Factors Associated with Helping Behavior When Witnessing an Accident: A Cross-sectional Survey

Dorien O[1], Bert Avau[1], Emmy De Buck[1,2,3], Diane Issard[4,5], Philippe Vandekerckhove[3,6], Pascal Cassan[4,5]

[1] Centre for Evidence-Based Practice (CEBaP), Belgian Red Cross, Mechelen, Belgium
[2] Cochrane First Aid, Belgian Red Cross, Mechelen, Belgium
[3] Department of Public Health and Primary Care, KU Leuven, Leuven, Belgium
[4] Global First Aid Reference Centre (GFARC), International Federation of Red Cross and Red Crescent Societies (IFRC), Paris, France
[5] French Red Cross, Paris, France
[6] Belgian Red Cross, Mechelen, Belgium

Background: First aid is the immediate help provided to the ill or injured. Although it can be lifesaving, many people refrain from helping when encountering a person in need. This study aimed to describe the types of accidents people are most likely to encounter in daily life and to assess the association between several variables, including having received first aid training and helping behavior.

Methods: An online survey was distributed from December 2016 to February 2017. The factors affecting provision of first aid and calling of emergency services were analyzed using multivariable logistic regression.

Results: More than half of the 59,477 respondents (51.9%) stated that they had encountered an accident in the past five years. A total of 59,110 accidents were reported. First aid was provided in 70.2% of accidents and emergency services were called in 72.0% of accidents. Age, gender, WHO region, type of accident and environment of the accident were all significantly associated with providing first aid and calling emergency services. People who were trained in first aid were more likely to provide first aid or to call for emergency services than untrained people ($p<0.0001$).

Conclusion: Several factors were associated with helping behavior, including but not limited to having received first aid training. There is a need for lifelong training, with special attention to those subgroups that are less likely to report helping behavior.

Keywords: prehospital care, accidents, survey, first aid training

Injuries place a large burden on global health, with a global annual estimate of 195,231,100 life years lost (GBD Causes of Death Collaborators, 2018). This burden may in part be attenuated by adequate first aid (FA) actions. According to the International Federation of Red Cross and Red Crescent Societies (IFRC), FA is defined as "immediate assistance provided to a sick or injured person until professional help arrives. It is concerned not only with physical injury or illness but also with other initial care, including psychosocial support for people suffering from emotional distress caused by experiencing or witnessing a traumatic event. FA interventions seek to preserve life, alleviate suffering, prevent further illness or injury and promote recovery" (International Federation of Red Cross and Red Crescent Societies, 2016, p. 15). In cases where the potential actions of a layperson are limited, quickly alerting emergency services (ES) is equally important. In the event of a cardiac arrest, calling emergency services is the first link in the chain of survival, followed by early bystander cardiopulmonary resuscitation (CPR), early defibrillation, and early advanced cardiovascular life support by paramedics (ERC, 2000). Other time-critical conditions which benefit from early mobilisation of emergency services are acute ischemic stroke and trauma (Harmsen et al., 2015; Moller et al., 2015). Although providing help can be lifesaving, people may refrain from it when encountering an emergency, because of fear of doing something wrong or lack of competence and confidence in FA skills (Heard et al., 2020).

Every year, more than 15 million people worldwide are trained in FA by Red Cross and Red Crescent National Societies (International Federation of Red Cross and Red Crescent Societies, 2016), historically pioneers in FA education. The Red Cross/Red Crescent (RC) Movement strives to offer quality training for better care of victims, based on evidence and scientific studies on various subjects such as depth of cardiac massage, rehydration methods, and compression for haemorrhages (International Federation of Red Cross and Red Crescent Societies, 2016). However, little research (He et al., 2014; Van de Velde et al., 2009) exists on the impact of FA training on the ability and confidence to act in the event of an accident. Furthermore, it is currently unclear which accidents or health emergencies citizens are most commonly facing and how they react to those incidents.

The aim of this study conducted by the IFRC Global First Aid Reference Centre was twofold: first, to gather empirical information on the accidents and health emergencies faced by people with or without FA skills, and second, to investigate whether FA training and other factors are associated with helping behavior (provision of FA and calling ES). Thus, this survey collected data on actual helping behavior, rather than willingness to help.

Materials and Methods

Survey

An anonymous, self-administered, cross-sectional survey using a web-based questionnaire (SurveyMonkey software) was distributed from December 2016 to February 2017. The survey was developed by the IFRC Global First Aid Reference Centre (GFARC) and the Global Disaster Preparedness Center (GDPC) and was advertised via a press release, social media, and through various communication channels of the RC national societies worldwide. The survey was open to anyone across the world, *i.e.* there was no preselected sample of respondents. The survey was hosted on the server of the GDPC and launched online at http://preparecenter.org/FAsurvey. It was aimed at the general public: men and women of different ages, with and without FA training. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional studies.

The full questionnaire in English, consisting of 11 questions, is presented in Appendix 1. The

participants were asked questions about their demographics (age, gender, and country of residence), level of FA training, and whether they had encountered any accidents or health emergencies during the past five years. If the answer to question 4 ("During the last 5 years, did you have or witness another person having an accident or health emergency") was 'Yes', then questions followed about the details of the accident, including type and the location of the accident and whether they had provided FA and/or called the ES. If they answered 'No' to question 4, then they were directly diverted to question 10. Question 9 ("In addition to your previous response, did you have or witness someone else having an accident or health emergency during the last five years?") was repeated until the answer was 'No'. The questionnaire was available in 18 languages.

Ethics

Due to the study design (cross-sectional, anonymous survey), the study was not reviewed by a Medical Ethics Committee. Our study follows the principles of the Declaration of Helsinki. Data were handled in full confidentiality.

