CPR knowledge and attitude to performing bystander CPR among secondary school students in Norway

B. K. Kanstad[a*], S. Aa. Nilsen[a*]& K. Fredriksen[b].**

[a]Faculty of Health Sciences, University of Tromsø, 9037 Tromsø, Norway, and [b]Division of Emergency Medical Services , University Hospital of North Norway, 9038 Tromsø, and Anaesthesia and Critical Care Research Group, Faculty of Health Sciences, University of Tromsø, 9037 Tromsø, Norway.

*B.K.K and S.Aa.N. have contributed equally to the study, and submitted an unpublished thesis based on this manuscript for the partial fulfilment of the MD degree at the University of Tromsø in September 2010.

****Corresponding author at:** Division of Emergency Medical Services, University Hospital of North Norway, N-9038 Tromsø, Norway. Tel.: +47 77 62 60 00. E-mail address: knut.fredriksen@unn.no

Word count: 2867 words. Abstract: 250 words.

Keywords: Bystander CPR, Basic Life Support (BLS), Schools, Training

Abstract

Background: Early bystander cardiopulmonary resuscitation (CPR) is essential for survival from out-of-hospital cardiac arrest (OHCA). Young people are potentially important bystander CPR providers, as basic life support (BLS) training can be distributed widely as part of the school curriculum.

Methods: Questionnaires were distributed to nine secondary schools in North Norway, and 376 respondents (age 16-19 years) were included. The completed questionnaires were statistically analyzed to assess CPR knowledge and attitude to performing bystander CPR.

Results: Theoretical knowledge of handling an apparently unresponsive adult person was high, and 90% knew the national medical emergency telephone number (113). The majority (83%) was willing to perform bystander CPR in a given situation with cardiac arrest. However, when presented with realistic hypothetical cardiac arrest scenarios, the option to provide full BLS was less frequently chosen, to e.g. a family member (74%), a child (67%) or an intravenous drug user (18%). Students with BLS training in school and self-reported confidence in their own BLS skills reported stronger willingness to perform BLS. 8 % had personally witnessed a cardiac arrest, and among these 16% had performed full BLS. Most students (86%) supported mandatory BLS training in school, and three out of four wanted to receive additional training.

Conclusion: Young Norwegians are motivated to perform bystander CPR, but barriers are still seen when more detailed cardiac arrest scenarios are presented. By providing students with good quality BLS training in school, the upcoming generation in Norway may strengthen the first part of the chain of survival in OHCA.

1. Introduction

Survival from out-of-hospital cardiac arrest (OHCA) depends on all the individual parts of the chain of survival, [1-3] and immediate bystander cardiopulmonary resuscitation (CPR) is a major contributor to survival from OHCA, [4-8] probably increasing survival fourfold. [9] However, bystander CPR rates vary between 15 – 50 % in OHCA. [9-13] Layperson training and attitude to actually performing CPR in a given cardiac arrest situation, are both important factors in order to increase bystander contribution to OHCA survival. [11,14]

According to the literature, both basic life support (BLS) training, [10, 15, 16] and attitude to performing CPR, [17-19] varies between countries. Both factors also differ between different age groups. In recent studies, the willingness to perform CPR varies considerably among high school students in e. g. Japan[20] and New Zealand.[21]

To investigate knowledge of CPR and attitude to performing bystander CPR among young Norwegians, we questioned secondary school students about CPR training, self-reported experience with cardiac arrest situations, and how they think they would react in given cardiac arrest situations.

Abbreviations: CPR = Cardiopulmonary resuscitation, CC = Chest compressions, BLS = Basic life support, OHCA = Out-of-hospital cardiac arrest, LOK = Level of Knowledge

2. Materials and methods

800 questionnaires were distributed to second year students from the Specialization in General Studies Programme of nine secondary schools in the counties of Nordland and Troms (Norway). Approval was given by the Chief County Education Officers and the headmasters of the selected schools. Participation was voluntary and the form teachers were kindly asked to motivate the students to respond to the questionnaire. One reminder was given six weeks after the initial contact. Students outside the target group, age 16-19 years and the Specialization in General Studies Programme, were excluded.

The printed questionnaire (see supplementary material) consisted of three sections with 28 questions. Section One assessed the students' BLS training level, attitude to receiving further training, and personal experience with cardiac arrest. Section Two tested the theoretical knowledge of BLS, and in Section Three, the students were asked to comment on six realistic hypothetical cardiac arrest scenarios in order to evaluate attitudes to performing BLS in given situations.

