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Title page

What are the barriers to implementation of cardiopulmonary resuscitation training in secondary schools? A qualitative study

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ABSTRACT

Objective: Cardiopulmonary resuscitation (CPR) training in schools is recommended to increase bystander CPR and thereby survival of out-of-hospital cardiac arrest, but despite mandating legislation, low rates of implementation have been observed in several countries, including Denmark. The purpose of the study was to explore barriers to implementation of CPR training in Danish secondary schools.

Design: A qualitative study based on individual interviews and focus groups with principals and teachers. Thematic analysis was used to identify regular patterns of meaning both within and across the interviews.

Setting: Eight secondary schools in Denmark. Schools were selected using strategic sampling to reach a maximum of variation, including schools with/without recent experience in CPR training of students, public/private schools, and schools near/far from hospitals.

Participants: The study population comprised 25 participants, nine principals and sixteen teachers varying in age, prior CPR training, etc.

Results: Principals and teachers considered it important for implementation and sustainability of CPR training that teachers conduct CPR training of students. However, they preferred external instructors to train students, unless teachers acquired the CPR skills which they considered to be needed. They considered CPR training to differ substantially from other teaching subjects because it is a matter of life and death, and they thus expected extraordinary skills to be required for conducting the training. This was mainly rooted in their insecurity about own CPR skills. CPR training kits seemed to lower expectations of skill requirements to conduct CPR training, among those who were familiar with such kits.

Conclusions: To facilitate implementation of CPR training in schools, it is necessary to have clear guidelines regarding required proficiency level to train students in CPR, to provide teachers with these skills, and to underscore that extensive skills are not required to provide CPR. Further, it is important to familiarise teachers with CPR training kits.

ARTICLE SUMMARY

Strengths and limitations of this study

- The qualitative design of our study allowed us to gain in-depth and nuanced understanding of why implementation of CPR training in schools has been unsuccessful despite mandating legislation.
- We were able to reveal new important barriers, get insight into the complex relation between barriers, and to reach understanding of the underlying mechanisms related to previously identified barriers.
- We managed to obtain a broad representation of schools and interviewees, to portray different positions, and reached data saturation.
- The study did not explore how schools that currently train students in CPR implemented and conducted the training, though this could inspire and give directions for other schools.

INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a major public health problem affecting 700,000 persons in Europe and North America annually,[1, 2] and the overall survival rate is generally less than 10%.[1-3] Early initiation of cardiopulmonary resuscitation (CPR) can increase survival rates markedly,[4, 5] and this places bystanders in a central role. However, only about 30% of patients receive CPR before the arrival of the Emergency Medical Services.[4-7]

CPR training in schools has been pointed out as an essential component to raise bystander CPR rates, because it will ensure that a large proportion of the population is CPR trained.[1, 8-12] Several organizations such as the European Parliament and the World Health Organization therefore recommend CPR training in secondary schools and encourage national legislation.[1, 8-12] In 2013, a survey showed that four out of the 16 participating European countries had made CPR training an official learning outcome for primary/secondary schools,[12] and in the United States, 20 states have currently mandated CPR training as a condition for graduation for high school students.[1, 8-12] Generally, there are few guidelines as to how this training should take place (for instance, who should train the students or what proficiency level is required).

Despite mandating legislation, low rates of implementation of CPR training in schools have been observed in several countries, including Denmark, which was one of the first countries to introduce such regulation.[13-15] Thus, other barriers seem important to address in parallel to promoting legislation to ensure CPR training of students. Little is known about the reasons for the unsuccessful implementation, and knowledge on how to facilitate it is warranted.[13, 16, 17] Few studies have tried to identify barriers to implementation of CPR training in schools. These studies primarily identified organizational factors such as lack of time, funds, curriculum pressure, training materials, and teacher training, but did not provide a deeper understanding of these factors or how to change them.[13, 14, 18, 19] Following 8 years of legislation mandating CPR training, we aimed to explore barriers to implementation of CPR training in Danish

secondary schools. We used qualitative methods as they offer the possibility to provide in-depth and nuanced understanding of the barriers.

METHIODS

Study design

This is a qualitative study based on interviews with principals and teachers, since both are important actors in the implementation of changes in schools. We used qualitative methods as they can reveal new information, uncover dimensions such as beliefs, thoughts, and motivations and provide insight into complex relations,[20-22] which can be critical in order to understand what hinders the implementation of CPR training in schools. The study was conducted in 2012 at secondary schools in Denmark (6th- to 9th- grade students, age 12 to 16).

Sampling and participants

To reach a maximum of variation of the study sample, we used a strategic sampling strategy to select schools,[22] including (I) schools with and without recent experience in CPR training of students, (II) public and private schools, and (III) schools near and far from hospitals. We asked principals to participate in the study, but they could delegate participation to a middle manager; all referred to as principals. Principals were asked to select between four and eight teachers. We stopped recruiting schools, when data saturation was achieved, which is defined as the point at which no new or relevant data emerges.[21] The study was conducted at eight schools, and the study population comprised 25 participants, nine principals and sixteen teachers. They varied in age, prior CPR training, and other background variables (Table 1). Two principals and seven teachers had never taken a CPR course.

Table 1: Main characteristics of the study participants

		Principals n=9	Teachers n=16
		n	n
Sex	Women	2	12
	Men	7	4
Age	< 55	5	8

	≥ 55	4	8
	Mean	53 years	46 years
Years teaching	< 15	3	9
	≥ 15	6	7
CPR course	Yes, incl. AED use	1	3
	Yes, excl. AED use	6	6
	No	2	7
Position	Principal	5	-
	Administrative manager	2	-
	Section manager	2	-

CPR: cardiopulmonary resuscitation.

AED: automatic external defibrillator.

- indicates that the information is irrelevant for the specific group.

