

1 **KIDS SAVE LIVES in schools: Cross-sectional survey of schoolteachers**

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21

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27

28 **Abstract**

29 Training schoolchildren in basic life support (BLS) is strongly recommended to effectively increase  
30 bystander cardiopulmonary resuscitation (CPR) rates. Paediatricians and other health staff members used  
31 to be involved in BLS training, but the wide dissemination of BLS skills would need additional support; as  
32 a solution, schoolteachers might have enough knowledge necessary to help to achieve this goal. The aim of  
33 this cross-sectional survey study, which involved 3423 schoolteachers, was to evaluate the knowledge  
34 related to first aid (FA) and BLS of schoolteachers in Spain. In addition, the study aimed to evaluate the  
35 content taught to the schoolchildren regarding FA and teachers' attitudes towards teaching FA. Three-  
36 quarters of the surveyed schoolteachers reported knowing FA, and 17% reported teaching it. The emergency  
37 medical telephone number and CPR were the subjects taught most often by schoolteachers. However, the  
38 schoolteachers demonstrated a lack of knowledge in the identification of cardiac arrest and in CPR. Ninety-  
39 eight percent of the respondents agreed with including FA training in schools and as part of university  
40 degree programmes and supported the KIDS SAVE LIVES-statement. Teaching FA was a positive  
41 predictor to be willing to perform CPR (OR: 1.7; 95% CI 1.32-2.31) and to use a defibrillator (OR: 1.4;  
42 95% CI 1.10-1.67).

43 *Conclusions:* Schoolteachers are willing to teach FA in schools. However, more training and specific  
44 curricula are needed to increase the quality of schoolchildren's CPR training. The training of schoolteachers  
45 in CPR might be the foundation for the sustainable transfer of CPR-related knowledge to schoolchildren.  
46 Therefore, the inclusion of FA and BLS in university degree programmes seems to be essential.

47 **Keywords:** Schools; schoolchildren; education; training; surveys and questionnaires

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## 51 **KIDS SAVE LIVES in schools: Cross-sectional survey of schoolteachers**

### 52 **Introduction**

53 *KIDS SAVE LIVES (KSL)* is an international joint initiative that recommends including cardiopulmonary  
54 resuscitation (CPR) training in school curricula to increase bystander CPR rates in cases of out-of-hospital  
55 cardiac arrest (OHCA). To date, KSL has been endorsed by the World Health Organization [1], the  
56 European Resuscitation Council, the European Patient Safety Foundation, the International Liaison  
57 Committee on Resuscitation and the World Federation of Societies of Anesthesiologists [2,3].

58 Teaching basic life support (BLS) and/or first aid (FA) in schools has been recommended since the 1990s  
59 [4]. The International Liaison Committee on Resuscitation published a consensus recommending  
60 incorporating CPR into school curricula in 2003 [5], and the American Heart Association encouraged  
61 schools to train both schoolteachers and schoolchildren starting in 2004 [6]. Since then, the awareness of  
62 the need to incorporate BLS and FA in school curricula has increased exponentially [7], and several  
63 initiatives including single projects [8-10] and long-term programmes [11], have been initiated. However,  
64 inconsistent curricula and the limited education of personnel have previously affected the level of training  
65 [4]. Accordingly, the *KSL* initiative was elaborated to develop uniform guidelines and sensitize healthcare  
66 professionals, schoolteachers and the general population for training schoolchildren in CPR. To date,  
67 several *KSL* campaigns have been conducted in different countries [12-14]. Moreover, CPR education is  
68 legislated in 6 European countries and is suggested for legislation in 23 additional European countries [15-  
69 17].

70 Over the years, KSL has become a key measure to sustainably increase lay resuscitation rates. Various KSL  
71 strategies have been scientifically indicated: 1) studies have already shown that the concatenation of  
72 different community initiatives increases bystander CPR rates; one such initiative is to include CPR in  
73 school curricula [18,19]; 2) the number of CPR-trained individuals in the population gradually increases  
74 over time [19]; 3) the BLS training of the majority of the population cannot be achieved through voluntary  
75 courses [1,4]; 4) children from 5 to 18 years old are able to learn certain aspects of FA [20]; and 5) knowing  
76 how to provide BLS would be similar to riding a bike (in the sense you would never forget it) [2,3].

77 To implement KSL in school curricula, several teaching strategies are currently debated. Current evidence  
78 has shown that the results of BLS taught by teaching staff with previously trained are promising [11,21].  
79 However, data about the personal attitudes of teachers towards KSL are scarce. Furthermore, the levels of  
80 BLS and/or FA among teachers may vary.