Statistical analysis

Questionnaire data were compiled in MS Excel and answers were translated to English before final analysis. Each country of residence was assigned to their respective WHO region (https://www.who.int/gho/publications/world_health_statistics/2017/EN_WHS2017_AnnexC.pdf?ua=1). Analyses were done using the R software version 3.6.0 (R Core Team, 2019). Univariate analysis was performed using the Chi square test to compare groups and logistic regression (glm function) to calculate crude odds ratios (OR). All dependent variables that were significant in the univariate analysis were included in multivariate logistic regression models in which adjusted ORs of the main effects were generated. For each of the two outcomes (FA provided and ES called per encountered accident) a model was built including the variables age, gender, WHO region, type of accident, environment, and FA training. A subgroup analysis was done on people who were trained in FA, which included the variable specifying type of FA (RC or other) instead of FA training. Exploratory analyses of interaction factors among variables were done by multivariate logistic regression in which the main effects and interaction terms between *a priori* determined potential interactors (age, gender, and FA training) were modelled. Unknown and not-encountered values were omitted from univariate and multivariate analyses. P values lower than 0.05 were considered statistically significant.

Results

Demographics

The demographic characteristics of the survey respondents can be found in Table 1. Among the 59,477 unique respondents, 39 226 were female (66%) and 20 221 were male (34%). The most common age group was 25-44 years (37.6%). The majority of respondents (91.1%) were from Europe. 53.8% of the participants were trained in FA, and half of those were trained by RC societies.

In our sample, young people (aged 13-18 years or 19-24 years) were more likely to be trained in FA than people in the other age categories ($p<0.0001$) (Appendix 2), and men were more likely than women to be trained first aiders (65.1% trained vs 59.7% trained, $p<0.0001$). Just over half of the respondents (n = 30 868) had encountered an accident in the previous 5 years. People who had encountered an accident were more likely to be trained in FA than people who did not report encountering an accident (70.9% vs 53.6%, $p<0.0001$).

Accident type

A total of 59,110 accidents were reported (Table 2). On average, 1.9 accidents were reported per person who encountered an accident. The most reported type of accident was malaise or discomfort. The most common environment was the road. FA was provided in 70.2% of accidents and ES were called in 72.0% of accidents.

Table 1

Demographic characteristics of survey participants

Variable		*n*	%
Gender	Male	20221	34%
	Female	39226	66%
Age	0-12 years (category 1)	166	0.3%
	13-18 years (category 2)	10019	16.9 %
	19-24 years (category 3)	12491	21.0 %
	25-44 years (category 4)	22372	37.6 %
	45-64 years (category 5)	12494	21.0 %
	>65 years (category 6)	1888	3.2%
	Unknown	17	0.0%
WHO region	Africa	196	0.3%
	Americas	3748	6.3%
	Europe	54181	91.1 %
	South-East Asia	478	0.8%
	Eastern Mediterranean	163	0.3%
	Western Pacific	322	0.5%
	Unknown	359	0.6%
Trained in first aid in past 5 years?	Yes	31994	53.8%
	No	20054	33.7%
	Unknown	7399	12.4%
Training by Red Cross/Red Crescent?	RC	15818	26.6%
	Other	15527	26.1%
	No	20054	33.7%
	Unknown	8048	13.5%
Encountered accident in past 5 years	Yes	30868	51.9%
	No	28579	48.1%

Association between covariates and helping behavior

Age, gender, WHO region, type of accident, and environment of accident all significantly ($p<0.0001$) influenced whether people provided FA and called ES in univariate analysis (Table 3a for FA provided and Table 3b for ES called). Importantly, people who were trained in FA were more likely to provide FA (crude OR of 4.11, 95%CI [3.92;4.32]) and to call ES (crude OR of 1.45, 95%CI [1.38;1.53])($p<0.0001$). A subgroup analysis on people who were trained in first aid showed that RC training resulted in higher odds of providing FA (crude OR: 1.64, 95%CI [1.55;1.75]) and calling ES compared with other training (crude OR: 1.27, 95%CI [1.20;1.34]) ($p<0.0001$).

Multivariate logistic regression was performed to adjust for confounding factors and uneven distribution of groups. Results of adjusted ORs are shown in table 3. Minors (categories 0-12 years and 12-18 years) were significantly less likely to provide FA or call ES compared with the reference category of young adults (19-24 years). Adults (categories 25-44 and 45-64 years) were statistically significantly more likely to provide FA or call ES than young adults.

Elderly (>65 years) were significantly less likely to provide FA in the univariate analysis, but after adjusting for confounding in the multivariate analysis this was no longer the case. In contrast, for the outcome of calling ES elderly remained less likely to do so after multivariate analysis. Women were also less likely to provide FA (aOR: 0.62, 95%CI [0.59;0.66]) or call ES (aOR: 0.83, 95%CI [0.78;0.87]) than men. Additionally, people were significantly more likely to provide FA at work (aOR: 1.37, 95%CI [1.26;1.49]), but less likely in other places, compared to at home. People were more likely to call ES in a work environment (aOR: 1.18, 95%CI [1.09;1.28]) or on the road (aOR: 1.61, 95%CI [1.49;1.75]), compared to at home, but less likely in school (aOR: 0.79, 95%CI [0.70;0.89]). As in the univariate analysis, people were significantly more likely to provide FA (aOR: 4.24, 95%CI [4.02;4.48]) or call ES (aOR: 1.36, 95%CI [1.29;1.45]) when trained in FA.

Subgroup analysis specifying type of FA training in FA trained people is provided in Appendix 3. For the covariates that were shared between this model and the main model, the results were similar. Moreover, people trained by RC societies were statistically significantly more likely to provide FA (aOR: 1.6, 95%CI [1.49;1.71]) or call ES (aOR: 1.19, 95%CI [1.12;1.27]) than people trained by others.

