

Injury prevention, drowning prevention habits and resuscitation knowledge of Portuguese surfing instructors. A cross-sectional study

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Abstract

Surfing instructors can play an important role both in preventing sport related injuries and as first responders in water emergencies events. Even though Portugal is a predominantly oceanic country, with many people enrolling in water sports activities, we still don't have a clear insight of the knowledge and educational practices of surfing instructors concerning both injury prevention and first response actions. This study aimed to analyze the educational practices on prevention of surf-related injuries of Portuguese surfing instructors and their knowledge and experience acting as first responders in the sea. A cross-sectional study was designed, using an online survey distributed by all surfing schools registered at Portuguese Surfing Federation to their instructors. The survey included a brief demographic characterization, questions regarding teaching practices about prevention of surfing-related injuries and knowledge/experience acting as first responders at the sea. Data was collected anonymously using Google Forms. A total of 102 instructors participated in the study. The analysis of the survey responses showed that 93.2% of surfing instructors are aware of the importance of prevention habits for teaching but skip some major preventive measures when teaching novice surfers. Nevertheless, the instructors with more than 15 years of experience provide more feedback on prevention habits during classes than instructors with less experience ($p=0.019$). When looking at self-perceptions of own competence to act in a drowning event, the instructors who have attended a basic life support course asserted to be more competent than those who never attended a course ($p<0.05$). These findings suggest that it would be very positive that all surfing schools followed the same protocol, giving due importance to prevention measures. Moreover, surfing instructors can play an important role in first response to drowning events but might have some training flaws that should be considered as part of a Water Safety National Strategy.

Key Words: Occupational health, Preventive measures, Safe practice, Water emergency, Rescue, Surf

Introduction

In the last decade, the popularity of surfing as a leisure activity in Portugal has increased. According to the Portuguese Surfing Federation (FPS), in 2011 it was estimated that there were 212000 surfers in Portugal. In 2016 there were already about 260000 surfers (FPS, 2017a). Between 2013 and 2016, Portugal increased from 1501 to 2494 federated athletes, representing 90 clubs, with a change in the number of High-Performance Athletes from 6 to 47 (FPS, 2017a). In 2020 a total of 312 surfing schools were registered in the FPS (FPS, 2020). Surfing instructors can play an important role both in preventing sport related injuries and as first responders in water emergencies events. However, there is no information on what type of guidelines are taught to surfing students.

With more than 850 kilometers of coast, Portugal offers a large number of surf spots at very short distance, making it attractive both to domestic and international surfing tourists. With the increase of surfing schools, the extension of the age group of surfers and the positioning of Portugal as the main destination of Surfing in Europe, the practice of surfing is reaching worrying levels of concurrent surfers in water (FPS, 2017b; Porto, 2017). Accordingly, the greater number of surfers in the water, the poor knowledge of the spot and poor technical and physical preparation is increasing the likelihood of accidents, ranging from small bruises to severe injuries or even fatal accidents (FPS, 2017a). Even though Portugal is a predominantly oceanic country, with many people enrolling in water sports activities, we still don't have a clear insight of the knowledge and

educational practices of surfing teachers concerning both injury prevention and first response actions.

Preparation and prevention are the phases where the efforts to reduce the burden of injuries should focus on when implementing effective surf-related injury prevention measures (Szpilman et al., 2016). Considering the increasing number of both recreative and federated surfers in Portugal that attend surfing lessons, the surfing instructors can play an important role both in preventing sport-related injuries and acting as first responders in water emergencies events (Attard et al., 2015; Brander et al., 2019). However, there is still no clear insight of the knowledge and educational practices of surfing instructors concerning both injury prevention and first response actions. Therefore, the aim of this study is to get a glance of what Portuguese instructors lecture their students about prevention of surfing-related injuries and their knowledge and experience acting as first responders in the sea.

Methods

This is a cross-sectional study of the Portuguese surfing instructors – defined as the instructors certified to teach surf, bodyboard, stand up paddle and other wave riding sports.

A survey was prepared as a first draft by the authors. A second round, by a Delphi process in collaboration with eight surfing instructors with more than 10 years of teaching experience, who not only provided their inputs for the questions but also assisted in the survey reliability testing. The survey included a brief demographic characterization and questions regarding teaching practices about prevention of surfing-related injuries and knowledge/experience acting as first responders in the sea (supplementary table 1). The online survey was distributed by all surfing schools registered at Portuguese Surfing Federation (FPS) to the instructors in their mailing list. It should be noted that all surfing schools working legally in Portugal need to be registered with the FPS. Data was collected anonymously using Google Forms between March and July 2018 and all the participants were informed that the survey would be used with research finds and that their completion collected consent to the use of the data. This work respected the ethical principles of the Helsinki declaration.