Data collection

The two primary investigators (LZ, CMH) carried out individual interviews with principals and one interview with two principals from the same school, along with four focus group interviews with three to five teachers in each group and one individual interview with a teacher. The interviews were conducted at the schools. The semi-structured interview protocol was developed by discussion in the research group and was inspired by the theory of planned behaviour, using concepts such as perceived behavioural control,[23] and by existing literature exploring barriers to implementation of CPR training in school.[13, 14, 18] We also included questions on beliefs about CPR outside the school context and were open and flexible to issues that the interviewees brought up themselves. The individual interviews lasted 45 minutes to 1½ hour, and each focus group session lasted 1½ to 2 hours.

Data analysis

Thematic analysis was used to identify regular patterns of meaning both within and across the interviews, thus allowing us to specify major themes in the material.[21, 22] The two primary investigators separately used open coding for each paragraph of the transcriptions to discover categories, characteristics, and dimensions in the material.[22] The coding was then discussed with the research group. Related categories were reduced to form major themes with subcategories. Within these themes, similarities and differences in the statements both within and across interviews were identified. Selections of quotes were based on how well they illustrated and elucidated the themes and important points identified in the complete material.

Ethics

All participants were informed about the aim of the study and were assured that participation was voluntary, results would be anonymous, and we had no intention of evaluating any specific school, principal, or teacher. No financial incentives were offered to the participants. The study was approved by the Danish Data Protection Agency J.nr. 2012-54-0217 for safe handling and storing of data. In Denmark this type of study does not require formal ethical approval.

RESULTS

CPR was currently taught in four of the eight schools, and systematically in one school. The four schools without CPR training did not correspond to the schools without knowledge of the legislation or to private schools (Table 2), to which the legislation does not fully apply, demonstrating that other barriers are important to implementation of CPR training. Although principals and teachers had a positive attitude towards the idea of CPR training in school, their numerous obligations and general lack of time raised questions as to whether they would prioritize it, as they prioritized core subjects such as math and English. Nevertheless, other subjects of the same status as CPR training such as sex education and bicycle Safety Education were already systematically implemented. We identified three main themes covering barriers to CPR training which offer explanations to the low implementation rate: (I) insecurity about own CPR instruction skills, (II) insecurity about own CPR skills and (III) organization of CPR training, which are all interrelated.

Table 2: CPR training at the participating schools, the study populations' knowledge of the legislation, and school type (private/public).

School	Current CPR training	Knowledge of legislation		School type
		Principal	Teachers	
1	Yes	Yes	Yes	Public
2	Yes	No	-	Public
3	Yes	No	Some	Public
4	Yes	No	-	Private
5	No	Yes	Yes	Private
6	No	Yes	Some	Public
7	No	Yes	Some	Public
8	Principal does not know	Yes	-	Public

CPR indicates cardiopulmonary resuscitation.

AED indicates automatic external defibrillator.

- indicates that teachers were not interviewed at these schools.

Insecurity about one's own CPR instruction skills

Principals and teachers considered it important for implementation and sustainability of CPR training that teachers conduct CPR training of students. However, they thought that teachers were currently incapable of training students. Illustrative of this finding one principal stated:

> I could also say that we must teach all our students to swim, and that would also depend on the number of teachers who already know how to swim, and how many have passed the swim test. (Principal)

Also, a CPR course was not necessarily regarded as sufficient to enable teachers to conduct CPR training of students. CPR training was perceived to be unlike other teaching subjects because it is a matter of life and death, and teaching students correct and adequate CPR skills was thus perceived to be of critical importance. Teachers' CPR skills were therefore regarded as extraordinarily important. Principals and teachers considered an up-to-date CPR course of a certain length (e.g., more than four hours) a prerequisite to train students. Still, not all would feel capable because of fear of teaching the students something wrong. As one of the teachers described it:

> Imagine if I taught the students something wrong. I could not bear that. Imagine if I had shown a student something wrong, and they performed CPR that actually made it worse. I would never be able to forgive myself. (Teacher who attended a CPR course 1½ years ago)

Some even argued teachers should be certified instructors to train students. The few interviewees who did not think extensive skill requirements were needed to train students were confident about training students in CPR. With high expectations followed expectations of high costs needed to qualify teachers to train students,

because it shaped their thoughts about length, type, and frequency of courses needed or costs needed to hire external experts.

Insecurity about one's own CPR skills

Principals' and teachers' general considerations about CPR played an important role in relation to their insecurity about own ability to train students in CPR. They felt a moral obligation to act in case they witnessed a cardiac arrest, but lacked confidence in their own CPR skills which were related to three aspects concerning skill requirements: CPR skills need to be acquired, CPR guidelines frequently change, and CPR skills rapidly decline. (1) The interviewees considered it necessary to acquire CPR skills through a CPR course. This is illustrated by a principal saying:

> Personally, I should have enrolled myself in the [CPR] course. I probably should have. I cannot perform CPR, and I wish I could. (Principal)

(2) The interviewees described how the CPR algorithm and specific parts of the algorithm had changed during their lifetime (e.g. removal of hitting the chest and changes in the compression-to-ventilation ratio). It was considered essential for survival to perform CPR in accordance with the latest guidelines. As one teacher said:

> There you go, 30:2, yes okay. There has been a breakthrough in terms of knowledge, and such things may be crucial. So I do not feel competent, because I do not have the latest knowledge. (Teacher)

(3) CPR skills were considered to decline rapidly, and skills acquired from former CPR courses were considered invalid. As one of the teachers explained it:

> I have actually completed a big first aid course three times with exams and everything, and I have done it again, because I simply cannot remember it. Now, I cannot remember it again, because it has been ten years since my last course. (Teacher)

Principals' and teachers' perception of extensive requirements to perform CPR and insecurity with own CPR skills were transferred to their thoughts about training students, and can thus be identified as a barrier to implementation of CPR training of students. Few other interviewees took another position "You cannot make mistakes". The man is dead. You cannot kill him". These were more confident in their own CPR skills and were more self-confident about training students, and it seemed to be regardless of previous CPR training.