WHO region and type of accident were statistically significant in the univariate analysis and thus are included in the multivariate logistic regression models, but the conclusions to be drawn from these are limited due to 1) low numbers in subgroups for some WHO regions, with Europe alone representing >90% of cases and 2) a very large number of categories for accident type, with potential misclassifications.

Table 2

Type and Circumstances of 59,110 Unique Responses to Encountered Accidents

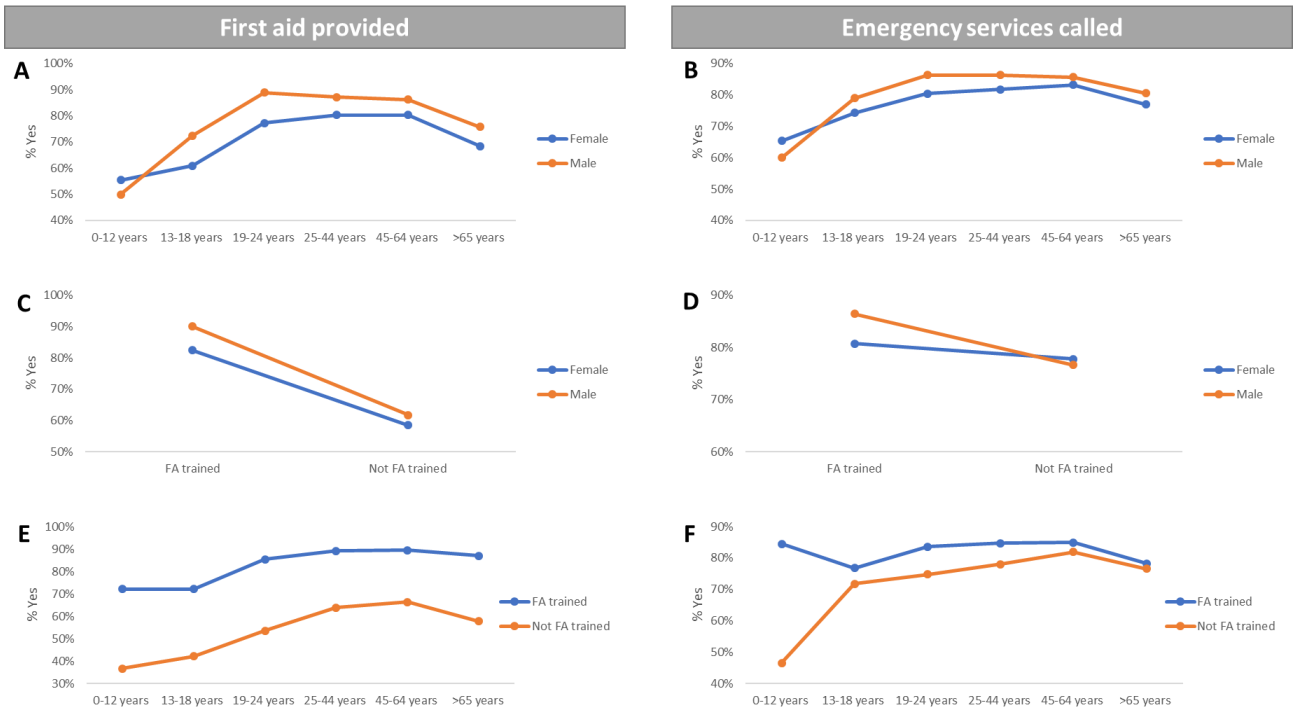
Variable		n	%
Type of accident	Choking	2249	3.8%
	Severe bleeding	2763	4.7%
	Unconscious breathing	6312	10.7%
	Cardiac arrest	4359	7.4%
	Heart attack	2042	3.5%
	Malaise or discomfort	8226	13.9%
	Severe burn	744	1.3%
	Superficial burn	1351	2.3%
	Severe wound	3066	5.2%
	Superficial wound	4194	7.1%
	Head injury	3651	6.2%
	Back injury	1103	1.9%
	Upper or lower limb injury	5027	8.5%
	Poisoning	463	0.8%
	Other	6054	10.2%
	Unknown	7506	12.7%
Environment	Home	11757	19.9%
	Work	11638	19.7%
	Road	12823	21.7%
	School	2429	4.1%
	Leisure-Sport	6743	11.4%
	Other	6691	11.3%
	Unknown	7029	11.9%
Did you provide first aid?	Yes	41519	70.2%
	No	10215	17.3%
	Unknown	7376	12.5%
Did you alert the emergency services?	Yes	42536	72.0%
	No	9047	15.3%
	Unknown	7527	12.7%

Exploration of interactions between age, gender, and FA training

Age and gender (Figure 1 A-B) significantly interacted for all age categories for FA provided ($p<0.05$), indicating that although females provided less aid overall than males, the difference was most pronounced in the reference category (19-24 years). For ES called, none of the interaction factors were significant.

Figure 1

Interaction Plots for Provision of First Aid and Calling Emergency Services to Visualize the Interactions Between (A-B) Age and Gender, (C-D) First Aid Training and Gender, (E-F) Age and First Aid Training



The interaction factor between FA training and gender was significant ($p<0.0001$) both for FA provided and ES called, indicating that the differences in helping behavior between women and men were affected by their FA training status (Figure 1 C-D). FA trained women were less likely to provide FA or call ES than their male counterparts (8% and 6%, respectively). However, among untrained people the difference between men and women was only small (3%) for FA provided and even reversed for calling ES (-1%); that is, among untrained people women were more likely to call ES than men.