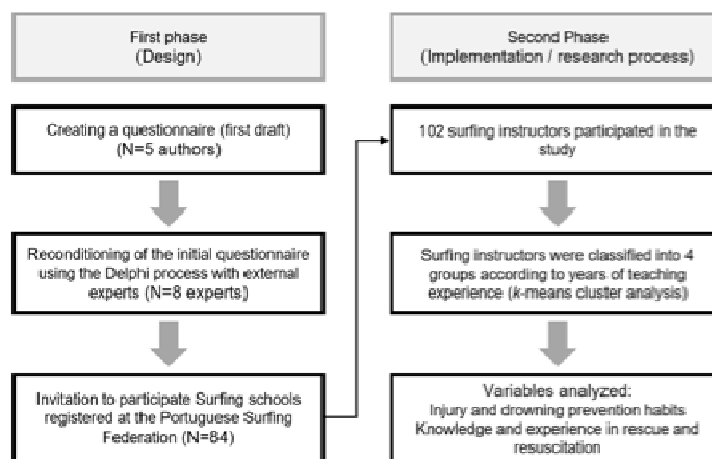


Figure 1. Flow chart design

Collected data was analyzed using the statistical package SPSS® version 25.0 for Windows (IBM Co., New York, NY, USA). The normality of the variables was assessed using the Kolmogorov-Smirnov test, with all variables showing non-normal distributions. Results are presented as absolute frequency (F) and percentage (%) of responses for categoric variables or mean (M) and standard deviation (SD) for continuous variables. Surfing instructors were classified using a k-means cluster analysis into 4 different groups according to years of teaching experience (<5 years; 5-9 years; 10-15 years; >15 years). One-way non-parametric Kruskal-Wallis analysis of variance (ANOVA) with Bonferroni corrected post-hoc analysis was used to analyze the differences in preventive habits according to years of teaching experience, as well as the differences in self-perception about the competence to act in a drowning event according to attendance to a basic life support (BLS) course. The association of knowledge about how to act in a drowning event according to attendance to a BLS course was analyzed using Pearson Chi-square test. For all this analysis, statistical significance was accepted at $p < 0.05$.

Results

A total of 102 instructors participated in the study. Mean age of participants was 35 ± 8 years old (range of 20-52 years). Most participants (94,1%) were male and (70,6%) had higher education. Time of experience as a teacher ranged from 1 to 30 years with a mean of 9,8 years.

Injury and drowning prevention habits

Concerning the frequency with which surfing instructors report talking about prevention habits during an inaugural class: (78,4%) always talk about general activation and mobilization of joints, (60,8%) always remind about head protection during falls, (60,8%) always talk about sun protection, only (19,6%) always talk

about ear protection (Table 1). On the other hand, (47,1%) never talk about eye protection and (68,6%) never talk about softening the fins' edges to prevent cuts to first timers (Table 1).

Table 1. Instructors' frequency in speaking about prevention habits during an inaugural class [F (%)]

	Never	Hardly ever	Sometimes	Almost always	Always
Q12. General activation and mobilization of joints	5 (4.9)	5 (4.9)	8 (7.8)	4 (3.9)	80 (78.4)
Q13. Protection against traumatic head injury during the fall.	9 (8.8)	10 (9.8)	11 (10.8)	10 (9.8)	62 (60.8)
Q14. Softening the fins' edges to prevent cuts	70 (68.6)	16 (15.7)	10 (9.8)	5 (4.9)	1 (1.0)
Q15. Use of sun protection	0 (0.0)	7 (6.9)	14 (13.7)	19 (18.6)	62 (60.8)
Q16. Sunglasses to eye protection	48 (47.1)	15 (14.7)	18 (17.6)	11 (10.8)	10 (9.8)
Q17. Use of earplugs for ear protection	25 (24.5)	20 (19.6)	20 (19.6)	17 (16.7)	20 (19.6)
Q18. How to act if faced with a drowning situation	21 (20.6)	22 (21.6)	17 (16.7)	11 (10.8)	31 (30.4)

Concerning instructors' self-perception on the importance of knowing about surfing injuries and their prevention: 97 (95.1%) considered important or very important for the practice and 94 (93.2 %) considered important or very important for teaching.

