always saw the forecasts before surfing and 42.3% always saw the webcams before surfing. Additionally, 42% sometimes dived headfirst when they fall off the board or at the end of the wave; 73% sometimes surfed alone but 72.4% of them considered surfing alone to be risky.

About the common troubles of surfers during their practice, only 15.1% have never had issues while surfing, while the others had either been caught by a rip current (38.8%), hit by a wave (38.7%); had a muscle injury or cramp (37.2%); were hit by their own board (36.7%); hit the bottom of the sea (36.6%) or were hit by another surfer (26.6%).

3.2. Rescues attended by surfers

Concerning the number of rescues carried out by surfers throughout their career, 13.8% made 10 or more rescues, 10.4% between 6 and 9, 40.2% between 2 and 5, 14.2% made one, and only 21.5% of the surfers under study reported having never made any rescue.

A significant association between the average number of rescues performed and the number of years of experience as a surfer was found, ($\chi^2 = 721.363$; $p < 0.001$, $V = 0.297$, small), indicating that the number of rescues performed by individual surfers increased as the years of surfing experience also increased (Table 1). A second Chi-square test of independence showed a significant relationship between a surfer's surfing level self-perception and the rescues performed, ($\chi^2 = 447.258$; $p < 0.001$; $V = 0.270$, small). The higher level a surfer had, the more likely they were to have participated in a rescue (Table 1).

When we analyzed the participation in the rescue of multiple victims, from a group of five or more people, 26.3% of respondents answered yes. A Chi-square test of independence found a significant relationship between the participation in a rescue with multiple victims and the number of years of surfing experience, ($\chi^2 = 173.492$; $p < 0.001$; $V = 0.291$, small), indicating that the participation in a rescue with multiple victims increased as the years of surfing experience increased.

Respondents were asked to describe what they considered to be their most serious rescue event, providing data about the location, the climate, the sea conditions, how they got involved in the rescue, how it was carried out and personal perspectives on the causes and outcomes of the rescue event. Analyzing the geographical area where the most serious rescues took place, 56.2% were carried out in Portugal and 40.7% in Spain, distributed across the different regions of the two countries (Fig. 2).

Summer was the season when most rescues occurred (57.2%), of which 68.1% were conducted on sunny days and 53.2% with rough seas. Regarding the size of the waves, most respondents answered that the swell was between 0.5 and 1 m (47.4%) or between 1 and 2 m (36.9%). In 33.3% of these rescues, the beach was full but with few people in the water and in 34% the beach was empty with few surfers in the water. The majority of the most serious rescues occurred on unpatrolled beaches (28.9%) and on patrolled beaches but outside of lifeguard patrol hours (22.2%). In order to understand how surfers performed their most serious rescue, participants were asked to describe how the rescue developed from the beginning to the end. Most respondents (86.1%) replied that the victims were in danger because they were caught in a rip current. In 62.2% of responses, the surfer-rescuer saw the person in trouble and decided to help, with most respondents indicating the rescued person showed signs of panic (57%) and exhaustion (54.2%). In addition, 50.1% of surfer rescuers paddled the victim to the shore, 56.9% of the victims stayed calm after the rescue and could walk away on their own feet and 17.4% needed medical assistance. The surfers' dominant reactions post-rescue were being happy to have helped (74.7%) and being relieved (41%). Sixty percent of surfer respondents believed that they had saved the life of the victim. Regarding the number of rescued victims, 76.2% were one person and 23.8% were multiple victims.

3.3. Surfers' knowledge and experience in rescue and resuscitation

A large proportion of the participants (35.8%) never attended a cardiopulmonary resuscitation (CPR) course, 23.1% took a course more than 5 years ago and 76.2% had no work experience as a lifeguard. Only 14.2% of respondents knew that the first thing to do when observing a victim at risk of drowning is to call for help. Only 14.4% knew that in case of assistance to a drowning victim, the first

Table 1
Association between years of surfing experience or self-perception of surfing level and rescues carried out [F (%)].