Organization of CPR training

Type of instructor

Principals and teachers were reluctant to train students in CPR unless they acquired the skills they thought were needed to be able to conduct the training. Otherwise an external instructor was considered strictly necessary. Due to the extensive proficiency level principals and teachers expected, some thought teachers would not be able to train students as well as external instructors, irrespective of provision of CPR training:

> It results in a greater impact for students if an external instructor comes. Even if the teachers get a [CPR] course, there will always be questions they cannot answer. And when people and teachers feel that there are things they cannot answer, then it [the training] may not be that convincing. (Principal)

On the other hand, interviewees believed teachers were more qualified when it came to pedagogical skills needed to carry out the training. Also, they emphasized it would reduce scheduling difficulties with external instructors and expenses to hire them were and result in more sustainable CPR training. However, expenses for CPR training of teachers were also viewed as important. As an alternative to limit expenses, interviewees suggested CPR training could be organized by having CPR coordinators (teachers) at the school, arguing that not all teachers needed these skills to educate all students in CPR. Nevertheless, some teachers also opposed to this, because it was assumed that having a CPR coordinator meant that not all teachers would receive the CPR training courses they requested in order to be able to deal with emergency situations occurring at the school (for their own skills and not training students).

Training material

Training material was considered essential to train students in CPR. Training kits including a video-based self-instruction seemed to lower principals and teachers expectations of skill requirements to conduct CPR training, among those who were familiar with them. This is illustrated by a teacher explaining how the DVD took over the role as the main teacher, and thus requiring fewer skills by the instructor:

> You are not responsible for teaching and introducing it all. The DVD does that (...). We do not need to perform so much, we become more like assisting teachers, you may say. (Teacher)

Some of those familiar with CPR training kits even stated that everyone could teach CPR, regardless of CPR skills, if provided with such training material. Nevertheless, others also familiar with CPR training kits, emphasized that they themselves and others would feel more comfortable if they were provided with a CPR course and acknowledged that even so, some would not feel capable of training students in CPR. Principals and teachers not familiar with CPR training kits explained that they would not try to use such material, unless feeling confident that they possessed the required CPR skills, and they had expectations of extensive skill requirements. There was some resistance towards video-based training as some considered it too artificial and less effective. This attitude was also present among interviewees familiar with the material. Further, many did not know CPR training kits was available to Danish schools free of charge.

DISCUSSION

Main findings

This is the first study to provide in-depth information about barriers needed to address to ensure CPR training in schools. Our main findings were that principals and teachers considered it important for implementation and sustainability of CPR training that teachers conduct CPR training of students. However, they preferred external instructors to train students, unless teachers acquired the CPR skills which they considered to be needed. They considered CPR training to differ substantially from other teaching subjects because it is a matter of life and death, and they thus expected extraordinary skills to be required for conducting CPR training of students. This was mainly rooted in their insecurity about own CPR skills. CPR training kits seemed to lower expectations of skill requirements to conduct CPR training, among those who were familiar with such kits.

Strengths and weaknesses of this study

The qualitative design of our study allowed us to gain in-depth and nuanced understanding of why implementation of CPR training has been unsuccessful despite mandating legislation. We were able to reveal new important barriers (e.g. that principals and teachers believe that extraordinary skills are required for conducting CPR training of students), get insight into the complex relation between barriers (e.g. that principals and teachers expectations of extensive skill requirements to perform CPR and the accompanying insecurity with own CPR skills is transferred to their thoughts about training students), and to reach understanding of the underlying mechanisms related to previously identified barriers (e.g. the underlying mechanisms to the barrier lack of teacher training). We managed to obtain a broad representation of schools and interviewees, to portray different positions, and reached data saturation. Further, teachers who volunteered to participate did not differ from those who were pointed out by their principal according to their views on CPR training. Nevertheless, the views of the participating principals and teachers could differ from those who did not. The study did not explore how schools that currently train students in CPR implemented

and conducted the training, though this could inspire and give directions for other schools. As such this is a question for further research.

Comparison with existing literature

The current literature emphasizes lack of time, funds, curriculum pressure, training materials, and teacher training as barriers for implementation of CPR training in schools.[13-15, 18, 19] Our study is in accordance with these findings but importantly, our findings provide novel information to understand and target these previously identified barriers and also identified previously unknown barriers. For instance, our findings that teachers and principals feel they lack CPR knowledge and training (proficiency), which then generates insecurity about training students, is paramount to understand why CPR training has not been successfully implemented. Our study further contributes with understanding of the underlying mechanisms related to why and how principals' and teachers' insecurities affect their behaviour towards CPR training.

In many countries schoolteachers are expected to conduct CPR training of students, including in Denmark, France and Belgium.[15, 24, 25] Also, health care professionals argue that the skills can be learned quickly by teachers and recommend that teachers should provide CPR training, because they can generate more sustainable training.[14, 17, 25, 26] Importantly, we found that generally teachers and principals agree that teachers should conduct this training, but only if they acquire the CPR skills they consider to be needed. Otherwise, external instructors were considered strictly necessary. We found that principals and teachers are very insecure about their own proficiency level and whether they are competent enough to train students. This do not seem to be restricted to Denmark, since previous studies have found that teachers do not feel they have the required training to deliver CPR training, [15, 19] and that most principals think CPR training should be provided by external instructors[27]. But in these studies, the underlying mechanisms for this were not described. Our study shows that principals and teachers expect that extensive CPR instruction skills are required to train students. A previous CPR course was for example not regarded as sufficient by many. This might also explain why teachers have been found to be unwilling to train students,[24, 28] despite a high interest in CPR training among them,[27, 28] and despite previous CPR training.[24] The mismatch in expectations of skill requirements between health care professionals and school staff is a key finding to

understanding the barriers to implementing CPR training in school. There is currently no evidence or guidelines for schools, regarding what proficiency level is required to train students in CPR, or who should conduct the training. Further, our study indicates that training kits including a video-based self-instruction has the potential to increase teachers' confidence in training students in CPR, as such kits seemed to lower their expectations of skill requirements. Importantly, this was only expressed among those familiar with training kits. They did not think a previous CPR course was strictly necessary to conduct CPR training, while this was unthinkable for those not familiar with such training kits.