Recording of the anonymously completed questionnaires was approved by the University Hospital´s Data Protection Officer. The completed questionnaires were transferred to a Microsoft Excel (2007 version, Microsoft Corporation, USA) spreadsheet for analysis. Non-continuous data were analysed with Chi-square tests. For E-values ≤ 5, Fisher exact tests were used with SPSS (16.0 version, SPSS Inc, Chicago, USA). Significant *P*- values were recorded as <0.05, <0.01 or <0.001.

3. Results

3.1 The respondents

A total of 404 completed questionnaires were returned, but 28 of these did not fulfil the inclusion criteria, leaving 376 participants. The main characteristics of the respondents are shown in Table 1. Fifty-nine percent were female, and the predominant age was 17 years (63.5 %).

Previous BLS training was common (89 %) in both genders, and 73 % had obtained this at school. More than half of the respondents had attended BLS courses through organizations, work, or other providers. The majority (75%) said they would like to receive more BLS training, with female students showing significantly stronger commitment than male students ($p<0.001$). The answers also suggest that female students express particular interest in attending BLS training outside school if such courses had been more available. The predominant motivation for more training was to prevent avoidable death (81 %). The vast majority (86 %) even supported compulsory BLS training in school, and only 1% expressed the view that BLS training should be an optional activity.

Most students (90 %) knew the national medical emergency telephone number (113), with females again scoring higher than males ($p <0.05$). The answers indicated that the students understand the importance of bystander CPR, as the majority (96 %) believed that it increased survival by a factor of two or four. As one might expect, neither the exact magnitude of bystander's importance for survival, nor OHCA survival rates in Norway, was common knowledge. The students demonstrated basic theoretical knowledge of handling an apparently unresponsive adult, including the need for the recovery position in an unconscious person. However, even if the correct number of chest compressions and ventilations was known by 85.5 % of the respondents, it was less clear to them that compressions precede ventilations in the 2005 BLS algorithm. Self-reported confidence in BLS proficiency was modest (37 %), with males reporting significantly higher confidence than females ($p <0.05$).

3.2 Practical experience and attitude

We assumed that attitude to starting CPR in a given situation also would be determined to some extent by whether the student personally had witnessed or participated in CPR. Despite the young age, as many as 8% confirmed they had witnessed a cardiac arrest (Table 2), with significantly more personal experience among the female students (11 % vs. 5 %, $p < 0.05$). Among those that had witnessed a real cardiac arrest, 16% called for help and provided full BLS, and 35% called the emergency number only. However, 32% provided no BLS at all. In at least some of these situations, the practical CPR may have been carried out by someone else that was present.

The majority (83%) answered that they would perform CPR if confronted with cardiac arrest, and lack of BLS skills was the most frequent reason given for not starting CPR in a given situation (79%). Only 6 % reported fear of disease transmission as a reason for not starting CPR. However, when the students were confronted with realistic cardiac arrest scenarios (described in Table 3), both contagious diseases and aversiveness became more prevalent answers (Table 2). In addition, three out of four students expressed the view that (or "said that") that they would have been more likely to initiate BLS if rescue breathing had been removed from the BLS algorithm.

3.3 Cardiac arrest scenarios

To investigate whether the students' responses changed if more specific details about situation and the identity of the patient was given, we presented six different realistic cardiac arrest scenarios (Tables 3 and 4). Overall, the students were more willing to perform full BLS (i.e. call for ambulance, chest compressions and rescue breathing) on a family member (74%) and least willing if the patient was suspected to be an intravenous drug user (18%) ($p < 0.001$). There was also a significant difference ($p < 0.001$) between providing full BLS to a child (67%) and an elderly lady (28%). Over half of the students (60%) would perform full BLS on an adult skier with cardiac arrest, while fewer (45%) would provide this in the moped collision scenario with blood in the patient's face ($p < 0.001$). There were no significant gender differences in any of the scenarios regarding the option to provide full

BLS. Across all scenarios, 49% of the students would perform full BLS, and less than 1 % would do no BLS at all.

The option to call for help, and not start CPR, was significantly more frequently chosen for the drug user scenario ($p < 0.001$), but this alternative was relatively more common also for the elderly lady and the moped collision. The choice of calling for emergency assistance only showed no gender differences in any of the scenarios ($p > 0.05$).

3.4 Attitudes towards BLS according to the level of training and practical experience with cardiac arrest

To examine whether attitude to performing BLS was related to the level of proficiency and training, the students were divided into two groups according to their assumed level of knowledge (LOK). Students with previous BLS training in school and self-reported confidence on own BLS knowledge were considered to have a high level of knowledge and were compared to students with neither BLS training in school, nor self-reported confidence in own BLS proficiency (Table 5).