There was a statistically significant interaction ($p=0.001$) between age category 2 (13-18 years) and FA training regarding FA provision, where the difference in FA provided between FA trained and not FA trained was slightly smaller in category 2 (30%) than in the reference category 3 (19-24 years) (32%) (Figure 1E). The significant interaction ($p=0.0059$) between age category 1 (0-12 years) and FA training regarding ES calling (Figure 1F), indicated that FA training had a larger positive influence on calling ES (38% increase) in that age category than in the reference age category 3 (9% increase) (Figure 1F). People in age categories 5 (45-64 years) and 6 (> 65 years) showed a lesser increase ($p=0.041$ and $p=0.029$, respectively) in ES calling when trained in FA (3% and 2% increase, respectively) than in age category 3.

Table 3a

Factors Associated with Provision of First Aid in Univariate and Multivariate Analysis

Variables	N Yes / N total (%)	p-value[a]	crude OR	95%CI	p-value	adjusted OR[b]	95%CI	p-value
Age: 0-12 years	60/112 (53.6%)	(p<0.0001)	**0.25**	**[0.17;0.36]**	**<0.0001**	**0.4**	**[0.25;0.65]**	**0.0002**
Age: 13-18 years	4609/7078 (65.1%)		**0.4**	**[0.37;0.43]**	**<0.0001**	**0.51**	**[0.47;0.55]**	**<0.0001**
Age: 19-24 years	9701/11787 (82.3%)		1	-	-	1	-	-
Age: 25-44 years	18263/21942 (83.2%)		**1.07**	**[1.01;1.13]**	**0.03**	**1.39**	**[1.30;1.49]**	**<0.0001**
Age: 45-64 years	8176/9846 (83.0%)		1.05	[0.98;1.13]	0.15	**1.52**	**[1.40;1.65]**	**<0.0001**
Age: >65 years	682/939 (72.6%)		**0.57**	**[0.49;0.66]**	**<0.0001**	1.08	[0.9;1.3]	0.39
Gender: Male	18803/22027 (85.4%)	(p<0.0001)	1	-	-	1	-	-
Gender: Female	22716/29707 (76.5%)		**0.55**	**[0.53;0.58]**	**<0.0001**	**0.62**	**[0.59;0.66]**	**<0.0001**
WHO region: Europe	34599/43040 (80.4%)	(p<0.0001)	1	-	-	1	-	1
WHO region: Africa	219/261 (83.9%)		1.27	[0.92;1.79]	0.15	0.79	[0.55;1.15]	0.2
WHO region: Americas	5183/6591 (78.6%)		**0.9**	**[0.84;0.96]**	**0.0009**	**0.72**	**[0.66;0.77]**	**<0.0001**
WHO region: Eastern Mediterranean	151/181 (83.4%)		1.23	[0.84;1.86]	0.31	0.92	[0.57;1.52]	0.73
WHO region: South East Asia	877/1034 (84.8%)		**1.36**	**[1.15;1.62]**	**0.0004**	1.16	[0.92;1.47]	0.21
WHO region: Western Pacific	327/388 (84.3%)		1.31	[1.0;1.74]	0.06	1.2	[0.87;1.69]	0.27
Type of accident: Choking	1860/2233 (83.3%)	(p<0.0001)	1	-	-	1	-	-
Type of accident: Severe bleeding	2409/2744 (87.7%)		**1.44**	**[1.23;1.69]**	**<0.0001**	**1.39**	**[1.15;1.67]**	**0.0005**

Type of accident: Unconscious breathing	5173/6281 (82.4%)		0.94	[0.82;1.06]	0.32	0.99	[0.86;1.15]	0.93
Type of accident: Cardiac arrest	3792/4336 (87.5%)		**1.4**	**[1.21;1.61]**	**<0.0001**	0.95	[0.8;1.11]	0.5
Type of accident: Heart attack	1652/2027 (81.5%)		0.88	[0.75;1.03]	0.12	**0.79**	**[0.66;0.95]**	**0.01**
Type of accident: Malaise/ discomfort	6468/8136 (79.5%)		**0.78**	**[0.69;0.88]**	**<0.0001**	**0.85**	**[0.7;0.97]**	**0.02**
Type of accident: Severe burn	621/743 (83.6%)		1.02	[0.82;1.28]	0.86	1	[0.78;1.30]	0.98
Type of accident: Superficial burn	1193/1342 (88.9%)		**1.61**	**[1.31;1.97]**	**<0.0001**	**1.82**	**[1.45;2.30]**	**<0.0001**
Type of accident: Severe wound	2415/3034 (79.6%)		**0.78**	**[0.68;0.90]**	**0.0007**	**0.83**	**[0.71;0.99]**	**0.03**
Type of accident: Superficial wound	3372/4139 (81.5%)		0.88	[0.77;1.01]	0.07	0.97	[0.83;1.14]	0.72
Type of accident: Head injury	2929/3606 (81.2%)		**0.87**	**[0.75;0.997]**	**0.045**	0.96	[0.82;1.12]	0.61
Type of accident: Back injury	800/1088 (73.5%)		**0.56**	**[0.47;0.66]**	**<0.0001**	**0.6**	**[0.49;0.74]**	**<0.0001**
Type of accident: Upper or lower limb injury	3838/4949 (77.6%)		**0.69**	**[0.61;0.79]**	**<0.0001**	**0.77**	**[0.66;0.89]**	**0.0006**
Type of accident: Poisoning	364/462 (78.8%)		**0.74**	**[0.58;0.96]**	**0.02**	**0.71**	**[0.54;0.94]**	**0.02**
Type of accident: Other	4219/6010 (70.2%)		**0.47**	**[0.42;0.53]**	**<0.0001**	**0.55**	**[0.48;0.63]**	**<0.0001**
Environment: Home	9193/11631 (79.0%)	(p<0.0001)	1	-	-	1	-	-
Environment: Work	10297/11533 (89.3%)		**2.21**	**[2.1;2.4]**	**<0.0001**	**1.37**	**[1.26;1.49]**	**<0.0001**
Environment: Road	9704/12687 (76.5%)		**0.86**	**[0.81;0.92]**	**<0.0001**	**0.67**	**[0.63;0.72]**	**<0.0001**
Environment: School	1705/2407 (70.8%)		**0.64**	**[0.58;0.71]**	**<0.0001**	**0.86**	**[0.76;0.97]**	**0.01**
Environment: Leisure-Sport	5282/6676 (79.1%)		1	[0.93;1.08]	0.9	**0.84**	**[0.77;0.92]**	**<0.0001**