Our finding on the link between perceived CPR instruction skills and perceived ability to perform CPR are not restricted to Denmark. A Belgian study found that the majority of teachers willing to teach CPR felt capable to act in a cardiac arrest situation.[24] However, only 34% of teachers felt capable to provide CPR. Also among those with previous CPR training only 47% felt capable.[24] Our study provides new insight to this, as we show that principals and teachers insecurity with their own ability to perform CPR is shaped by expectations of comprehensive skill requirements and because they consider CPR skills acquired from former CPR courses to be outdated. Medical experts recommend that a skills assessment and, if required a skills refresher course should be undertaken more often than every 12–24 months.[29] Our study suggests that a strict focus on correct CPR skills may cause laypersons to doubt their own CPR skills which is supported by previous studies showing that fear of performing CPR incorrectly decreases the willingness of bystanders to start CPR.[29, 30] Our study suggests that this also decreases CPR training in schools. Importantly, regular retraining might not be necessary for bystander CPR to be effective.[31]

Implications for practice and policy

It is a public health goal that all students receive CPR training to raise bystander CPR rates and thereby increase survival after out-of-hospital cardiac arrest. This study clearly demonstrates a need for specification of what is required to be qualified to train students in CPR, to communicate this to the schools, and to provide teachers with these skills in order to achieve this goal. It is paramount to address principals' and teachers' expectations of extensive skill requirements for conducting CPR training of students and their

insecurity with own CPR instruction skills. In line with this, there is a great need to simplify messages about skill requirements to perform CPR and emphasize the importance of providing CPR, regardless of correct CPR technique. This is important, because principals' and teachers' expectations of extensive skill requirements to perform CPR and the accompanying insecurity with own CPR skills is transferred to their thoughts about training students, and thus becomes a barrier to implementation of CPR training of students. Last, this study showed that it is important to familiarise teachers with training kits, because the kits seemed to lower principals and teachers expectations of skill requirements to conduct CPR training, among those who were familiar with them.

Conclusions

Principals and teachers considered it important for sustainability of CPR training that teachers conduct CPR training of students. However, they preferred external instructors, unless teachers acquired the CPR skills which they considered to be needed. They expected that extraordinary skills are required, because they regarded CPR training of students to differ substantially from other teaching subjects since it is a matter of life and death. This is mainly rooted in their insecurity about own CPR skills. To facilitate implementation of CPR training in schools, it is necessary to have clear guidelines regarding required proficiency level to train students in CPR, to provide teachers with these skills, and to underscore that extensive skills are not required to provide CPR. Further, it is important to familiarise teachers with CPR training kits.

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Competing interest

The authors declare that there is no conflict of interests.

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Contributors

LZ drafted the manuscript, recruited participants, and transcribed the interviews. LZ and CMH collected the data. LZ, CMH, TTT, FF and CTP were involved in the study conception and design. LZ, CMH, TTT and MH analysed the data. All authors took part in interpretation of the data, have critically revised the manuscript and approved the final manuscript.

Data sharing statement

No additional data are available.

Ethics approval

The study was approved by the Danish Data Protection Agency J.nr. 2012-54-0217. In Denmark this type of study does not require formal ethical approval.

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Title page

What are the barriers to implementation of cardiopulmonary resuscitation training in secondary schools? A qualitative study

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ABSTRACT

Objective: Cardiopulmonary resuscitation (CPR) training in schools is recommended to increase bystander CPR and thereby survival of out-of-hospital cardiac arrest, but despite mandating legislation, low rates of implementation have been observed in several countries, including Denmark. The purpose of the study was to explore barriers to implementation of CPR training in Danish secondary schools.

Design: A qualitative study based on individual interviews and focus groups with school leadership and teachers. Thematic analysis was used to identify regular patterns of meaning both within and across the interviews.

Setting: Eight secondary schools in Denmark. Schools were selected using strategic sampling to reach maximum variation, including schools with/without recent experience in CPR training of students, public/private schools, and schools near/far from hospitals.

Participants: The study population comprised 25 participants, nine school leadership members and sixteen teachers.

Results: School leadership and teachers considered it important for implementation and sustainability of CPR training that teachers conduct CPR training of students. However, they preferred external instructors to train students, unless teachers acquired the CPR skills which they considered to be needed. They considered CPR training to differ substantially from other teaching subjects because it is a matter of life and death, and they thus expected extraordinary skills to be required for conducting the training. This was mainly rooted in their insecurity about own CPR skills. CPR training kits seemed to lower expectations of skill requirements to conduct CPR training, but only among those who were familiar with such kits.

Conclusions: To facilitate implementation of CPR training in schools, it is necessary to have clear guidelines regarding required proficiency level to train students in CPR, to provide teachers with these skills, and to underscore that extensive skills are not required to provide CPR. Further, it is important to familiarise teachers with CPR training kits.

ARTICLE SUMMARY

Strengths and limitations of this study

- The qualitative design of our study allowed us to gain an in-depth and nuanced understanding of why implementation of CPR training in schools has been unsuccessful despite mandating legislation.
- We were able to reveal new important barriers, get insight into the complex relationship between barriers, and to reach an understanding of the underlying mechanisms related to previously identified barriers.
- We managed to obtain a broad representation of schools and interviewees, to portray different positions, and reached data saturation.
- The study did not explore how schools currently providing CPR training of students had implemented and conducted the training, though this could inspire and give directions for other schools.

INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a major public health problem affecting 700,000 persons in Europe and North America annually,[1, 2] and the overall survival rate is generally less than 10%.[1-3] Early initiation of cardiopulmonary resuscitation (CPR) can increase survival rates markedly,[4, 5] and this places bystanders in a central role. However, only about 30% of patients receive CPR before the arrival of the Emergency Medical Services.[4-7]

CPR training in schools has been identified as an essential component to raise bystander CPR rates, because it will ensure that a large proportion of the population is CPR trained.[1, 8-12] Several organizations such as the European Parliament and the World Health Organization therefore recommend CPR training in secondary schools and encourage national legislation.[1, 8-12] In 2013, four out of16 surveyed European countries had made CPR training an official learning outcome for primary/secondary schools,[12] and in the United States, 20 states have currently mandated CPR training by graduation of high school.[1, 8-12]

Denmark was one of the first countries to approve mandating legislation on CPR training in schools, stating students should receive the training before graduation of secondary school.[13, 14] As in many other countries, Danish legislation provides no guidance regarding who should train the students, required trainer proficiency level, training material, training time, which part of the school curriculum CPR training should be integrated in, or the source of funding. The importance of a framework providing such guidance has been underscored.[15] The schools do not receive any financial benefits for adhering to the mandate of providing CPR training and there are no formally approved repercussions for not adhering. Nevertheless, it is the responsibility of the school leadership to implement the state law.[13]

Despite mandating legislation, low rates of implementation of CPR training in schools have been observed in several countries, including Denmark.[16, 17] Thus, other barriers seem important to address in parallel to promoting legislation to ensure CPR training of students. Little is known about the reasons for the unsuccessful implementation, and knowledge on how to facilitate CPR training in schools is warranted.[15, 16, 18] Few studies have tried to identify barriers to implementation of CPR training in schools. These

studies primarily identified organizational factors such as lack of time, funds, curriculum pressure, training materials, and teacher training, but did not provide a deeper understanding of these factors or how to change them.[16, 19-21] Following 8 years of legislation mandating CPR training, we aimed to explore barriers to implementation of CPR training in Danish secondary schools. We used qualitative methods as they offer the possibility to provide an in-depth and nuanced understanding of the barriers.

METHIODS

Study design

This is a qualitative study based on interviews with school leadership and teachers, since both are important actors in the implementation of changes in schools. We used qualitative methods as they can reveal new information, uncover dimensions such as beliefs, thoughts, and motivations and provide insight into complex relations,[22-24] which can be critical in order to understand what hinders the implementation of CPR training in schools. The interviews were conducted during November 2012 to January 2013 at secondary schools in Denmark (6th- to 9th- grade students, age 12 to 16).

Sampling and participants

To reach maximum variation of the study sample, we used strategic sampling strategy to select schools,[24] including (I) schools with and without recent experience in CPR training of students, (II) public and private schools, and (III) schools near and far from hospitals. We asked principals to participate in the study through a telephone call, but they could delegate participation to a middle manager (e.g. administrative managers and section managers), if relevant according to their area of responsibility. Principals and middle managers are all referred to as school leadership. Teachers were recruited only at schools with participating school leadership. School leadership were asked to give access to between four and eight secondary school teachers We stopped recruiting schools, when data saturation was achieved, which is defined as the point at which no new or relevant data emerges.[23] The study was conducted at eight schools, and the study population comprised 25 participants, nine school leadership members and sixteen teachers. They varied in age, prior CPR training, and other background variables (Table 1). Two school leaders and seven teachers had never taken a CPR course.

Table 1: Main characteristics of the study participants

	School leadership n=9	Teachers n=16
	n	n

Sex	Women	2	12
	Men	7	4
Age	< 55	5	8
	≥ 55	4	8
	Mean	53 years	46 years
Years teaching	< 15	3	9
	≥ 15	6	7
CPR course	Yes, incl. AED use	1	3
	Yes, excl. AED use	6	6
	No	2	7
Position	Principal	5	-
	Administrative manager	2	-
	Section manager	2	-

CPR: cardiopulmonary resuscitation.

AED: automatic external defibrillator.

- indicates that the information is irrelevant for the specific group.

Only three out of 16 teachers had conducted CPR training of students, all three using a CPR training kit including a video-based self-instruction. One of these teachers, who were a certified instructor, had also provided a full week basic life support training to students without using such a kit. Another three teachers and one school leader had observed CPR training of students.

Data collection

The two primary investigators (LZ, CMH) carried out individual interviews with school leadership and one interview with two school leaders from the same school, along with four focus group interviews with three to five teachers in each group and one individual interview with a teacher. The interviews were conducted at the schools, and field notes were made following the interviews. School leadership and teachers were interviewed separately due to the power imbalance between them. Individual interviews with school

leadership were chosen due to logistical considerations. Further, they are well suited for sensitive topics,[23, 24] which admitting not having implemented mandatory CPR training may be. Focus group interviews with teachers were preferred, because they elucidate different positions and uncover the degree of consensus or diversity on a topic. Participants can present their own views and comment on others, responses can be compared, and positions can evolve in the interaction during the interview.[23, 24] The semi-structured interview protocol (in supplement) was developed by discussion in the research team including professionals from anthropology (TTT, MHR), medicine (CMH, FF, CTP), and public health (LZ) and was inspired by the theory of planned behaviour, using concepts such as perceived behavioural control,[25] and by existing literature exploring barriers to implementation of CPR training in school.[16, 19, 20] We also included questions on beliefs about CPR outside the school context and were open and flexible to issues that the interviewees brought up themselves. The interview protocol used for school leadership and teachers only differed marginally. The individual interviews lasted 45 minutes to 1½ hour, and each focus group session lasted 1½ to 2 hours. All interviews were audio-recorded and transcribed (LZ).