Students in the high LOK group reported significantly more BLS training outside the school setting ($p < 0.05$). However, they were less likely to ask for more training ($p < 0.05$). Regarding compulsory BLS training, LOK did not influence the students' answers.

More importantly, the group with higher LOK answered "yes" to performing BLS in a given situation with cardiac arrest significantly more often than the other ($p < 0.001$). This was also seen in the scenario with the moped collision ($p < 0.01$), but there were no significant differences in the other cardiac arrest scenarios, although the option of providing full BLS to a child ($p=0.12$) and an adult skier ($p=0.06$) was more frequent among students with higher LOK. Surprisingly, fear of disease transmission was more frequent among those with higher LOK ($p < 0.05$). However, they were less concerned about performing it wrongly due to lack of competence ($p < 0.001$).

Students with previous BLS training in school had significantly higher confidence on BLS knowledge compared to those without this background ($p < 0.001$).

The majority (81 %) of the 31 students who had personally witnessed a cardiac arrest (Table 5) had attended courses outside school and reported a wish for more BLS training (84 %). Fifty-five percent of these students reported themselves as having sufficient BLS knowledge in a situation with cardiac arrest.

4. Discussion

Early bystander CPR is one of the most significant factors for survival from OHCA.[4,22,23] Although some recent studies have shown increased rates, [24] most authors report bystander CPR rates below 50 %, and the rates vary between different countries.[11,14,25] As higher rates could increase survival, a focus on BLS training has been suggested, with a view to training those who live together with the elderly (and have the highest probability of encountering cardiac arrest), and trying to reduce psychological barriers to performing CPR.[11, 12, 14] Recently, the bystander CPR rate was reported as high as 70.7 % in a small OHCA study from Norway.[26] For this reason, we set out to investigate the level of training and attitudes to CPR among young Norwegians.

BLS is recommended as part of the school curriculum, [27] and compulsory resuscitation training was introduced in Norwegian schools in 1961.[28] Children are easy to motivate and quick learners. [29,30] At the age of 6-7 they are competent to perform basic first aid to an unconscious patient, [31] and may provide effective chest compressions when 13-14 years old.[32] All Norwegian children should go through one BLS course during middle school, but in the present study only 73 % of the respondents could recall that they had received BLS training at school. This implies that the full potential of training during school has not been fulfilled.

The majority of the students in our study reported a wish for further BLS training to follow the existing compulsory training in school. However, they also reported the same barriers to taking extracurricular BLS courses as described elsewhere: lack of time and interest, and the inconvenience of leaving the house to attend a course. [12] Cost was not considered a problem by the respondents in the present study, but almost half of the students were not sure about where to find a BLS course.

Despite good theoretical knowledge about e. g. handling an apparently lifeless adult, and the Norwegian medical emergency telephone number (113), self-reported confidence in having sufficient BLS knowledge was only modest. Lack of skill retention even a short time after courses has been

documented by others. [33, 34] This underlines the need for follow up courses, and in our study, the majority of the students supported compulsory BLS training in school and would even like to have more training in addition to the basic curriculum. Thus, the motivation among the students is strong.

We report that 8 % of the young secondary school students already had experienced a cardiac arrest situation, and even higher rates have been seen in other countries. [17, 18] Therefore, the notion that students may not be a cost effective target for BLS training, and training should target those that live together with the elderly, is not supported by our data. We rather believe that training should start early, and refresher courses should be offered to improve skill retention.

Even if training is widespread, barriers to actually performing CPR in a given situation of OHCA exist. The self- reported willingness to perform CPR in the present study decreased when the respondents were presented with detailed cardiac arrest scenarios. Full bystander CPR (i.e. calling for help, providing both chest compressions and rescue breathing) would be performed to the arrested family member and the child by the majority of the students. However, the figures were much lower for scenarios with an elderly person and with an intravenous drug user. This suggests that training must focus on reducing existing barriers to assist typical cardiac arrest patients.

The Norwegian students in the present report showed a higher degree of willingness than young students in a similar study from Japan.[20] However, high school students in a New Zealand study[21] reported an even higher willingness to provide BLS to a family member than the Norwegian students in the present study. Compared to slightly younger high school students in the USA[18] our students were more reluctant to perform rescue breathing on a child, but more willing to resuscitate a family member, intravenous drug user and trauma victim. It is difficult to assess how much of the reported variation between the different studies results from differences in attitude, or from the setting in which the scenarios were presented.