81 Studies carried out in Galicia (one of the 17 autonomous communities in Spain) have shown that future  
82 schoolteachers, schoolteachers and parents of primary schoolchildren would support the inclusion of BLS  
83 in school curricula. However, restricted knowledge related to BLS was described in these individuals [22-  
84 24]. In Spain, although education laws are promulgated by the Spanish government, the different  
85 autonomous communities have specific competencies regarding education plans, including the capacity to  
86 design and implement part of the school curricula. To scientifically evaluate the different levels of KSL  
87 implementation in Spain, we collected data from a large number of teachers with the following four  
88 objectives: 1) to evaluate the BLS knowledge of schoolteachers, 2) to determine the attitudes of  
89 schoolteachers towards teaching BLS and its inclusion in school curricula (in both schools and universities),  
90 3) to know if the *KSL* initiative is known to schoolteachers in Spain, and 4) to assess whether BLS is taught  
91 in Spanish provinces where providing FA is mandatory by law.

92

## 93 **Methods**

### 94 *Ethics*

95 Ethical approval was not required because this study did not consist of a human intervention and it did not  
96 use personal/patient data or biological human samples.

97

### 98 *Study design*

99 In this cross-sectional survey study, an anonymous online structured questionnaire was sent to schools  
100 located in all autonomous communities of Spain. The survey was sent by e-mail to 14056 schools in which  
101 pre-school (students 3-6 years old) and primary education (students 6-12 years old) were taught. E-mail  
102 contacts were retrieved from a dataset of the autonomic governments that contains data from each school.

103 Information from the web page of the Spanish Education Ministry was also used. The heads of the schools  
104 were asked to distribute the questionnaire to all the teachers at their schools. Since one of the aims of the  
105 study was to determine the attitudes of schoolteachers towards the inclusion of BLS/FA training in  
106 undergraduate teaching degrees, we considered it necessary to survey all teachers, not only those who were  
107 more likely to teach BLS/FA in schools. One month after contact was made by e-mail, a reminder e-mail  
108 was sent to each school.

109

### 110 *Questionnaire*

111 The main core of the questionnaire was extracted from previous publications [22,23]; additional questions  
112 were included from similar investigations regarding the decrease in the chances of survival during OHCA  
113 without CPR, the signs to identify a person in cardiac arrest, when to use an automated external defibrillator  
114 (AED) after confirming that somebody is in cardiac arrest, how recently BLS training had been undertaken  
115 and the respondents' willingness to call EMS, perform CPR and go and/or use an AED [25,26]. The  
116 questionnaire was divided into four parts (Online Resource 1): 1) general information about the respondent;  
117 2) the respondent's previous training in BLS; 3) questions about cardiac arrest, CPR, AED and foreign  
118 body airway obstruction (FBAO) management; and 4) attitudes towards FA and its potential inclusion in  
119 school and university curricula. It was estimated that a time of 10 min was necessary to complete the survey.

120

### 121 *Statistical analysis*

122 The data from questionnaires were imported into a database (Microsoft Excel for Mac, v 16.32) and then  
123 transferred to SPSS software (IBM corp., v. 23.0.0.0) for analysis. The data are expressed as the median  
124 (interquartile range) and the absolute frequencies (relative frequencies) as appropriate. Correlation between  
125 the number of contact e-mails sent per autonomous community and the number of responses received was  
126 analysed with Pearson correlation coefficient. Chi-square was used to compare independent samples with  
127 a significance level of  $p < 0.05$ . Logistic regression was undertaken to study the impact of the participants'  
128 characteristics on willingness to call EMS, perform CPR, and obtain and/or use an AED. Single-variable  
129 regression models were performed. Then, a backward stepwise regression model was undertaken that

130 integrated those variables with  $p < 0.02$  in the single-variable regression models. A significance level of  
131  $p > 0.05$  was used to remove variables from the final model.

132

### 133 **Results**

134 After sending the contact e-mails, 844 e-mails were automatically returned due to incorrect addresses or  
135 full mailboxes. In addition, 18 schools replied that they were not interested in participating. Altogether,  
136 3516 teachers completed the survey and 3423 were ultimately included in the study after removing (i)  
137 duplicates ( $n = 44$ ), (ii) questionnaires that were not correctly filled out ( $n = 9$ ), and (iii) surveys that were  
138 filled out by employees of the school who were not teachers ( $n = 40$ ). The first author placed into order and  
139 checked all the surveys received. When duplicates were found,  $n-1$  equal responses were removed.