	Number of Times that Rescued Someone Drowning				
	Never	Once	2–5	6–9	10 or More
Surfing experience					
<1 year	22 (91.7)	2 (8.3)	0 (0.0)	0 (0.0)	0 (0.0)
1–5 years	162 (59.1)	54 (19.7)	55 (20.1)	2 (0.7)	1 (0.4)
6–10 years	139 (33.4)	83 (20.0)	163 (39.2)	19 (4.6)	12 (2.9)
11–20 years	89 (15.8)	82 (14.6)	270 (48.0)	66 (11.7)	56 (9.9)
>20 years	28 (3.6)	69 (8.9)	335 (43.5)	126 (16.3)	213 (27.6)
Surfing level					
Beginner	49 (68.1)	15 (20.8)	6 (8.3)	0 (0.0)	2 (2.8)
Intermediate	303 (33.0)	165 (18.0)	349 (38.0)	59 (6.4)	42 (4.6)
Advanced	79 (8.3)	103 (10.8)	432 (45.4)	140 (14.7)	197 (20.7)
Professional	9 (8.4)	7 (6.5)	36 (33.6)	14 (13.1)	41 (38.3)

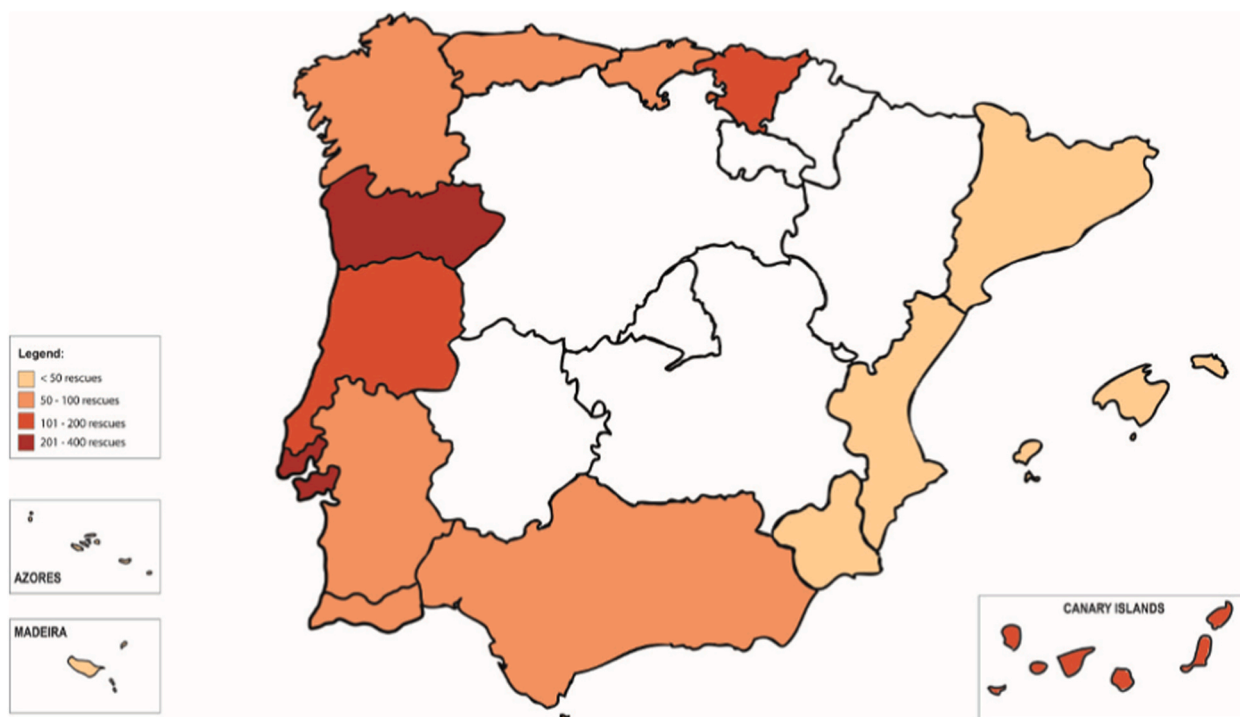


Fig. 2. Number of most serious rescues per geographic area.

Table 2
Surfers' experience and knowledge in relation to rescue and resuscitation.