We found that the most common reason for not providing bystander CPR was an impression of insufficient technical skills. However, among those who were reluctant to perform rescue breathing

in one or more of the scenarios, the most frequent reason was fear of disease transmission. This was even higher than reported in studies from Japan, [20] USA[18] and Australia.[35] For this reason, firm reassurance about the negligible risk of disease transmission in mouth-to-mouth ventilation[36, 37] must still be emphasised during BLS training.

When the students were presented with hypothetical cardiac arrest scenarios, a weak positive association between knowledge of BLS and attitude to performing CPR was observed in some of the scenarios. However, only one of the associations was statistically significant, i.e. the traumatised moped driver. It is possible that the complex trauma situation described in this scenario favoured the students with more first aid knowledge. On the contrary, it may be easier to explain why LOK did not make any difference with a collapsed family member (probably the most emotional situation to all, without regard to LOK), the intravenous drug user (fear of contracting a contagious disease, or a repulsive situation at large), and the elderly person. The fear of disease transmission was more common among students with high LOK. This paradox could possibly be explained by increased awareness of this topic because of previous BLS training, but this should be addressed more specifically before attempts to draw any conclusion.

The fact that higher LOK increased the willingness to perform BLS could reflect both a self-confident personality type as well as objective knowledge of BLS, since subjective self-reported confidence was part of the criteria. With the present study design, it was not possible to objectively assess the students' true knowledge of BLS.

Self-reported commitment does not imply that the students would actually respond in a real situation. We did, however, ask the students about personal experience with real cardiac arrest situations, and could thus compare self-reported attitude between students who had been in a real cardiac arrest situation, with students without this experience. Within the group with cardiac arrest experience in our study, only 16 % reported to have provided full BLS, which is quite similar to that reported among Saudi Arabian college students.[17] Details about the situations were not disclosed,

e.g. whether the students were alone, or whether they were witnesses as other provided the CPR. Approximately half of the students with personal cardiac arrest experience felt they had sufficient BLS knowledge to face a new cardiac arrest scene, and the majority of them wanted to receive more BLS training.

5. Conclusions

These findings confirm that secondary school students are an important target for efforts to increase the bystander CPR rate, at least in Norway. The motivation to help is good in this population, but barriers to start CPR become evident when the students are exposed to realistic details in potential CPR scenarios. Sufficient BLS training in school, including appropriate refresher courses and focus on known barriers to bystander CPR could strengthen the chain of survival and contribute to increased survival from OHCA.

6. Study limitations

We believe it is unlikely that the respondents differ very much from the general student population with regard to BLS training and attitude. We can, however, not rule out that the findings would have been slightly different with a higher response rate. Our study includes only students of the academically oriented “Specialisation in general studies” programme, and thus describes a subset of the population. However, this subset is representative of the majority of secondary school students in Norway. The current study design also precludes assessment of actual CPR knowledge, and the attitude of the high LOK group may thus reflect both self confidence as well as true CPR knowledge.

Conflicts of Interest

There are no conflicts of interest.

Funding sources

None.

References

1. Cummins RO, Ornato JP, Thies WH, et al. Improving survival from sudden cardiac arrest: the “chain of survival” concept. A statement for health professionals from the Advanced Cardiac Life Support Subcommittee and the Emergency Cardiac Care Committee, American Heart Association. Circulation. 1991 May;83:1832-47.

2. European Resuscitation Council. European Resuscitation Council Guidelines for Resuscitation 2005. Resuscitation 2005;67: Suppl. 1.

3. Iwami T, Nichol G, Hiraide A, et al. Continuous Improvements in “Chain of survival” Increased Survival After Out-of-Hospital Cardiac Arrest. Circulation 2009;119:728-734.

4. Gallagher EJ, Lombardi G, Gennis P. Effectiveness of bystander cardiopulmonary resuscitation and survival following out-of-hospital cardiac arrest. JAMA. 1995;274:1922-1925.

5. Van Hoeyweghen RJ, Bossaert LL, Mullie A, et al. Belgian Cerebral Resuscitation Study Group. Quality and efficiency of bystander CPR. Resuscitation. 1993;26:47-52.

6. Wik L, Steen PA, Bircher NG. Quality of bystander cardiopulmonary resuscitation influences outcome after prehospital cardiac arrest. Resuscitation. 1994;28:195-203.

7. Valenzuela TD. Roe DJ, Cretin S, et al. Estimating effectiveness of cardiac arrest interventions: a logistic regression survival model. Circulation. 1997;96:3308-3313.

8. Larsen MP, Eisenberg MS, Cummins RO, et al. Predicting survival from out-of-hospital cardiac arrest: a graphic model. Ann Emerg Med. 1993;22:1652-1658.