Data analysis

The analysis, taking an inductive descriptive approach, was data-driven and guided by conventional thematic analysis strategies identifying regular patterns of meaning both within and across the interviews, thus allowing us to specify major themes in the material.[23, 24] The transcripts were read repeatedly by the two primary investigators (LZ, CMH) to get an overall impression and become familiar with the diversity of the data. They separately used open coding for each paragraph of the transcriptions to discover categories, characteristics, and dimensions in the material,[24] and met to discuss and refine the categories. The coding was then discussed with the research team (LZ, CMH, TTT, MHR), and related categories were reduced to form major themes with subcategories. Each interview was coded (LZ) applying a colour for each theme. Each colour/theme was transferred to another document and colour divided into subthemes. Within these (sub)themes, similarities and differences in the statements both within and across interviews were identified. Selections of quotes were based on how well they illustrated and elucidated the themes and important points identified in the complete material.

Ethics

Verbal consent was obtained from all individual persons participating in the study. All participants were informed about the aim of the study and were assured that participation was voluntary, results would be anonymous, that we had no intention of evaluating any specific school, school leader, or teacher, and that refusal of participation would be without any consequences. Only persons attached to the research team had access to the data, and full names of the participants were kept separated from the transcripts. The study was approved by the Danish Data Protection Agency J.nr. 2012-54-0217 for safe handling and storing of data. In Denmark this type of study does not require formal ethical approval hereunder written consent.[26]

RESULTS

Four schools were currently teaching students in CPR. However, only one of these schools was providing CPR training systematically and ensuring all students were trained in CPR before graduating secondary school. At the three other schools CPR training seemed to be unorganized, irregular and coincidental. Not all interviewees knew CPR training of students was mandatory. At the schools without CPR training, the school leader knew about the legislation. Further, only one of the schools without CPR training was a private school, to which the legislation does not fully apply (Table 2). This demonstrates that other barriers, besides lack of knowledge about CPR legislation, is important to implementation of CPR training.. Although school leadership and teachers had a positive attitude towards the idea of CPR training in schools, their numerous obligations and general lack of time raised questions as to whether they would prioritize it, as they prioritized core subjects such as math and English. Nevertheless, other subjects of the same status as CPR training such as sex education and bicycle Safety Education were already systematically implemented. We identified three main themes covering barriers to CPR training: (I) insecurity about own CPR instruction skills, (II) insecurity about own CPR skills and (III) organization of CPR training, which are all interrelated.

Table 2: CPR training at the participating schools, the study populations' knowledge of the legislation, and school type (private/public).

School	Current CPR training	Knowledge of legislation		School type
		School leadership	Teachers	
1	Yes	Yes	Yes	Public
2	Yes	No	-	Public
3	Yes	No	Some	Public
4	Yes	No	-	Private
5	No	Yes	Yes	Private
6	No	Yes	Some	Public

7	No	Yes	Some	Public
8	School leader does not know	Yes	-	Public

CPR indicates cardiopulmonary resuscitation.

AED indicates automatic external defibrillator.

- indicates that teachers were not interviewed at these schools.

Insecurity about one's own CPR instruction skills

School leadership and teachers considered it important for implementation and sustainability of CPR training that teachers conduct CPR training of students. However, they thought teachers were currently incapable of training students. Illustrative of this finding a school leader and teacher stated:

> I could also say that we must teach all our students to swim, and that would also depend on the number of teachers who already know how to swim, and how many have passed the swim test. (School leader, school 3)

> I would not be able to do it. I would not be able to teach that [CPR]. I would have no idea about how to do it. (Teacher 1, school 6)

A CPR course including practical training was considered essential to train students in CPR. A teacher expressed this by saying:

> I know it's a bad comparison, but in your medical terms it may serve as a good illustration. You can also read about surgery, but it would be nice to have tried to use a scalpel. This is how I would feel. I'd feel much the same way. (Teacher 2, school 6)

However, a CPR course was not necessarily regarded as sufficient to enable teachers to conduct CPR training of students. CPR training was perceived to be unlike other teaching subjects because it is a matter of life and death, and teaching students correct and adequate CPR skills was thus perceived to be of critical importance. Teachers' CPR skills were therefore regarded as extraordinarily important. School leadership

and teachers considered an up-to-date CPR course of a certain length (e.g., more than four hours) a prerequisite to train students. Still, not all would feel capable because of fear of teaching the students something wrong. As one of the teachers described it:

> Imagine if I taught the students something wrong. I could not bear that. Imagine if I had shown a student something wrong, and they performed CPR that actually made it worse. I would never be able to forgive myself. (Teacher 3, who attended a CPR course 1½ years ago, school 7)

Some even argued teachers should be certified instructors to train students. The few interviewees who did not think extensive skill requirements were needed to train students were confident about training students in CPR. With high expectations followed expectations of high costs needed to qualify teachers to train students, because it shaped their thoughts about length, type, and frequency of courses needed or costs needed to hire external experts.

Insecurity about one's own CPR skills

School leadership and teachers' general considerations about CPR played an important role in relation to their insecurity about own ability to train students in CPR. They felt a moral obligation to act in case they witnessed a cardiac arrest, but lacked confidence in their own CPR skills which were related to three aspects concerning skill requirements: CPR skills need to be acquired, CPR guidelines frequently change, and CPR skills rapidly decline. (1) The interviewees considered it necessary to acquire CPR skills through a CPR course. This is illustrated by a school leader who said:

> Personally, I should have enrolled myself in the [CPR] course. I probably should have. I cannot perform CPR, and I wish I could. (School leader, school 7)

(2) The interviewees described how the CPR algorithm and specific parts of the algorithm had changed during their lifetime (e.g. removal of hitting the chest and changes in the compression-to-ventilation ratio). It was considered essential for survival to perform CPR in accordance with the latest guidelines. As two teachers said:

> There you go, 30:2, yes okay. There has been a breakthrough in terms of knowledge, and such things may be crucial. So I do not feel competent, because I do not have the latest knowledge. (Teacher 2, school 6)