	Frequency	Percentage (%)
Attendance to a CPR course		
a) Less than 5 years ago	841	41.1
b) More than 5 years ago	474	23.1
c) Never	733	35.8
Working experience as a lifeguard		
a) None	1560	76.2
b) Less than 5 years	275	13.4
c) 5 or more years	213	10.4
What is the first thing to do when you see a victim at risk of drowning?		
a) Always use a floating element to rescue	327	16.0
b) * Call for help	290	14.2
c) Try not to lose sight of the victim	132	6.4
d) Get into the water only if it is safe	47	2.3
e) All sentences are correct	1223	59.7
f) Do not know	29	1.4
In case of assistance to a drowning victim, what should you do first?		
a) See, hear and feel the breathing movements	289	14.1
b) Getting the victim to a safe environment if it is safe to do	1296	63.3
c) *Assess if the victim is conscious	295	14.4
d) Check airway patency	57	2.8
e) Start rescue breaths	21	1.0
f) Do not know	90	4.4
How to start basic life support in a drowning victim		
a) 2 ventilations	409	20.0
b) 15 abdominal compressions	21	1.0
c) 15 chest compressions	269	13.1
d) * 5 ventilations	267	13.0
e) 30 chest compressions	439	21.4
f) Do not know	643	31.4

*This sentence was considered the correct one.

thing to do is to assess the state of consciousness of the victim and only 13% knew that the basic life support in a drowning victim, should start with 5 ventilations (Table 2).

There was a significant association between the knowledge about how to act in a drowning event and the surfers that attended the CPR course ($p < 0.001$) (Table 3). Surfers who have never attended a CPR course showed a lower percentage of correct answers in all the questions, while surfers that attended the CPR course less than 5 years ago were the ones who showed better knowledge ($p < 0.001$).

Regarding the knowledge of how to act in a drowning event, significant differences were found according to the surfers' working experience as lifeguards (Table 4). The group with 5 or more years of experience as lifeguards and the group with less than 5 years of experience obtained a higher percentage of correct answers compared to the group with no work experience as lifeguards, in the questions "first thing to do when you see a victim at risk of drowning" and "first thing to do in case of assistance to a drowning victim" ($p < 0.001$). However, in the question "how to start basic life support in a drowning victim", the group with 5 or more years of experience as a lifeguard obtained a higher percentage of correct answers compared to the other two groups ($p < 0.001$). Conversely, in the same question, the group with less than 5 years of experience obtained a higher percentage of correct answers compared to the group with no work experience as a lifeguard ($p < 0.001$).

Regarding the association between both the years of surfing experience and surfing level with the knowledge of how to act in a drowning event, no significant differences were found ($p > 0.05$).

4. Discussion

This study attempted to characterize how surfers act in drowning prevention and mitigation. The key findings are: a) most of the participants carried out at least one rescue in their lifetime; b) the surfers that attended a CPR course and the surfers who had experience working as a lifeguard revealed to have more knowledge and potentially be more capable to perform a safe and effective rescue; c) the vast majority of the surfers analyzed did not have basic knowledge about rescue and resuscitation techniques. Moreover, this study revealed that 49.5% of rescues performed by surfers occurred on unsupervised beaches or outside surveillance hours.

Drowning is a global threat to public health, with coastal locations being the main contributor to the overall burden of drowning [10]. Beaches are places of high risk for drowning in many countries [11]. Previous studies from other countries found a rate of 63% of surfers who participated in water rescue in Australia [5] and in Europe [7], found a rate of 39%. However, in this study, 78.5% of the surfers referred to have carried out at least one rescue in their lifetime.

This difference compared to previous studies can be due to the representative sample included in this investigation, but mainly due to the specific characteristics of Portugal and Spain, namely more dangerous sea conditions and warmer climates in comparison with the northern European countries [7]. In addition, most of the surfers studied performed more than 2 rescues during their lifetime. Although it is not possible to indicate an exact number, the results of this study strongly suggest that the number of rescues conducted by surfers each year in these countries is very relevant. According to the International Surfing Association (ISA), the estimated surfing population in Portugal and Spain is around 500,000. As a conservative hypothetical example and based on the result of our study, if 80% of Portuguese and Spanish surfers made at least one rescue each over a 25-year period, this would amount to 16,000 rescues per year [12].