9. Stiell IG, Wells GA, Field B, et al. Advanced cardiac life support in out-of-hospital cardiac arrest. N Engl J Med 2004, 351:647-656.

10. Hollenberg J, Herlitz J, Lindqvist J, et al. Improved Survival After Out-of-Hospital Cardiac Arrest Is Associated With an Increase in Proportion of Emergency Crew-Witnessed Cases and Bystander Cardiopulmonary Resuscitation. Circulation. 2008;118:389-396.

11. Vaillancourt C, Grimshaw J, Brehaut J C, et al. A survey of attitudes and factors associated with successful cardiopulmonary resuscitation (CPR) knowledge transfer in an older population most likely to witness cardiac arrest: design and methodology. BMC Emergency Medicine 2008;8:13.

12. Vaillancourt C, Stiell AG, Wells GA. Understanding and improving low bystander CPR rates: a systematic review of the literature. Can J Emerg Med 2008;10: 51-65.

13. Axelsson Å, Thoren A, Holmberg S, Herlitz J. Attitudes of trained Swedish lay rescuers toward CPR performance in an emergency. A survey of 1012 recently trained CPR rescuers. Resuscitation 2000;44:27-36.

14. Abella BS, Aufderheide TP, Eigel B, et al. Reducing Barriers for Implementation of Bystander-Initiated Cardiopulmonary Resuscitation. Circulation. 2008;117:704-709.

15. Jennings S, Hara TO, Cavanagh B, et al. A national survey of prevalence of cardiopulmonary resuscitation training and knowledge of the emergency number in Ireland. Resuscitation 2009;80:1039-1042.

16. Larsen P, Pearson J, Galletly D. Knowledge and attitudes towards cardiopulmonary resuscitation in the community. N Z Med J 2004;117:U870.

17. Al-Turki YA, Al-Fraih YS, Jalaly JB, et al. Knowledge and attitudes towards cardiopulmonary resuscitation among university students in Riyadh, Saudi Arabia. Saudi Med J 2008;29: 1306-1309.

18. Hubble MW, Bachman M, Price R, et al. Willingness of high school students to perform cardiopulmonary resuscitation and automated external defibrillation. Prehosp Emerg Care 2003;7:219-224.

19. Chew KS, Yazid MNA. The willingness of final year medical and dental students to perform bystander cardiopulmonary resuscitation in an Asian community. Int J Emerg Med.2008. 1:301-309.

20. Omi W, Taniguchi T, Kaburaki T, et al. The attitudes of Japanese high school students toward cardiopulmonary resuscitation. Resuscitaion 2008;78:340-345.

21. Parnell MM, Pearson J, Galletly DC, et al. Knowledge of and attitudes towards resuscitation in New Zealand high-school students. Emerg Med J 2006;23:899-902.

22. Sans S, Kesteloot H, Kromhout D. The burden of cardiovascular diseases mortality in Europe. Task Force of the European Society of Cardiology on Cardiovascular Mortality and Morbidity Statistics in Europe. Eur Heart J 1997;18:1231-48.

23. Zheng ZJ, Croft JB, Giles WH, et al. Sudden cardiac death in the United States, 1989 to 1998. Circulation. 2001;104:2158-2163.

24. Ghose R, Lyon RM, Clegg GR, Gray AJ, on behalf of the Emergency Medicine Research Group Edinburgh. Bystander CPR in south east Scotland increases over 16 years. Resuscitation 2010;81:1488-1491.

25. Isbye DL, Rasmussen LS, Ringsted C, Lippert FK. Disseminating Cardiopulmonary Resucitation Training by Distributing 35000 Personal Manikins Among School Children. Circulation 2007;116:1380-1385.

26. Rasmussen JR, Haanæs EK, Gilbert M. Hjertestans utafor sykehus i Tromsø kommune i perioden 1999-2003 (in Norwegian). (Accessed 6 January 2011, at http://www.ub.uit.no/munin/bitstream/10037/815/1/student.pdf)

27. European Resuscitation Council. Guidelines for basic life support. A statement by the Basic Life Support Working Party of the European Resuscitation Council, 1992. Resuscitation 1992;24:103-10.

28. Lind B, Stovner J. Mouth-to-mouth resuscitation in Norway. JAMA 1963;185:933-5.

29. Van Kerschaver E, Delooz HH, Moens GFG. The effectiveness of repeated cardiopulmonary resuscitation training in a school population. Resuscitation 1989;17:211-2.

30. Eisenburger P, Safar P. Life supporting first aid training of the public – review and recommendations. Resuscitation 1999;41:3-18.