Environment: Other	5230/6642 (78.7%)		0.98	[0.91;1.06]	0.64	**0.79**	**[0.72;0.86]**	**<0.0001**
FA training: No	6307/10589 (59.6%)	(p<0.0001)	1	-	-	1	-	-
FA training: Yes	28728/33468 (85.8%)		**4.11**	**[3.92;4.32]**	**<0.0001**	**4.24**	**[4.02;4.48]**	**<0.0001**

OR: odds ratio, CI: confidence interval, FA: first aid

[a] Chi-square test

[b] Multivariate logistic regression including covariates age, gender, WHO region, type of accident, environment and FA training

Table 3b

Factors Associated with Calling Emergency Services in Univariate and Multivariate Analysis

Variables	N Yes / N total (%)	p-value[a]	crude OR	95%CI	p-value	adjusted OR[b]	95%CI	p-value
Age: 0-12 years	73/115 (63.5%)	(p<0.0001)	**0.36**	**[0.25;0.53]**	**<0.0001**	**0.44**	**[0.28;0.72]**	**0.0007**
Age: 13-18 years	5315/6995 (76%)		**0.65**	**[0.61;0.70]**	**<0.0001**	**0.80**	**[0.74;0.87]**	**<0.0001**
Age: 19-24 years	9706/11703 (82.9%)		1	-	-	1	-	-
Age: 25-44 years	18351/21927 (83.7%)		1.06	[0.99;1.12]	0.076	**1.09**	**[1.02;1.17]**	**0.012**
Age: 45-64 years	8323/9871 (84.3%)		**1.11**	**[1.03;1.19]**	**0.0064**	**1.19**	**[1.09;1.29]**	**<0.0001**
Age: >65 years	744/942 (79%)		**0.77**	**[0.66;0.91]**	**0.0021**	**0.82**	**[0.68;0.99]**	**0.04**
Gender: Male	18747/22021 (85.1%)	(p<0.0001)	1	-	-	1	-	-
Gender: Female	23789/29562 (80.5%)		**0.72**	**[0.69;0.75]**	**<0.0001**	**0.83**	**[0.78;0.87]**	**<0.0001**
WHO region: Europe	35265/42886 (82.2%)	(p<0.0001)	1	-	-	1	-	1
WHO region: Africa	195/260 (75%)		**0.65**	**[0.49;0.87]**	**0.0026**	**0.44**	**[0.32;0.61]**	**<0.0001**
WHO region: Americas	5519/6586 (83.8%)		**1.12**	**[1.04;1.20]**	**0.0018**	1.02	[0.94;1.11]	0.583

WHO region: Eastern Mediterranean	132/182 (72.5%)		**0.57**	**[0.41;0.80]**	**0.0007**	**0.43**	**[0.29;0.65]**	**<0.0001**
WHO region: South East Asia	917/1038 (88.3%)		**1.64**	**[1.36;1.99]**	**<0.0001**	**1.79**	**[1.42;2.28]**	**<0.0001**
WHO region: Western Pacific	322/390 (82.6%)		1.02	[0.79;1.34]	0.86	0.92	[0.69;1.24]	0.56
Type of accident: Choking	1511/2209 (68.4%)	(p<0.0001)	1	-	-	1	-	-
Type of accident: Severe bleeding	2397/2734 (87.7%)		**3.29**	**[2.84;3.80]**	**<0.0001**	**2.86**	**[2.44;3.36]**	**<0.0001**
Type of accident: Unconscious breathing	5486/6240 (87.9%)		**3.36**	**[2.99;3.78]**	**<0.0001**	**3.17**	**[2.79;3.61]**	**<0.0001**
Type of accident: Cardiac arrest	4031/4328 (93.1%)		**6.27**	**[5.41;7.28]**	**<0.0001**	**5.23**	**[4.44;6.18]**	**<0.0001**
Type of accident: Heart attack	1877/2029 (92.5%)		**5.7**	**[4.74;6.91]**	**<0.0001**	**5.53**	**[4.51;6.83]**	**<0.0001**
Type of accident: Malaise/ discomfort	6416/8118 (79%)		**1.74**	**[1.57;1.93]**	**<0.0001**	**1.70**	**[1.51;1.91]**	**<0.0001**
Type of accident: Severe burn	604/734 (82.3%)		**2.15**	**[1.75;2.66]**	**<0.0001**	**2.18**	**[1.74;2.76]**	**<0.0001**
Type of accident: Superficial burn	686/1320 (52%)		**0.50**	**[0.43;0.58]**	**<0.0001**	**0.47**	**[0.40;0.54]**	**<0.0001**
Type of accident: Severe wound	2723/3039 (89.6%)		**3.98**	**[3.44;4.62]**	**<0.0001**	**3.12**	**[2.65;3.69]**	**<0.0001**
Type of accident: Superficial wound	2784/4084 (68.2%)		0.99	[0.88;1.11]	0.85	**0.83**	**[0.73;0.93]**	**0.0025**
Type of accident: Head injury	3148/3624 (86.9%)		**3.06**	**[2.68;3.49]**	**<0.0001**	**2.78**	**[2.41;3.22]**	**<0.0001**
Type of accident: Back injury	926/1092 (84.8%)		**2.58**	**[2.14;3.12]**	**<0.0001**	**2.30**	**[1.88;2.83]**	**<0.0001**
Type of accident: Upper or lower limb injury	4040/4975 (81.2%)		**2.00**	**[1.78;2.24]**	**<0.0001**	**1.82**	**[1.60;2.06]**	**<0.0001**
Type of accident: Poisoning	411/461 (89.2%)		**3.80**	**[2.82;5.22]**	**<0.0001**	**3.57**	**[2.61;4.99]**	**<0.0001**