When analyzing the drowning prevention habits according to years of teaching experience (Table 2), significant differences were found. During an inaugural class, surfing instructors with less than 5 years of teaching experience report lecturing less frequently about how to act if faced with a drowning situation, compared to the surfing instructors with more than 15 years of teaching experience ($p=0.024$). Additionally, significant differences were also observed in the feedback on prevention habits during classes, according to the years of teaching experience.

Generally, instructors with more than 15 years of experience asserted to provide more feedback during classes than instructors with less than 5 years of experience ($p=0.019$). Those differences observed between the group with 10-15 years of experience and the group with more than 15 years were concerning the "protection against traumatic head injury during a fall" ($p=0.015$). Significant differences were also obtained between the group with less than 5 years of experience and the group with more than 15 years, due to feedback about the "use of sun protection" ($p=0.018$). In relation to the importance of knowing surfing injuries and their prevention for teaching the modality, we also observed significant differences between the group with less than 5 years of teaching experience and the group with 10-15 years of experience ($p=0.026$), with the more experienced instructors attributing less importance to this issue.

Table 2. Differences in preventive habits according to years of teaching experience ($M \pm SD$).

	Years of teaching experience				ANOVA	
	< 5 years (n=26)	5-9 years (n=25)	10-15 years (n=29)	> 15 years (n=22)	χ^2	p-value
Prevention habits during an inaugural class	3.0 \pm 0.8	3.3 \pm 0.6	3.2 \pm 0.7	3.5 \pm 0.7	6.575	0.087
How to act if faced with a drowning situation	2.5 \pm 1.4 [‡]	3.5 \pm 1.4	2.8 \pm 1.6	3.8 \pm 1.4*	11.166	0.011
Feedback on prevention habits during classes	3.1 \pm 0.9 [‡]	3.4 \pm 0.8	3.2 \pm 0.8	3.7 \pm 0.7*	9.680	0.021
Protection against traumatic head injury during a fall	4.1 \pm 1.4	4.2 \pm 1.4	3.8 \pm 1.3 [‡]	4.8 \pm 0.5 [†]	9.365	0.025
Use of sun protection	3.8 \pm 1.4 [‡]	4.4 \pm 1.1	4.1 \pm 1.0	4.6 \pm 0.8*	8.659	0.034
Importance for the teaching of the modality	4.7 \pm 0.7 [†]	4.5 \pm 0.7	4.3 \pm 0.8*	4.4 \pm 1.0	8.127	0.043

*Significant difference ($p<0.05$) with <5 years; # Significant difference ($p<0.05$) with 5-9 years; † Significant difference ($p<0.05$) with 10-15 years; ‡Significant difference ($p<0.05$) with >15 years.

Rescue and resuscitation

Concerning their own experience in drowning events, 74 (72,5%) had to help someone drowning at least once in the last two years, but only 44 (43,1%) had attended a basic life support course in the same period of time. Regarding knowledge about how to act in a water emergency, 86 (84,3%) knew what to do when someone was about to drown, 60 (58,8%) knew that the first thing to do in a drowning event is getting the victim to a safe environment without putting oneself in danger, but only 18 (17,6%) knew that they should start basic life support with 5 airway insufflations (Table 3).

Table 3. Experience of instructors in drowning events and instructors' knowledge.

	Frequency	Percentage (%)
Q27. Number of times that helped someone drowning in the last 2 years		
Never	28	27.5
At least one	74	72.5
Between 1 to 5	62	60.8
Between 6 to 10	10	9.8
More than 10	2	1.9
Q28. Attendance to a basic life support course		
Less than 2 years ago	44	43.1
More than 2 years ago	42	41.2
Never	16	15.7
Q30. What to do when someone was about to drown		
Get into the water only if it is safe	5	4.9
Try not to lose sight of the victim	2	2.0
Always use a float	9	8.8
All sentences are correct	86	84.3
Q31. What should be the first thing to do in a drowning event?		
Call for help	16	15.7
See, hear and feel the breathing movements	20	19.6
Getting the victim to a safe environment if it is safe to do	60	58.8
Check airway permeability	6	5.9
Q32. How to start basic life support		
15 abdominal compressions	1	1.0
15 chest compressions	20	19.6
2 ventilations	24	23.5
30 chest compressions	39	38.2
5 ventilations	18	17.6

When looking at self-perceptions of own competence to act in a drowning event significant differences were found according to attendance to a BLS course ($\chi^2=10.114$; $p=0.006$). The surfing instructors that never attended a BLS course asserted to be less able to help (3.4 ± 0.9) in comparison with those who attended a BLS course more than 2 years ago (4.1 ± 0.8 ; $p=0.026$) or less than 2 years ago (4.3 ± 0.7 ; $p=0.005$).