As a drowning prevention strategy, it is recommended for beaches to be guarded by lifeguards [9,13]. However, not all beaches are supervised and usually, this supervision is only during the summer season. So, bystanders often play a key role in drowning prevention [14]. In this vein, increasing the presence of lifeguards and lifesaving services has been suggested to be an effective intervention to reduce drowning deaths [15]. However, it is not possible to have trained lifeguards everywhere and at all times. On Australian beaches, surfers make as many rescues as professional lifeguards [5]. This study revealed that 49.5% of rescues performed by surfers occurred on unsupervised beaches or outside surveillance hours. Our findings are supported by prior research suggesting that surfers are in a unique position to act as first responders even on guarded beaches as they are closer to the victim and critical to initiating the "call for help" and activating the chain of rescue [5].

The recognition of distress is the second step in the Drowning Chain of Survival [13]. Additionally, a previous study [16] showed that someone who was in danger of drowning could hardly ask for help. In this study, specifically in the most serious rescues, participants reported that only 19.3% of victims asked for help and in most rescues, the surfer saw the person in danger and decided to help without being asked for. Recognition of distress is of utmost importance and apparently, the surfer's position in the water allows an effective reading of the danger signs, even for those without any water safety training [8]. Additionally, surfers have flotation devices (surfboards) and, for the most part, are competent swimmers [5]. Accordingly, surfers in this study have a high self-rated level

Table 3

Differences in knowledge about how to act in a drowning event according to attendance to a CPR course [F (%)].

		<5 Years Ago	>5 Years Ago	Never	χ^2	p-value	V
First thing to do when you see a victim at risk of drowning	Yes	161 (19.1)	62 (13.1)	67 (9.1)	32.834	<0.001	0.127
	No	680 (80.9)	412 (86.9)	666 (90.9)			
First thing to do in case of assistance to a drowning victim	Yes	162 (19.3)	72 (15.2)	61 (8.3)	38.332	<0.001	0.137
	No	679 (80.7)	402 (84.8)	672 (91.7)			
How to start basic life support in a drowning victim	Yes	195 (23.2)	47 (9.9)	25 (3.4)	140.402	<0.001	0.262
	No	646 (76.8)	427 (90.1)	708 (96.6)			

Table 4

Differences in knowledge about how to act in a drowning event according to surfers' working experience as lifeguards [F (%)].

		5 Years or More	Less than 5 Years	None	χ^2	p-value	V
First thing to do when you see a victim at risk of drowning	Yes	45 (21.1)	56 (20.4)	189 (12.1)	22.577	<0.001	0.105
	No	168 (78.9)	219 (79.6)	1371 (87.9)			
First thing to do in case of assistance to a drowning victim	Yes	50 (23.5)	60 (21.8)	185 (11.9)	34.668	<0.001	0.130
	No	163 (76.5)	215 (78.2)	1375 (88.1)			
How to start basic life support in a drowning victim	Yes	93 (43.7)	73 (26.5)	101 (6.5)	279.726	<0.001	0.370
	No	120 (56.3)	202 (73.5)	1459 (93.5)			

of water skills (45.6%), and the use of surfboards can decrease the effort rate and reduce the water rescue time [17,18]. Nevertheless, in the case of unsupervised beaches, the presence of surfers may increase the safety of the water environment, but it could also be a risk for the bystander rescuers since they are not trained in water rescues [14,19–21].

When we analyze the association between the years of surfing experience, the surfing level and the number of rescues carried out, this study demonstrates that the number of rescues performed (individual victim or multiple victims) increased as the surfing level and the years of surfing experience increased. This finding is in line with previous studies which showed that the number of years of surfing experience or higher self-rated surf ability is linked to the ability to perform a rescue, as well as to the number of rescues performed [5, 7].

Our results show that the majority of victims were in danger because they were caught in a rip current. A previous investigation found that 75% of rescues performed by surfers were related to rip currents [5], demonstrating they are one of the main hazards on beaches [22–29]. However, both in Spain and Portugal there is little information about rip currents on beaches. Previous studies carried out on the Spanish Atlantic coast in different populations found that the majority of teenagers and adults did not know what rip currents were and had never heard of them [23,30]. In contrast, surfers have demonstrated adequate knowledge of rip currents [23]. In our study, 93.8% of the surfers studied responded that they know how to identify a rip current, 87.2% could get out of a rip current without help and 38.8% had already been caught by a rip current. While bathers are caught in rip currents, surfers use them to quickly get to the area where waves break [31]. The majority (73%) of coastal bystander rescuer fatality incidents occurred in the presence of rip currents [25].