Type of accident: Other	5029/5984 (84%)		**2.43**	**[2.17;2.72]**	**<0.0001**	**2.30**	**[2.03;2.61]**	**<0.0001**
Environment: Home	9066/11585 (78.3%)	(p<0.0001)	1	-	-	1	-	-
Environment: Work	9705/11512 (84.3%)		**1.49**	**[1.40;1.60]**	**<0.0001**	**1.18**	**[1.09;1.28]**	**<0.0001**
Environment: Road	11144/12701 (87.7%)		**1.99**	**[1.86;2.13]**	**<0.0001**	**1.61**	**[1.49;1.75]**	**<0.0001**
Environment: School	1742/2379 (73.2%)		**0.76**	**[0.69;0.84]**	**<0.0001**	**0.79**	**[0.70;0.89]**	**<0.0001**
Environment: Leisure-Sport	5289/6644 (79.6%)		**1.08**	**[1.01;1.17]**	**0.032**	0.95	[0.87;1.03]	0.22
Environment: Other	5483/6614 (82.9%)		**1.35**	**[1.25;1.46]**	**<0.0001**	1.06	[0.97;1.16]	0.18
FA training: No	8161/10542 (77.4%)	(p<0.0001)	1	-	-	1	-	-
FA training: Yes	27803/33386 (83.3%)		**1.45**	**[1.38;1.53]**	**<0.0001**	**1.36**	**[1.29;1.45]**	**<0.0001**

OR: odds ratio, CI: confidence interval, FA: first aid

[a] Chi-square test

[b] Multivariate logistic regression including covariates age, gender, WHO region, type of accident, environment and FA training

Discussion

The purpose of this study was to describe which accidents or health emergencies people encounter and to examine the association of several individual and accident-related variables with helping behavior (providing FA or calling ES) during a witnessed accident. Just over half of the respondents (n = 30 868) had encountered an accident in the previous 5 years, with the most commonly reported types of accident being malaise or discomfort, and also several types of skeletal trauma (limbs, skull, spine). FA was provided in 70.2% of accidents and ES were called in 72.0% of accidents. All investigated covariates, including age, gender, WHO region, type of accident and environment of accident, significantly influenced provision of FA and calling ES. Importantly, people who were trained in FA were more likely to provide FA or call ES.

Our survey was designed to estimate which general accidents people from different countries frequently encounter, whereas previous FA surveys have mainly focused on national results (Bakke et al., 2017; Franklin et al., 2019; Pei-Chuan Huang et al., 2019) and on certain aspects of FA such as CPR or trauma (Bouland et al., 2017; Franklin et al., 2019; Pei-Chuan Huang et al., 2019). Our study gauged whether FA had been provided when having witnessed an accident rather than previous studies that examined the willingness of interviewees to perform FA actions (Enami et al., 2011; Lee et al., 2013; Pei-Chuan Huang et al., 2019).

We found that 53.8% of our respondents had followed a FA training course in the last five years, which is higher than the estimated proportion of 25% reported in a recent scoping review (Heard et al., 2020). Over half of our interviewees had encountered an accident in the last five years, which is in line with results from a survey in Norway (43%) (Bakke et al., 2017). In our survey, in 70% of accidents FA was provided and in 72% ES were alarmed. This number is slightly lower than the Norwegian survey which reported that 89% of people who had been in a situation requiring FA had provided FA (Bakke et al., 2017), but is higher than the 20% reported by a Swedish study on bystander actions at traffic crashes (Larsson et al., 2002). A retrospective review of prehospital trauma deaths from two coronial jurisdictions in the UK found that a bystander was present prior to the emergency services in 86-96% of cases and called for help in 86-93% of cases (Oliver et al., 2017). In victims who were not found dead, assistance was provided in 43-57% of cases (Oliver et al., 2017). This study differs from ours in that only fatal accidents were included, which may explain the high rate of emergency calls, compared to our data. Rates of bystander assistance may be heterogeneous and context-dependent, as illustrated by a systematic review in low and middle income countries (Balhara et al., 2019). The most commonly reported accidents correspond to the FA topics included in most of the training courses intended for the general public.

Our findings, demonstrating that elderly persons and women reported less helping behavior in actual encountered situations, are in line with previous studies suggesting that older age and female gender were negatively associated with willingness to call ES, perform bystander CPR or perform basic life support (Enami et al., 2011; Heard et al., 2020; Lee et al., 2013; Pei-Chuan Huang et al., 2019). The interaction effect between age and gender in our study suggests that women are less likely to perform FA than men, but that this effect is most pronounced in the reference category (19-24 years). This finding is in contrast with another study which reported that female respondents were more negative than males towards performing basic life support in the elderly group but not in other age groups (Enami et al., 2011). Importantly, our study results suggest the importance and influence of FA training on the behavior of the general public if they witness any type of emergency in any location. Trained individuals were more likely to initiate the chain of survival by performing the emergency call and FA actions than untrained individuals. It is unclear from the literature whether FA training results in a higher willingness to provide FA. Some studies have shown an improved willingness or actual provision of FA in trained individuals (Cho et al., 2010; Enami et al., 2011; Tanigawa et al., 2011)

while other studies did not (Bakke et al., 2017; Moon et al., 2019; Van de Velde et al., 2009). Our study also reported a positive impact of FA training on whether people will call ES, but this was not observed in another study (Enami et al., 2011).