140 Online resource 2 (A) shows the proportion of questionnaires of each region of Spain, illustrating the  
141 Spanish decentralization in some services such as Education. Significant correlation was found between  
142 the number of contact e-mails sent per autonomous community and the number of responses received ( $r =$   
143  $0.669$ ;  $p = 0.003$ ). Online resource 2 also shows the number of e-mails sent in each autonomous community  
144 (B) and the incidence of responses (C): number of responses received in each autonomous community per  
145 100 contact e-mails sent. Most of the responses were submitted by female schoolteachers [2762 (81%)],  
146 and the median age was 42 years old (IQR; 35-51). A larger percentage of primary schoolteachers  
147 responded [2294 (67%)] compared to pre-school teachers [782 (23%)]. Seventy-five percent of the  
148 respondents reported knowing FA [2573 (75%)] (Online Resource 3: supplementary table 1), and 592  
149 (17%) teachers reported teaching FA.

150 FA-teachers were defined as schoolteachers with FA training who taught FA to schoolchildren (FA-  
151 teachers:  $n = 592$ ). FA-teachers more often evaluated their knowledge as either excellent or good compared  
152 to those who, despite having FA training, did not teach FA (not-FA-teachers:  $n = 1981$ ) ( $p < 0.001$ ). In  
153 addition, the latest training of FA-teachers was more recent ( $p < 0.001$ ) and practical ( $p < 0.001$ ) than that of  
154 non-FA-teachers (Fig. 1). Descriptive statistics of these variables are provided in online resource 3:  
155 supplementary table 2.

156

157

<< Insert Figure 1 near here >>

158 The schoolteachers were asked to report their reasons for participating in FA training (or not) (Online  
159 Resource 3: supplementary table 3). One-thousand, nine hundred eighty-one teachers (77%) considered FA  
160 to be fundamental knowledge. The second leading cause for participation in CPR training was an obligation  
161 in school, high school or university [454 (18%)]. To have not ever thought about FA training was the reason  
162 most often reported by teachers with no training [356 (42%)], followed by not knowing where to attend to  
163 a course [303 (36%)] or experiencing a shortness of time [236 (28%)]. Direct association was found  
164 between have FA knowledge and correct responses (Online Resource 3: supplementary table 4)

165 The content primarily taught by FA-teachers was the emergency medical services (EMS) telephone number  
166 [512 (87%)], followed by practical CPR [296 (50%)], FBAO management [266 (45%)] and the  
167 identification of OHCA [203 (34.3%)] (Online Resource 3: supplementary table 5).

168 An association between teaching FA and correct responses was found for all the questions about BLS except  
169 those related to identifying OHCA and those about the compression:ventilation ratio, and the compression  
170 depth and rate (Table 1). Comparing FA-teachers with schoolteachers without FA knowledge, positive  
171 associations were also found in two more questions: identifying OHCA and correct compression depth &  
172 rate of CPR in children (Online Resource 3: supplementary table 6).

173

<< Insert Table 1 near here >>

174 A total of 36 education laws from the Spanish autonomous communities reviewed (18 primary education  
175 and 18 pre-school education). The expression “*first aid*” was mentioned in primary education curricula in  
176 the “*nature sciences*”, “*physical education*” and “*social and civic values*” sections. In preschool curricula,  
177 the term “*first aid*” does not appear, but terms such as “*health*”, “*healthy lifestyle*”, “*safety*” or “*calling for*  
178 *help if needed*” are mentioned. The correct answers to the questions about the BLS knowledge of the pre-  
179 school teachers and primary school teachers who reported teaching the sections of the curricula mentioned  
180 above were also analysed (*sciences, physical education and social and civic values*). No differences were  
181 found in terms of the correct answers between the groups of teachers except for the question in which they  
182 had to order the BLS sequence and the question about when to use an AED (Online Resource 3:  
183 supplementary table 7).

184 Ninety-eight percent of the schoolteachers would agree to teach FA in schools and agree with making FA  
185 a part of university degree programmes aiming to train future schoolteachers (Fig. 2). While the KSL  
186 initiative was largely unknown (80%), 98% supported it after they were introduced to it. Descriptive  
187 statistics are shown in online resource 3: supplementary table 8.