About the differences in knowledge on how to act in a water emergency between instructors who attended a basic life support (BLS) course less than 2 years ago, more than 2 years ago and never, no significant differences were found (Table 4).

Table 4. Differences in knowledge about how to act in a drowning event according to attendance to a basic life support course [F (%)]

		< 2 years ago	> 2 years ago	Never	χ^2	p-value
What to do when someone was about to drown	Yes	39 (88.6)	34 (81.0)	13 (81.2)	1.094	0.579
	No	5 (11.4)	8 (19.0)	3 (18.8)		
Knowledge of the first thing to do in a drowning event	Yes	10 (22.7)	6 (14.3)	0 (0.0)	4.688	0.096
	No	34 (77.3)	36 (85.7)	16 (100.0)		
How to start basic life support	Yes	7 (15.9)	8 (19.0)	3 (18.8)	0.162	0.922
	No	37 (84.1)	34 (81.0)	13 (81.2)		

Discussion

This study represents a first attempt to describe the knowledge, perceptions and acts of Portuguese surfing instructors concerning injury prevention and first response actions to water emergencies. Although there are some studies about surf injuries and the important role that surfer's play in saving lives (Nathanson et al., 2002; Nathanson et al., 2007; Attard et al., 2015; Jubbal et al., 2017; Mingheli et al., 2018), this research is the first to study these questions specifically in surfing instructors, trying also to understand what sort of information they provide to their students.

The main findings of this study were: (1) surfing instructors skip major injury prevention measures when teaching novice students; (2) the group of instructors with more than 15 years of experience inform their

students more about how to act if faced with a drowning situation, than less experienced ones and (3) instructors who attended a basic life support (BLS) course self-perceived themselves as being more competent to act in a drowning event, when compared to those that never attended a BLS course.

Surfing is a popular recreational sport that carries a substantial risk of injury (Nathanson et al., 2002). There has been an increase in the number of surfing injuries as the popularity of the sport continued to increase (Jubbal et al., 2017). Additionally, each year there are thousands of injuries in children, some fatal, associated with accidents in aquatic adventure sports (Buzzacott & Mease, 2018). According to our study, (77,5%) of the Portuguese surfing instructors surveyed, had at least one injury during the practice of these activities. As the later explores this thoroughly, this matter won't be further developed in the present discussion. The majority of injuries are caused by the impact of the surfer's own board, the ocean floor, or another surfer's board. (Nathanson et al., 2002; Mingheli et al., 2018; Nathanson et al., 2007). One possible approach could be to teach surfers self-protection measures in the event of a fall, such as defensive positions, especially regarding the head (Mingheli et al., 2018). Studies of recreational surfers have consistently found that lacerations, predominantly to the head and lower extremities, are the most common injuries (Nathanson et al., 2002; Nathanson et al., 2007, Woodacre et al. 2015; Swinney, 2015). Significant spinal fractures/injuries are sustained when the surfer (usually their head) strikes the seafloor (Dimmick et al., 2018). Novice surfers should be warned for the neurologic injuries that may occur during their surfing activities (Steinfeld et al., 2018). However, only (60,8%) of the respondents remind their students during the inaugural classes of measures about head protection during falls.

According to Mingheli et al. (2018) and Klick et al. (2016) the most common type of surfing injuries are lacerations. Surfboard design has taken into account the risk to others of sharp fins and points, and beginner boards used on crowded beaches by surf schools often utilize board designs and materials that lack sharp edges and are made of softer foam (Hay et al., 2009). Still, most surfboards have sharp tails, noses and fins (Nathanson et al., 2007) and it has been recommended the use of duller, softer or breakable fins to prevent lacerations (Nathanson et al. 2002). Despite the risk of laceration, (68,6%) of the surfing instructors surveyed never talk to first-timers about softening the fins' edges to prevent cuts.