This is the first time that a survey of the general public has been carried out to study their ability to respond to an emergency in different settings and countries. One strength of our study is the high level of accessibility (i.e. online access in 18 different languages) and the involvement of a large number of RC National Societies. As a consequence, a wide audience was reached, and a large sample size obtained. Furthermore, this study directly assessed actual helping behavior. This is a strength, compared to prior studies assessing only willingness to help (Enami et al., 2011; Lee et al., 2013; Pei-Chuan Huang et al., 2019) or estimating bystander assistance from data present in coroner's files (Oliver et al., 2017).

There are however several limitations to the study. Firstly, due to the online format of the survey and self-selected participation, the study sample is unlikely to be representative of the global population. The majority of respondents were European residents, followed at length by people from the Americas, thereby limiting our ability to draw conclusions on a global scale. These areas of the world have better internet access and may therefore be reached easier by an online survey. Correspondingly, the age categories of 0-12 years and > 65 years are underrepresented in the study sample as they may have a reduced online presence, compared with other age groups. Moreover, people who have followed a FA training course may be more motivated to participate in a FA survey and therefore overrepresented in our sample. Likewise, 66% of our participants were women which does not correspond with the frequency in the global population (~50%). Multivariate logistic regression was employed to correct for this uneven distribution of confounders, but some potential confounders such as education, profession, presence of other bystanders, involvement in the accident and relationship to the victim were not measured. Secondly, first aid training was not defined specifically in the survey and can be interpreted broadly. Our survey cannot distinguish between the potential impact of an intensive first aid training course, e.g. following multiple-day first aid classes, and less thorough training such as following an online course. The exact nature of FA provided was not gauged, limiting our ability to compare our results with for example CPR studies. A third source of potential bias was recall bias among respondents, i.e. it is possible that an accident is better remembered if FA has been provided, or that people who are trained in FA are more likely to remember incidents. Problems with recall might also have led to rather high percentages of unknown values for some variables or to potential misclassifications. Finally, the cross-sectional study design does not allow us to draw conclusions on temporality or causality.

This study confirms the need for lifelong learning, as young people (0-18 years) and older people (>65 years) are the least effective groups in terms of FA and calling the ES. The interaction between FA training and gender in our study suggested that although women receiving FA training showed a higher helping behavior (providing FA or calling ES) than women who did not receive FA training, they were less likely to put their training to use (providing FA or calling ES) than their male counterparts. National services may need to adapt their offer of FA courses as well as their communication towards these respondent subgroups. An evidence-based educational pathway has been developed for integration of FA in school curricula (De Buck et al., 2015). Based on this pathway, the Belgian Red Cross developed didactic material such as manuals (including exercises) that is specifically adapted to certain age groups (every grade of primary and secondary school) (De Buck et al., 2015). A similar approach resulted in an educational pathway and teaching materials for first aid training adapted to the African context (De Buck et al., 2020). A tailored approach could be developed for other target groups as well.

Conclusion

This study confirms the association of multiple variables with providing FA or calling ES in case of an accident, including training of FA skills. There is a need for lifelong training, with special attention to those respondent subgroups that are less likely to report helping behavior.

Acknowledgements

The authors acknowledge the Global Disaster Preparedness Center (GDPC), Washington, USA who hosted the survey on their servers and provided the data. The authors are grateful to all respondents who participated in the survey.

Funding

This work was in part funded by the Foundation for Scientific Research of the Belgian Red Cross (general internal funding, no specific project grant number). Financial support for GFARC is provided by the French Red Cross and the support of some sister national societies (general internal funding, no specific project grant number).

Conflict of Interests

The authors might have perceived conflicts of interest, since they are part of the Belgian Red Cross (DO, BA, EDB and PV) and GFARC (PC, DI). One of the activities of the Belgian Red Cross is providing first aid training to laypeople. GFARC is an association which provides first-aid related support to members of the IFRC. GFARC and GDPC developed and disseminated the survey, but data analysis was performed independently and in good conscience by members of CEBaP (DO, BA).

Corresponding Author

Dorien O, Email: dorien.o@rodekruis.be

Data availability statement

Data available upon reasonable request.

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Appendix 1
Questionnaire

This is the content of the survey for your information, please note that **only on-line answers** will be taken into account

1. How old are you?
   - 0 – 12 years
   - 13 – 18 years
   - 19 – 24 years
   - 25 – 44 years
   - 45 – 64 years
   - + 65 years

2. What is your gender?
   - Male
   - Female

3. In which country do you currently live?

4. During the last 5 years, did you have or witness another person having an accident or health emergency?
   - Yes
   - No

5. If yes, which type of accident or emergency?
   - Choking
   - Severe bleeding
   - Unconsciousness breathing
   - Cardiac arrest
   - Heart attack
   - Malaise or discomfort
   - Severe burn
   - Superficial burn
   - Severe wound
   - Superficial wound
   - Head injury
   - Back injury
   - Upper or lower limb injury
   - Poisoning
   - Other

6. Did you provide first aid?
   - Yes
   - No

7. If the situation required it and if an emergency service existed in the area, did you call the emergency services?
   - Yes
   - No

8. In which environment did you face the accident or health emergency?
   - Home
   - Work

- Road
- School
- Leisure-sport
- Other

9. In addition to your previous response, did you have or witness someone else having an accident or health emergency during the last five years? *NB : this question comes as many times as necessary until the answer is "no"*
- Yes
- No