188 << Insert Figure 2 near here >>

189 The results of a bivariate logistic regression analysis of willingness to act in case of OHCA are shown in  
190 table 2. Most schoolteachers [3394 (99%)] reported being willing to call EMS (Online Resource 3:  
191 supplementary table 9), but no positive factors were found in the regression model. In sum, 2212 (65%)  
192 schoolteachers reported being willing to conduct CPR; the most positive factors in the model were having  
193 ever participated in CPR training [odds ratio (OR): 2.3 (1.72-3.01)], especially within the last year [OR:  
194 2.0 (1.45-2.68)], having assisted a cardiac arrest in the past [OR: 2.2 (1.33-3.55)], and having ever  
195 participated in FA training [OR: 1.9 (1.47-2.47)]. Teaching FA was also a positive predictor [OR: 1.7 (1.32-  
196 2.31)]. Having undergone AED training in the past 10 years was the most significant predictor of  
197 willingness to go for an AED [OR: 4.4 (3.68-5.21)]. Having undergone AED training in the past 2 years  
198 was the most predictive factor for the use of an AED [OR: 6.9 (5.35-8.93)], and schoolteachers with  
199 practical training were 2 times more willing to use an AED than were other teachers (CI: 1.72-2.42).  
200 Teaching FA increased the respondents' willingness to use an AED by 1.4 times (CI: 1.10-1.67). Finally,  
201 men were more willing [OR: 1.5 (1.20-1.77)] than women to use an AED.

202 << Insert Table 2 near here >>

203

## 204 Discussion

205 The current study about schoolteachers reveals several findings as follows: (i) The majority of the  
206 respondents reported having previously taken some type of FA training, with a minority doing so within  
207 the past 2 years; (ii) a lack of knowledge is predominant in terms of CPR, AED and FBAO; (iii)  
208 schoolteachers support the KSL initiative; (iv) the education of schoolteachers as disseminators of FA  
209 knowledge is currently a great obstacle; (v) and voluntary FA training and teaching FA seem to be  
210 predictors of the willingness to act if OHCA is witnessed.



211 Regular repetition is crucial to maintaining theoretical and practical BLS skills [11,27]. There is a scientific  
212 body of evidence demonstrating a successful compression rate and depth after conducting at least one CPR  
213 training session per year [11,27]. Although the majority of schoolteachers in the current study reported  
214 having participated in FA training in the past, the current standard of BLS knowledge is at least  
215 questionable, perhaps due to a lack of annual repetition. With schoolteachers being important personnel in  
216 regard to the effective dissemination of BLS skills, the need for annual BLS training is high. However, it  
217 must be mentioned that scientific knowledge about the intensity of BLS training for teaching personnel  
218 remains scarce.

219 This is the first study in which the FA and BLS knowledge of schoolteachers from all autonomous  
220 communities in Spain is evaluated. According to the data provided by the Spanish Ministry of Education  
221 that reported  $\approx 80\%$  of women schoolteachers in the 2017-2018 academic year [28], our sample had an  
222 overrepresentation of females. The percentage of the schoolteachers who had previously undertaken FA  
223 training was similar to the percentage from another study that was carried out in one of the 17 autonomous  
224 communities of Spain (Galicia) [22]. However, the schoolteachers failed to adequately address most of the  
225 questions about BLS. Considering that pedagogical personnel as disseminators, they should be a key  
226 element in the sustainable education of schoolchildren in BLS. Accordingly, increasing bystander CPR  
227 rates would require the high-quality BLS training of schoolteachers. Presumably, the integration of BLS  
228 training into undergraduate teaching degrees would be a promising approach.

229 In our study, only 17% of the schoolteachers reported teaching FA. Interestingly, few differences were  
230 found in the number of correct answers between those teachers who were teaching FA and those who were  
231 not teaching FA. The fact that the law does not exclusively specify teaching BLS might be one of the  
232 reasons for this results. Most of the references to teaching FA in the laws are related “*to knowing and using*  
233 *FA techniques in simulated and real conditions*”. Therefore, FA is mandatory, but BLS is not. However,  
234 the schoolteachers in our study reported having undertaken BLS training, and according to their responses,  
235 the EMS telephone number, CPR and FBAO were taught by 87%, 50% and 45% of the schoolteachers,  
236 respectively. A study performed in Belgium reported that some of the teachers were not aware of the  
237 curriculum’s content [29], which might be another reason for the low rate of teachers who reported teaching  
238 FA in our study. Feeling not competent enough was also reported as a cause of not teaching FA [29]. In the

239 present study, only 25% of the schoolteachers reported having a good-to-excellent subjective perception of  
240 their competence.