31. Bollig G, Wahl HA, Svendsen MV. Primary school children are able to perform basic life-saving first aid measures. Resuscitation 2009;80:689-692.

32. Jones I, Whitfield R, Colquhoun M, et al. At what age can schoolchildren provide effective chest compressions? An observational study from the Heartstart UK schools training programme. BMJ 2007;334;1201.

33. Wollard M, Whitfield R, Newcombe RG, et al. Optimal refresher training intervals for AED and CPR skills: a randomized controlled trial. Resuscitation 2006;71:237-47.

34. Lester CA, Weston CF, Donnelly PD, et al. The need for wider dissemination of CPR skills: are schools the answer? Resuscitation 1994;28: 233-7.

35. Johnston TC, Clark MJ, Dingle GA, et al. Factors influencing Queenslanders` willingness to perform bystander cardiopulmonary resuscitation. Resuscitation 2003;56:67-75.

36. Handley AJ, Koster R, Monsieurs K, et al. European Resuscitation Guidelines for Resuscitation 2005 Section 2. Adult basic life support and use of automated external defibrillators. Resuscitation 2005;67 Suppl 1,S7-S23.

37. Mejicano GC, Maki DG. Infections acquired during cardiopulmonary resuscitation: estimating the risk and defining the strategies for prevention. Ann Intern Med 1998; 129:690-8.

Table 1 Characteristics of the respondents, their level of knowledge and attitudes towards BLS training			
The respondents	**All**	**Male**	**Female**
Response to the questionnaire	376 (100%)	154 (41%)	222 (59%)
Age			
- 16	10 (2,5%)	3 (2%)	7 (3%)
- 17	239 (63,5%)	101 (65,5%)	138 (62%)
- 18	113 (30%)	47 (30,5%)	66 (30%)
- 19	14 (4%)	3 (2%)	11 (5%)
Level of knowledge	**All**	**Male**	**Female**
Previous BLS training	335 (89%)	137 (89%)	198 (89%)
Where and how have the respondents got their BLS training?			
- During school	272 (73%)	109 (71%)	163 (74%)
- Elementary school	117 (31%)	41 (27%)	76 (34%)
- Middle school	195 (52%)	89 (58%)*	106 (48%)
- Secondary school	27 (7%)	10 (6%)	17 (8%)
- Outside school (Red Cross, private organization, work, other)	234 (62%)	94 (61%)	140 (63%)
Confidence on having sufficient BLS knowledge in a situation with cardiac arrest	136 (37%)	67 (44%) *	69 (32%)
Knowledge about the exact correct emergency telephone number (113)	340 (90%)	131 (85%)	209 (94%) *
What is the survival rate in out-of-hospital cardiac arrest in Tromsø, Northern Norway?			
- Approximately 35%	150 (40%)	58 (38%)	92 (41%)
- Approximately 1%	16 (4%)	10 (6,5%)	6 (3%)
- Approximately 10% (correct)	209 (56%)	85 (55,5%)	124 (56%)
What is the increment in chance of survival in out-of-hospital cardiac arrest, if the patient receives sufficient BLS before arrival of emergency personnel?			
- It increases twofold (correct)	184 (49%)	68 (44,5%)	116 (52%)
- BLS has little influence on survival if emergency personnel arrives early	16 (4%)	8 (5%)	8 (4%)
- It increases fivefold	174 (47%)	77 (50,5%)	97 (44%)
You are alone and come across an apparently lifeless adult person. What do you do?			
- Immediately start chest compressions	1 (0,25%)	1 (1%)	0 (0%)
- Check for consciousness, secure airways and check if the patient is breathing (correct)	308 (84%)	122 (80%)	186 (87%)
- Check for pulse	58 (15,75%)	29 (19%)	29 (13%)
It turns out the patient is breathing but shows no response to verbal stimuli. What do you do?			
- Immediately start chest compressions	16 (4%)	7 (4,5%)	9 (4%)
- Put the patient in recovery position and call for ambulance (correct)	342 (92%)	140 (91%)	202 (93%)
- Check for pulse	14 (4%)	7 (4,5%)	7 (3%)
You decide to perform BLS. Which of the following combinations of chest compressions and mouth ventilation would you choose?			
- 30 chest compressions:2 rescue breathings (correct)	153 (41%)	60 (39%)	93 (42%)
- 30 chest compressions:5 rescue breathings	56 (15%)	26 (17%)	30 (13,5%)
- 2 rescue breathings:30 chest compressions	166 (44%)	67 (44%)	99 (44,5%)
Attitudes towards BLS training	**All**	**Male**	**Female**
If you have had no BLS training outside school, what is the reason?			
- Little interest	45 (32%)	25 (42%) *	20 (24%)
- Little time	31 (22%)	16 (27%)	15 (18%)
- Not sure where to attend course	61 (43%)	16 (27%)	45 (55%) *
- Costs	5 (4%)	4 (7%)	1 (1%)
- No answer	10 (7%)	3 (5%)	7 (9%)
Do you want more BLS training? Yes:	282 (75%)	94 (61%)	188 (85%) *
If you want more BLS training, what is the reason?			
- Heart disease within family	20 (7%)	6 (6%)	14 (7%)