10. Were you trained or re-trained in first aid during the last five years?
- Yes
- No

11. Where have you been trained during the last five years?
- Red Cross or Red Crescent
- Other

Appendix 2

Demographics according to first aid training

Variable	Categories	FA trained			p-value
		Yes	No	% Yes	
Gender	Male	11068	5923	65.1%	p<0.0001
	Female	20926	14131	59.7%	
Age	0-12 years (category 1)	53	86	38.1%	p<0.0001
	13-18 years (category 2)	6232	2850	68.6%	
	19-24 years (category 3)	8454	2174	79.5%	
	25-44 years (category 4)	11156	8282	57.4%	
	45-64 years (category 5)	5612	5457	50.7%	
	>65 years (category 6)	476	1201	28.4%	
WHO region	Africa	91	65	58.3%	p<0.0001
	Americas	2303	740	75.7%	
	Europe	28974	18932	60.5%	
	South-East Asia	204	68	75.0%	
	Eastern Mediterranean	74	48	60.7%	
	Western Pacific	203	76	72.8%	
Accident encountered?	Yes	16816	6889	70.9%	p<0.0001
	No	15178	13165	53.6%	

FA: First Aid

Appendix 3

Subgroup analysis of people trained in First Aid

	FA provided			ES called		
Variables	adjusted OR[a]	95%CI	p-value	adjusted OR[a]	95%CI	p-value
Age: 0-12 years	**0.38**	**[0.19;0.81]**	**0.008**	1.15	[0.51;2.97]	0.75
Age: 13-18 years	**0.52**	**[0.47;0.57]**	**<0.0001**	**0.81**	**[0.73;0.89]**	**<0.0001**
Age: 19-24 years	1	-	-	1	-	-
Age: 25-44 years	**1.35**	**[1.24;1.46]**	**<0.0001**	**1.09**	**[1.01;1.18]**	**0.028**
Age: 45-64 years	**1.44**	**[1.29;1.6]**	**<0.0001**	**1.12**	**[1.01;1.23]**	**0.026**
Age: >65 years	1.03	[0.77;1.42]	0.83	**0.64**	**[0.49;0.83]**	**<0.0001**
Gender: Male	1	-	-	1	-	-
Gender: Female	**0.54**	**[0.5;0.58]**	**<0.0001**	**0.76**	**[0.71;0.81]**	**<0.0001**
WHO region: Europe	1	-	1	1	-	1
WHO region: Africa	1.12	[0.67;2.01]	0.69	**0.43**	**[0.29;0.64]**	**<0.0001**
WHO region: Americas	**0.72**	**[0.66;0.79]**	**<0.0001**	0.99	[0.91;1.09]	0.89
WHO region: Eastern Mediterranean	1.2	[0.59;2.99]	0.64	0.62	[0.37;1.10]	0.082
WHO region: South East Asia	1.05	[0.81;1.39]	0.71	**1.87**	**[1.43;2.47]**	**<0.0001**
WHO region: Western Pacific	1.24	[0.84;1.91]	0.31	0.99	[0.71;1.41]	0.95
Type of accident: Choking	1	-	-	1	-	-
Type of accident: Severe bleeding	**1.53**	**[1.21;1.95]**	**<0.0005**	**2.70**	**[2.24;3.26]**	**<0.0001**
Type of accident: Unconscious breathing	1.05	[0.86;1.26]	0.65	**3.20**	**[2.74;3.74]**	**<0.0001**
Type of accident: Cardiac arrest	1.1	[0.89;1.35]	0.38	**5.67**	**[4.66;6.93]**	**<0.0001**
Type of accident: Heart attack	0.87	[0.69;1.09]	0.23	**5.52**	**[4.31;7.13]**	**<0.0001**
Type of accident: Malaise/ discomfort	0.96	[0.8;1.15]	0.66	**1.51**	**[1.32;1.73]**	**<0.0001**
Type of accident: Severe burn	1.13	[0.82;1.59]	0.45	**2.10**	**[1.62;2.77]**	**<0.0001**
Type of accident: Superficial burn	**1.73**	**[1.3;2.32]**	**0.0002**	**0.44**	**[0.37;0.53]**	**<0.0001**
Type of accident: Severe wound	0.91	[0.74;1.13]	0.41	**3.06**	**[2.51;3.75]**	**<0.0001**
Type of accident: Superficial wound	0.95	[0.77;1.16]	0.59	**0.70**	**[0.60;0.81]**	**<0.0001**
Type of accident: Head injury	0.95	[0.77;1.16]	0.62	**2.56**	**[2.16;3.05]**	**<0.0001**
Type of accident: Back injury	**0.64**	**[0.49;0.82]**	**0.0006**	**2.41**	**[1.88;3.11]**	**<0.0001**
Type of accident: Upper or lower limb injury	**0.74**	**[0.61;0.89]**	**0.0002**	**1.74**	**[1.49;2.02]**	**<0.0001**
Type of accident: Poisoning	0.74	[0.52;1.07]	0.1	**3.76**	**[2.54;5.77]**	**<0.0001**
Type of accident: Other	**0.52**	**[0.43;0.63]**	**<0.0001**	**2.04**	**[1.76;2.38]**	**<0.0001**
Environment: Home	1	-	-	1	-	-
Environment: Work	**1.74**	**[1.55;1.94]**	**<0.0001**	**1.33**	**[1.22;1.46]**	**<0.0001**
Environment: Road	**0.73**	**[0.66;0.80]**	**<0.0001**	**2.00**	**[1.82;2.21]**	**<0.0001**
Environment: School	0.9	[0.77;1.04]	0.16	0.89	[0.77;1.02]	0.091
Environment: Leisure-Sport	1	[0.9;1.1]	0.94	**1.11**	**[1.01;1.23]**	**0.038**
Environment: Other	0.94	[0.84;1.05]	0.27	**1.26**	**[1.123;1.40]**	**<0.0001**

Type of FA training: Other	1	-	-	1	-	-
Type of FA training: RC	**1.6**	**[1.49;1.71]**	**<0.0001**	**1.19**	**[1.12;1.27]**	**<0.0001**

OR: odds ratio, CI: confidence interval, FA: first aid, ES: emergency services, RC: Red Cross/Red Crescent

[a] Multivariate logistic regression including covariates age, gender, WHO region, type of accident, environment and type of FA training