241 One of the reasons to include BLS training in schools is because the goal of increasing OHCA assisted by  
242 bystanders cannot be reached only by offering voluntary courses to the population [1]. A recent publication  
243 reviewed the process of implementing CPR training in schools [30], in which integrating BLS knowledge  
244 and competencies in university programmes might be a step in achieving the aforementioned goal. This  
245 approach was already been recommended in several studies carried out in Spain, in which future and active  
246 schoolteachers agreed with including FA training in university degree programmes aimed at training  
247 teachers [22,23]. This recommendation is also supported by the schoolteachers surveyed in the present  
248 study. If FA should be included in schools curricula to train the majority of the population, then FA must  
249 also be included in the education of future teachers in universities for three reasons. First, this way  
250 schoolteachers' intrinsic motivation could be increased, thereby leading to a higher willingness to teach  
251 BLS. Second, this measure would contribute to facing another challenge related to the inclusion of FA in  
252 school, i.e., funding [20,30]. The FA training of schoolteachers would be more expensive if their training  
253 depended on specific courses, and the FA training of schoolchildren would be more expensive if health  
254 staff had to go to schools to teach. Third, such an inclusion would suggest the presence of at least one first  
255 responder in each classroom, which would complement another initiative that has become more common  
256 in schools in recent years: placement of AEDs in schools [31].

257 Finally, it would be necessary to ensure the retraining of the schoolteachers. It is well known that FA skills  
258 deteriorate over time [32-35]. However, if FA training was mandatory and well implemented in both  
259 schools and universities, the fact that teachers have to teach FA would be, in itself, a form of retraining. In  
260 addition, the inclusion of FA in university degree programmes for future schoolteachers would mean the  
261 requirement of at least a subject during a semester as opposed to training only a few hours, as is the case  
262 with many FA courses. In any case, education administrations should include FA in their portfolios of  
263 retraining courses.

264

265 *Limitations*

266 This study has several limitations. First, our results are based on an online survey. Thus, the participants'  
267 use outside resources (books, webpages, etc.) to help respond to the questionnaire was not controlled.  
268 However, the results obtained for the BLS questions suggest that the schoolteachers did not consult any  
269 such sources. With respect to the BLS content, schoolteachers were asked if they knew how to perform  
270 CPR with no specification (paediatric/adult); in next questions they were asked about paediatric CPR in  
271 terms of compression:ventilation ratio and compression depth and rate; this might be the cause of some  
272 kind of bias as paediatric CPR requires specific training. Adult CPR was not evaluated so as to not enlarge  
273 the questionnaire. In addition, to manage an emergency in the classroom, teachers should know paediatric  
274 protocols. Second, we have no specific data about the response rate of schools and schoolteachers, as a  
275 confirmation response to the contact email asking the schoolteachers to collaborate in the study was no  
276 required. Moreover, the accuracy of the information from the national and autonomous datasets is also  
277 unknown. Finally, the survey was designed for only the theoretical knowledge of the participants.

278

## 279 **Conclusions**

280 The schoolteachers in Spain who were involved in this study showed a worrying lack of BLS and FA  
281 knowledge. However, they would consider as necessary the inclusion of BLS and FA training in school  
282 curricula and undergraduate teaching degree programmes. Having undergone BLS and FA training, as well  
283 as teaching these topics, were positive predictors to act in case of OHCA. If the BLS education of  
284 schoolteachers is a key measure to sustainably increasing bystander CPR rates, then the integration of high-  
285 quality BLS training in university curricula may increase the theoretical and practical knowledge of the  
286 next generation of schoolteachers and children.

287

## 288 **Author Declarations**

289 Funding: N/A

290 Conflicts of interest/Competing interests: N/A

291 Ethics approval: N/A

292 Consent to participate: N/A

293 Consent for publication: N/A

294 Availability of data and material: The authors confirm that the main data supporting the findings of this  
295 study are available within the article and its supplementary materials. Additional data of this study are  
296 available from the corresponding author [CA-G] on request.

297 Code availability: N/A

298 Authors' contributions: CA-G and AR-N conceived the idea and designed the methodology. CA-G, AC-F,  
299 SL-G and SM-I collected the schools' e-mail addresses. CA-G corresponded with the schools. CA-G, DCS  
300 and AC-F performed the statistical analysis. CA-G wrote the first draft. DCS, AC-F and BWB carried out  
301 the first revision of the manuscript. All the authors reviewed the subsequent versions of the manuscript and  
302 approved the final manuscript.

303

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404 **Figure Legends:**

405 **Fig. 1** Self-evaluation of knowledge, location of training, date of latest training and kind of training of  
406 schoolteachers with first aid knowledge. Bars shows the participant percentage. Black represents the  
407 schoolteachers who do not teach first aid, while white represents the schoolteachers who do teach first aid.

408 **Fig. 2** Teachers' attitudes towards the inclusion of first aid training in school curricula. Bars represents  
409 percentage of schoolteachers who knew KSL initiative; the line represents percentage of schoolteachers  
410 who supported KSL initiative after they were introduced to it. *KSL*: KIDS SAVE LIVES.