Our survey results showed that although most participating surfers had already been involved in episodes of water rescue, the vast majority of these surfers did not have the essential knowledge about rescue and resuscitation maneuvers. Surfers seem to be effective in rescuing victims, using all the means at their disposal to transport them to land, including when the victim is unconscious, and it is necessary to start basic life support procedures. However, the lack of knowledge of rescue and resuscitation procedures may result in a negative outcome for the victim. Although surfers are experienced in conditions that pose a great risk to beachgoers, they may not have the knowledge or skills necessary to perform rescues that require immediate medical attention [5]. In this study, 13.1% of the victims of the most serious rescues carried out by surfers were unconscious and 17.4% needed medical assistance. In these situations, if the rescuer does not have the necessary training and knowledge, the impact on the health of the victim could be negative. Specifically, in unconscious victims, the effective implementation of CPR is vital [13]. Rapid resuscitation to restore the lack of oxygen and circulation is essential in the survival of drowning [14]. Regarding cardio-respiratory arrest, the correct execution of the first aid techniques by the first intervener increases the chances of survival of victims at risk of death and favors the victim's recovery [32].

Analyzing the responses to all questions about rescue and resuscitation procedures, the group of surfers who had already taken the CPR course less than 5 years ago, obtained a higher percentage of correct answers than the group that attended the CPR course more than 5 years prior and the group that never attended a CPR course. Results indicate that the surfers who attended the CPR course appeared to have more knowledge to perform resuscitation. Results also show that the groups with experience as lifeguards obtained a much higher percentage of correct answers compared to the group that had no work experience as a lifeguard. Water rescue and first aid training are very important for people involved in water activities and these routine activities should be repeated regularly [8]. For these reasons, surfers should perform regular and updated training. It is also important to invest in strategies which instill and motivate safe behavior and practices around water among coastal users [10].

The main limitation of the present study is that the answers were based on the reports of surfers from a specific geographic location. Surfers from other countries or with other experiences could offer different data. The sample is biased in terms of participation, as there may have been a tendency for surfers who were somehow involved in rescue situations to feel more attracted to participate. Furthermore, this study is subject to the usual limitations of this type of research, such as recall bias or the possibility of overconfidence of the surfers. The research analyzed the rescues performed by surfers, as well as the completion of the CPR course and work experience as a lifeguard. However, it did not consider the temporal relationship between them; therefore, respondents may have taken the course and acquired experience after carrying out a rescue. The results of this study represent the first attempt to analyze the frequency and conditions of occurrence of rescues carried out by surfers exclusively on the beaches of Portugal and Spain. Our findings shed light on a poorly explored subject with a significant socioeconomic impact. This study provides valuable information, highlighting the vital role that surfers can have as part of a drowning prevention strategy.

5. Conclusions

This study has provided evidence of the important role that surfers play in saving lives on Portuguese and Spanish beaches. The

results suggest that the number of rescues conducted by surfers each year in Portugal and Spain is very relevant to reducing the number of fatalities that occur along coasts. The number of rescues performed by individual surfers increased as the surfing level and the years of surfing experience also increased. This study demonstrates that the surfers that attend CPR courses and the surfers who have experience working as a lifeguard believe to have more ability to perform a safe and effective rescue. This study identifies gaps in the surfers' knowledge about rescue and resuscitation maneuvers. In fact, water rescue programs that include CPR training for surfers are viewed as critical to improving the overall effectiveness and outcome of rescues.

Author contribution statement

Joel de Oliveira: Miguel Lorenzo-Martínez: Roberto Barcala-Furelos: Ana Catarina Queiroga: Alejandra Alonso-Calvete: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

Data included in article/supp. material/referenced in article.

Declaration of competing interest

Authors declare there is no conflict of interest regarding this manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e16032>.

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