Exostoses of the external ear canal have long been recognized as an important complication of surfing (Taylor et al., 2004; Hurst et al., 2004). Surfers who surf regularly for a prolonged period whether they are male, or female have a high probability of developing symptomatic exostoses (Hurst et al., 2004). Wong et al. (1999) in a study of Californian surfers reported a (73.5%) and (19.2%) overall prevalence of external auditory canal exostoses and osteomas, respectively. Although previous studies point to a high incidence of exostoses associated with surfing, in our study only (19,6%) of surfing instructors always talk about hearing protection in the inaugural classes.

The results of our study point to a very high level of response regarding the importance given to the knowledge of surfing injuries and diseases and their prevention during the practice (with 95.1% responding important or very important and none responding not important). Likewise, instructors considered very important to know surfing diseases and their prevention for teaching of the sport (with 93.2 % responding important or very important and 1% responding to not important). Despite these results, surfing instructors still skip major preventive measures when teaching novice students.

Survey data in this study indicates that the group of instructors with more than 15 years of experience, inform their students more about "how to act if faced with a drowning situation" during an inaugural class concerning the group of instructors with less than 5 years of experience. These results suggest that as the years of teaching experience increase, lecturing about this topic as a preventive measure when teaching novice students also increases. Because (72,5%) of respondents had to help someone who was drowning at least once in the past two years, it is expected that the most experienced instructors will already been confronted more often with water emergency situations. This study demonstrates that in the habit "protection against traumatic brain injury during the fall", the group of instructors with more than 15 years of experience, give more feedback to their students regarding the group of instructors with 10-15 years of experience. Although there are no studies to support this idea, this change in behavior may suggest that instructors with more years of experience have probably witnessed some serious injuries before (grave falls of fellow surfers), and therefore give more importance to this habit of prevention. However, results also show that the group of instructors with less than 5 years of experience attributed much more importance to surfing injuries knowledge and prevention for teaching the modality, comparing to the group with more than 15 years of experience.

Drowning is a global health problem, which in 2017 caused 295,210 drowning deaths (Franklin RC, Peden AE, Hamilton EB, et al., 2020). Beaches are frequently used by tourists for recreational activities, and people are often unaware of the dangers inherent to the ocean, placing themselves unconsciously at risk (Ballantyne et al., 2005). During the "low season" months, many lifeguarding and lifesaving services are out of service. However, surfing is practiced throughout the year, so surfers can play a significant role as bystander rescuers (Attard et al., 2015). In Australian beaches, surfers make as many rescues as professional lifeguards (Brander et al., 2019). Lifesaving science describes that the use of surfboards decreases the effort rate and reduces the water rescue time, when compared with other rescue methods (Barcala-Furelos et al., 2016; Palacios-Aguilar et al., 2018). After recognizing that a victim is in distress and asking someone to call for help, the next priority is to interrupt the drowning process by providing flotation to the victim. Devices such as body-boards

and surfboards should be used (Szpilman et al., 2014). According to our study, (72,5%) of the instructors studied had to do at least one rescue in the last two years. However, only (43,1%) attended a basic life support course in the last two years. Statistically, surfers who had formal water safety training were more likely to have performed a higher number of rescues compared to those who did not (Attard et al., 2015). We also found in our study that (15,7%) of instructors surveyed never attended a basic life support course.

Although (72.5%) of the surfing instructors studied had to help someone who was drowning at least once in the past two years, this study clearly demonstrates that they have gaps in their knowledge of how to act in the event of a water emergency. In their study, Attard et al., (2015), show that the surfer's ability to perform a rescue successfully is intrinsically linked to the number of years of surfing experience. In our study, the time of experience as a teacher ranged from 1 to 30 years with a median of 9,5 years. The advantage of surfers as bystander rescuers is that they have flotation devices (surfboards) and for the most part are competent swimmers (Attard et al., 2015).

About the differences in self-perception about the competence to act in a drowning event, instructors who attended a basic life support (BLS) course, responded that they were more competent to act in a drowning event, when compared to those that never attended a BLS course. These results suggest that those who have already taken the course, feel better prepared to face a water emergency situation. Previous water training can influence the confidence and initiative to face a rescue (Brander et al., 2019).

The main limitation of the study is that the answers were based on the opinion of surfing instructors with a specific geographic location. Surfing instructors from other countries or with other experience could offer different data. This study cannot assess whether the situation exactly matches the reported response.