- Wish of avoiding unnecessary death	228 (81%)	76 (81%)	152 (81%)
- Other reason or no answer	34 (12%)	12 (13%)	22 (12%)
Do you think BLS training should be mandatory?			
- Yes, in school	324 (86%)	127 (82%)	197 (89%)
- Yes, to obtain driving license	194 (52%)	80 (52%)	114 (51%)
- Yes, training should be included in all occupations	123 (33%)	51 (33%)	72 (32%)
- No, BLS training should be optional	4 (1%)	2 (1%)	2 (1%)

BLS= Basic life support

*** = *p* < 0.05 , between genders**

- No other statistical significant difference between genders for any of these variables

Table 2 Practical experience and attitudes towards BLS			
	All	**Male**	**Female**
Have you ever personally witnessed an assumed cardiac arrest and experienced that someone needed BLS? Yes:	31 (8%)	7 (5%)	24 (11%)*****
What did you actually do?			
- Did no BLS at all	10 (32%)	2 (29%)	8 (33%)
- Full BLS	5 (16%)	2 (29%)	3 (13%)
- Called only	11 (35%)	2 (29%)	9 (38%)
- Did chest compressions only	5 (16%)	1 (14%)	4 (17%)
Attitude to perform BLS in a given situation with cardiac arrest:			
- Yes:	313 (83%)	128 (83%)	185 (83%)
- No:	63 (17%)	26 (17%)	37 (17%)
If no: why?			
- I have too little knowledge in BLS	50 (79%)	19 (73%)	31 (84%)
- Fear of harming the victim	11 (17%)	3 (12%)	8 (22%)
- Fear of disease transmission	4 (6%)	3 (12%)	1 (3%)
- Other reason or no answer	6 (10%)	4 (15%)	2 (5%)
Reasons for reported reluctance to perform rescue breathing in scenario A-F:			
- Fear of disease transmission	123 (46%)	52 (46%)	71 (45%)
- I feel it's repulsive to perform	66 (24%)	23 (21%)	43 (27%)
- Fear of performing it wrong because of lack of competence	94 (35%)	37 (33%)	57 (36%)
- Other reason or no answer	43 (16%)	13 (12%)	30 (19%)
If rescue breathing was removed from the BLS algorithm, would it then be easier for you to initiate BLS? Yes:	263 (73%)	113 (76%)	150 (71%)

Full BLS= Call for ambulance + chest compressions + rescue breathing

*** = p < 0.05 , between genders**

- No other statistical significant difference between genders for any of these variables

Table 3 Six hypothetical cardiac arrest scenarios presented to the students

Scenario A: *You are at home watching TV. Suddenly you hear a roar from the kitchen. You burst in and find a close family member lying lifeless on the floor. He or she is not breathing. You are alone in the house. What are you willing to do?*

Scenario B: *You are at a big mall and need to visit the lavatory. There you find an unknown lifeless person lying on the floor. He is not breathing and is unconscious. He seems unkempt and you spot a needle in his arm. You immediately suspect a drug overdose. What are you willing to do?*

Scenario C: *You are cutting the lawn a nice summer day, when a little girl suddenly comes running. She screams that her friend is lying on the ground and does not wake up. You run towards the lifeless child, who is not breathing. What are you willing to do?*

Scenario D: *In the evening you spot a tumbled walking chair as you go home from the store. You approach it and find an elderly lady who she seems to be in her eighties, laying on the ground. She is not breathing and is unconscious, and she has vomit around her mouth. What are you willing to do?*

Scenario E: *You are bicycling home a late evening when a moped overtakes you at high speed. Suddenly the driver loses control and collides into a lamp post. He is thrown off the moped, and as he hits the ground his helmet bursts. You approach and find a severely injured adolescent with blood in his face. The injured does not breathe and is unconscious. What are you willing to do?*

Scenario F: *You are out skiing one evening. An adult skier overtakes you, but collapses in the next uphill. You rapidly approach him and observe that he is not breathing. What are you willing to do?*

Important information given to the students:
In the following questions different cardiac arrest scenarios will be presented. For each scenario we want you to mark which Basic life support efforts you are willing to provide. You can insert one or more marks. If you are not willing to perform any efforts, leave no marks.