> Skills in relation to this [CPR]. It is important in terms of whether people survive. So it is rather important to do it correctly. (Teacher 3, school 3)

(3) CPR skills were considered to decline rapidly, and skills acquired from former CPR courses were considered invalid. As one of the teachers explained it:

> I have actually completed a big first aid course three times with exams and everything, and I have done it again, because I simply cannot remember it. Now, I cannot remember it again, because it has been ten years since my last course. (Teacher 2, school 7)

One school leader even expressed that laypersons could not be expected to perform CPR, but only health professionals should do it. Laypersons' most important role was calling for professional help:

> Who do I get? How do I quickly get professional help? This must be the most important task, and then you could also say that it would also be good if there was someone who could perform CPR. But I do not think it is something you can expect. (School leader, school 4)

School leadership and teachers' perception of extensive requirements to perform CPR and insecurity with own CPR skills were transferred to their thoughts about training students, and can thus be identified as a barrier to implementation of CPR training of students. Few other interviewees took another position as illustrated by a teacher saying:

> You cannot make mistakes. The man is dead. You cannot kill him. (Teacher 4, school 1)

These interviewees were more confident in their own CPR skills and were more self-confident about training students, and it seemed to be regardless of previous CPR training.

Organization of CPR training

Type of instructor

School leadership and teachers were reluctant to train students in CPR unless they acquired the skills they thought were needed to be able to conduct the training. Otherwise an external instructor was considered strictly necessary. Due to the extensive proficiency level school leaders and teachers expected, some thought teachers would not be able to train students as well as external instructors, irrespective of prior CPR training:

> It results in a greater impact for students if an external instructor conducts the training. Even if the teachers get a [CPR] course, there will always be questions they cannot answer. And when people and teachers feel there are things they cannot answer, then it [the training] may not be that convincing. (School leader, school 4)

On the other hand, interviewees believed teachers were more qualified when it came to pedagogical skills needed to carry out the training. Also, they emphasized it would reduce scheduling difficulties with external instructors and expenses to hire them and result in more sustainable CPR training. However, expenses for CPR training of teachers were also viewed as important. As an alternative to limit expenses, interviewees suggested CPR training could be organized by having CPR coordinators (teachers) at the school, arguing that not all teachers needed these skills to educate all students in CPR. This is illustrated by a teacher saying:

> We do not all need to have the same skills. That's why we have each other. We can draw on each other's skills. So we do not need that. We cannot all be woodwork teachers either, or German teachers. When we are going to teach something with German, we ask the German teacher. (Teacher 4, school 1)

Nevertheless, some teachers also opposed to this, because it was assumed that having a CPR coordinator meant that not all teachers would receive the CPR training courses they requested in order to be able to deal with emergency situations occurring at the school (for their own skills and not training students).

Training material

Training material was considered essential to train students in CPR. Training kits including a video-based self-instruction seemed to lower school leaders' and teachers' expectations of skill requirements to conduct

CPR training, among those who were familiar with them. This is illustrated by a teacher explaining how the DVD took over the role as the main teacher, thus requiring fewer skills by the instructor:

> You are not responsible for teaching and introducing it all. The DVD does that (...). We do not need to perform so much, we become more like assisting teachers, you may say. (Teacher 2, school 1)

Some of those familiar with CPR training kits even stated that everyone could teach CPR, regardless of CPR skills, if provided with such training material. Nevertheless, others also familiar with CPR training kits, emphasized that they themselves and others would feel more comfortable if they were provided with a CPR course and acknowledged that even so, some would not feel capable of training students in CPR. School leadership and teachers not familiar with CPR training kits explained that they would not try to use such material, unless feeling confident that they possessed the required CPR skills. There was some resistance towards video-based training as some considered it too artificial and less effective. This attitude was also present among interviewees familiar with the material. Further, many did not know CPR training kits were available to Danish schools free of charge.

DISCUSSION

Main findings

This is the first study to provide in-depth information about barriers needed to address to ensure CPR training in schools. Our main findings were that school leadership and teachers considered it important for implementation and sustainability of CPR training that teachers conduct CPR training of students. However, they preferred external instructors to train students, unless teachers acquired the CPR skills which they considered to be needed. They considered CPR training to differ substantially from other teaching subjects because it is a matter of life and death, and they thus expected extraordinary skills to be required for conducting CPR training of students. This was mainly rooted in their insecurity about own CPR skills. CPR training kits seemed to lower expectations of skill requirements to conduct CPR training, but only among the few who were familiar with such kits.

Strengths and weaknesses of this study

The qualitative design of our study allowed us to gain an in-depth and nuanced understanding of why implementation of CPR training has been unsuccessful despite mandating legislation. We were able to reveal new important barriers (e.g. that school leadership and teachers believe extraordinary skills are required for conducting CPR training of students), get insight into the complex relationship between barriers (e.g. that school leadership and teachers expectations of extensive skill requirements to perform CPR and the accompanying insecurity with own CPR skills is transferred to their thoughts about training students), and to reach an understanding of the underlying mechanisms related to previously identified barriers (e.g. the underlying mechanisms to the barrier lack of teacher training). We managed to obtain a broad representation of schools and interviewees, to portray different positions, and reached data saturation. Nevertheless, the views of the participating school leadership and teachers could differ from those who did not participate. The study did not explore how schools currently providing CPR training of students had implemented and conducted the training, though this could inspire and give directions for other schools. As such this is a question for further research.

Comparison with existing literature

Current literature emphasizes lack of time, funds, curriculum pressure, training materials, and teacher training as barriers for implementation of CPR training in schools.[16, 17, 19-21] Our study is in accordance with these findings but importantly, our findings provide novel information to understand and target these previously identified barriers and also identified previously unknown barriers.