Conclusions

This study has provided quantitative and qualitative evidence of the knowledge and educational practices of surfing instructors concerning both injury prevention and first response actions to water emergencies.

Being a sport with a substantial risk of injury, it would be very positive that all surfing schools would follow the same protocol, giving due importance to injury prevention measures. We believe that this way, safety in water would increase significantly, because often, failure to comply with safety rules, puts at risk not only the surfer himself, but also everyone around him. Additionally, we think that it would be convenient for all new students who are involved in the practice of these sports to have knowledge about the most frequent injuries and also about the behavior to follow in order to avoid them.

Moreover, surfers use the beaches throughout the year, so they are responsible for many of the water rescues that have occurred. Surfing schools are active during the whole year and are spread all over the Portuguese coast. Many of the aquatic accidents happen during surfing lessons, whether it's involving students who are mostly beginners or involving other surfers, swimmers and tourists. Moreover, surfing instructors can play an important role in the first response to drowning events, however they have some flaws that should be considered as part of a Water Safety National Strategy.

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Supplementary Table 1. Survey

Q1. Current age?					
Q2. Gender?					
Q3. Academic qualifications?					
Q4. How many years have you been a surfing instructor?					
Q5. How many hours do you teach per week, on average?					
Q6. Modalities you teach (one or more)?					
Surf					
Bodyboard					
Stand-up paddle					
Skimboard					
Adapted surf					
Bodysurf					
Q7. Main modality you teach (only one)?					
Surf					
Bodyboard					
Stand-up paddle					
Skimboard					
Adapted surf					
Bodysurf					
Q8. Geographic area where you perform most of your role of instructor?					
North					
Center					
Lisbon					
Alentejo					
Algarve					
Azores					
Madeira					
Q9. How many years have you been surfing or practicing other related modalities (years)?					
Q10. Diseases or accidents already suffered (by the instructor) while surfing or practicing related modality?					
Cranioencephalic trauma					
Joint luxation					
Ligament rupture					
Bone fracture					
Wounds requiring suturing					
Malignant skin lesions					
Pterygium					
Exostosis					
Drowning					
Never had any surfing related injury or illness					
Other					
Q11. If joint luxation, ligament rupture or bone fracture was selected in the previous answer, please describe the affected bone (s) or ligament (s)?					
Frequency with which the instructor speaks about prevention habits during an inaugural class					
	Never	Hardly ever	Sometimes	Almost always	Always
Q12. General activation and mobilization of joints					
Q13. Protection against traumatic head injury during the fall					
Q14. Softening the fins' edges to prevent cuts					
Q15. Use of sun protection					
Q16. Sunglasses for eye protection					
Q17. Use of earplugs for ear protection					
Q18. How to act if faced with a drowning situation					
Frequency with which the instructor gives feedback when seeing a deficit in prevention habits during classes					
	Never	Hardly ever	Sometimes	Almost always	Always

Q19. General activation and mobilization of joints
 Q20. Protection against traumatic head injury during the fall.
 Q21. Softening the fins' edges to prevent cuts
 Q22. Use of sun protection
 Q23. Sunglasses for eye protection
 Q24. Use of earplugs for ear protection
 Q25. How to act if faced with a drowning situation
 Q26. How many times have you watched situations of drowning in the past 2 years?
 Q27. Number of times have you helped someone drowning in the last 2 years?
 Never
 At least one
 Between 1 to 5
 Between 6 to 10
 More than 10
 Q28. When was your last attendance to a basic life support course?
 Less than 2 years ago
 More than 2 years ago
 Never
 Q29. Would you feel able to help in a drowning event?
 Not able
 Slightly able
 Moderately able
 Quite able
 Very able
 Q30. What to do when someone was about to drown?
 Call the emergency line or ask someone to do it
 Get into the water only if it is safe
 Try not to lose sight of the victim
 Always use a float
 All sentences are correct
 Q31. What should be the first thing to do in a drowning event?
 Call for help
 Observe, hear, and feel the breathing movements
 Getting the victim to an environment that is safe for both the victim and the rescuer
 Check airway permeability
 Initiate forced ventilations
 Q32. How to start basic life support?
 15 abdominal compressions
 15 chest compressions
 2 ventilations
 30 chest compressions
 5 ventilations

Instructors' self-perception about the importance of the knowledge of surf injuries and their prevention

	Not important	Slightly important	Moderately important	Important	Very important
Q33. Importance for the practice of the modality					
Q34. Importance for the teaching of the modality					