- ❑ Call for ambulance
- ❑ Perform chest compressions
- ❑ Perform rescue breathing

Table 4 **Results on the six hypothetical cardiac arrest scenarios**

Part of BLS procedure	**Scenario A; *a member of your family***			***Scenario B; intravenous drug user***			***Scenario C; child***			***Scenario D; elderly lady***			***Scenario E; adolescent in moped collision with blood***			***Scenario F ; adult skier collapsed during exercise***		
	All	Male	Female	**All**	Male	Female	**All**	Male	Female	**All**	Male	Female	**All**	Male	Female	**All**	Male	Female
No BLS at all	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0, 25%)	0 (0%)	1 (0, 5%)	1 (0, 25%)	0 (0%)	1 (0, 5%)	3 (0, 75%)	0 (0%)	3 (1, 5%)	1 (0, 25%)	0 (0%)	1 (0, 5%)
Full BLS	280 **a[1]** (74%)	109 (71%)	171 (77%)	69 **a[1]** (18%)	25 (16%)	44 (20%)	252 **a[2]** (67%)	101 (66%)	151 (68%)	105 **a[2]** (28%)	42 (27%)	63 (28%)	170 **a[3]** (45%)	67 (44%)	103 (46%)	227 **a[3]** (60%)	88 (57%)	139 (63%)
Call only	47 (13%)	24 (16%)	23 (10%)	190 **a[4]** (51%)	75 (49%)	115 (52%)	60 (16%)	30 (19%)	30 (14%)	138 (37%)	55 (36%)	83 (37%)	128 (34%)	54 (35%)	74 (33%)	68 (18%)	30 (19%)	38 (17%)
Do CC only	10 (3%)	6 (4%)	4 (2%)	10 (3%)	6 (4%)	4 (2%)	16 (4%)	7 (5%)	9 (4%)	13 (3%)	10 (6%)	3 (1%)	9 (2%)	6 (4%)	3 (1%)	24 (6%)	13 (8%)	11 (5%)

Full BLS= Call for ambulance + chest compressions (CC) + rescue breathing

a[1 - 3] = *p* < 0.05 , Chi square test (between scenarios)

a[4] =*p* < 0.05 , Chi square test (between scenario B and A,C-F)

a [1-4] are referred to in Results, other statistical significances have not been marked in table 4.

Table 5 Attitudes towards BLS based on different level of knowledge(LOK) and cardiac arrest experience

Attitudes	**Higher LOK** **- BLS in school** **-Confidence on BLS knowledge** **- n: 112**	**Lower LOK:** **- No BLS in school** **- No confidence on BLS knowledge** **- n: 80**	***p*-value Higher LOK vs. lower LOK**	**Students with cardiac arrest experience** **-n: 31**
Want more BLS training:	71 (63%)	66 (83%)	< 0.01 *	26 (84%)
Previous BLS training outside school:	85 (76%)	44 (55%)	< 0.05 *	25 (81%)
Support mandatory BLS training:	111 (99%)	78 (98%)	NS	31 (100%)
Willingness to perform BLS in a given situation:	109 (97%)	59 (74%)	< 0.001 *	24 (77%)
Scenario A-F: Providing full BLS:				
- Scenario A; *a member of your family*	84 (75%)	61 (76%)	NS	21 (68%)
- Scenario B; *intravenous drug user*	19 (17%)	13 (16%)	NS	5 (16%)
- Scenario C; *child*	78 (70%)	47 (59%)	NS	19 (61%)
- Scenario D; *elderly lady*	30 (27%)	22 (28%)	NS	8 (26%)
- Scenario E; *moped collision*	60 (54%)	27 (34%)	< 0.01 *	14 (45%)
- Scenario F; *collapsed adult skier*	74 (66%)	42 (53%)	NS	20 (65%)
Reasons for reluctance towards rescue breathing in scenario A-F:				
- Fear of disease transmission:	48 (43%)	21 (26%)	< 0.05 *	7 (23%)
- Fear of performing it wrong:	7 (6%)	29 (36%)	< 0.001 *	7 (23%)
	Students with BLS training in school **-n: 272**	**Student with no BLS training in school** **- n: 103**	***p*–value Training vs. no training**	**Students with cardiac arrest experience**
Confidence on having sufficient BLS knowledge in a situation with cardiac arrest:	112 (41%)	23 (22%)	< 0.001 *	17 (55%)

***** = **Statistical significance**
NS= No significance