In many countries schoolteachers are expected to conduct CPR training, including in Denmark.[17, 27, 28] Also, health care professionals argue that skills can be learned quickly and recommend teachers should provide CPR training, because they can generate more sustainable training.[15, 19, 28, 29] Importantly, we found that generally teachers and school leadership agree teachers should conduct this training, but only if they acquire the CPR skills they consider to be needed. Otherwise, external instructors were considered strictly necessary. Our findings that school leadership and teachers are very insecure about their own proficiency level and whether they are competent enough to train students do not seem to be restricted to Denmark. Previous studies reported teachers did not feel they had the required training to deliver CPR training, [17, 21] and most school leaders thought CPR training should be provided by external instructors[30], but the studies did not describe the underlying mechanisms for this. Our findings that school leadership and teachers expect extensive CPR instruction skills are required to train students might explain why teachers have been found to be unwilling to train students,[27, 31] despite a high interest in CPR training,[30, 31] and despite previous CPR training.[27] The mismatch in expectations of skill requirements between health care professionals and school staff is a key finding to understanding the barriers to implementing CPR training in schools. There are currently no clear guidelines for schools regarding what proficiency level is required to train students in CPR, or who should conduct the training.

Previous studies have identified training material as important for implementation of CPR training.[19, 21] Our study indicates training kits including a video-based self-instruction have the potential to increase teachers' confidence in training students in CPR, as such kits seemed to lower their expectations of skill requirements. However, this was only expressed among those familiar with training kits. It is problematic that many interviewees did not know such training kits were available to Danish schools free of charge.

Several organizations offer different types of training material to schools and CPR courses for students and teachers in a varying price range. There is no overview of this to schools.

Our finding on the link between perceived CPR instruction skills and perceived ability to perform CPR are not restricted to Denmark. A Belgian study found that the majority of teachers willing to teach CPR felt capable to act in a cardiac arrest situation.[27] However, only 34% of teachers felt capable of providing CPR, and only 47% among those with previous CPR training .[27] Our study provides new insight to this, as we show that school leaders' and teachers' insecurity with their own ability to perform CPR is shaped by expectations of comprehensive skill requirements and because they consider CPR skills acquired from former CPR courses to be outdated. Medical experts recommend a skills assessment and, if required, a skills refresher course should be undertaken more often than every 12–24 months.[32] Our study suggests a strict focus on correct CPR skills may cause laypersons to doubt their own CPR skills which is supported by previous studies showing that fear of performing CPR incorrectly decreases the willingness of bystanders to start CPR[32, 33] and may hinder CPR training in schools. Importantly, regular retraining might not be necessary for bystander CPR to be effective.[34] To simplify skill requirements for lay bystanders the American Heart Association and the European Resuscitation Council introduced compression-only (or hands-only) CPR in 2010 for untrained or not proficient bystanders under some circumstances.[35-38] The Danish Resuscitation Council has, however, not included compression-only in their guidelines.[39] Nevertheless, we found that awareness of frequently changing guidelines contributed to the interviewee's insecurity, thus compression-only CPR may not necessarily enable school leaders and teachers to feel more competent.

Implications for practice and policy

It is a public health goal that all students receive CPR training to raise bystander CPR rates and thereby increase survival after OHCA. This study clearly demonstrates a need for specification of what is required to be qualified to train students in CPR, to communicate this to the schools, and to provide teachers with these skills in order to achieve this goal. It is paramount to address school leaders' and teachers' expectations of

extensive skill requirements for conducting CPR training of students and their insecurity with own CPR instruction skills. In line with this, there is a great need to simplify messages about skill requirements to perform CPR and emphasize the importance of providing CPR, regardless of correct CPR technique. Lastly, it is important to familiarise teachers with training kits.

Conclusions

School leadership and teachers considered it important for sustainability of CPR training that teachers conduct CPR training of students. However, they preferred external instructors, unless teachers acquired the CPR skills which they considered to be needed. They expected extraordinary skills are required to conduct CPR training, because they regarded this to differ substantially from other teaching subjects since it is a matter of life and death. This was mainly rooted in their insecurity about own CPR skills. To facilitate implementation of CPR training in schools, it is necessary to have clear guidelines regarding required proficiency level to train students in CPR, to provide teachers with these skills, and to underscore that extensive skills are not required to provide CPR. Further, it is important to familiarise teachers with CPR training kits.

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Competing interest

The authors declare that there is no conflict of interests.

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Contributors

LZ drafted the manuscript, recruited participants, and transcribed the interviews. LZ and CMH collected the data. LZ, CMH, TTT, FF and CTP were involved in the study conception and design. LZ, CMH, TTT and MH analysed the data. All authors took part in interpretation of the data, have critically revised the manuscript and approved the final manuscript.

Data sharing statement

No additional data are available.

Ethics approval

The study was approved by the Danish Data Protection Agency J.nr. 2012-54-0217. In Denmark this type of study does not require formal ethical approval.[26]

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COREQ check-list

No	Item	Guide questions/description	Page number in the manuscript file named 'revised manuscript changes marked'
Domain 1: Research team and reflexivity			
Personal Characteristics			
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group?	8
2.	Credentials	What were the researcher's credentials? *E.g. PhD, MD*	1
3.	Occupation	What was their occupation at the time of the study?	1
4.	Gender	Was the researcher male or female?	1
5.	Experience and training	What experience or training did the researcher have?	9
Relationship with participants			
6.	Relationship established	Was a relationship established prior to study commencement?	7
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. *personal goals, reasons for doing the research*	10
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. *Bias, assumptions, reasons and interests in the research topic*	10
Domain 2: study design			
Theoretical framework			
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? *e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis*	9
Participant selection			
10.	Sampling	How were participants selected? *e.g. purposive, convenience, consecutive, snowball*	7
11.	Method of approach	How were participants approached? e.g. *face-to-face, telephone, mail, email*	7
12.	Sample size	How many participants were in the study?	7
13.	Non-participation	How many people refused to	

		participate or dropped out? Reasons?	
Setting			
14.	Setting of data collection	Where was the data collected? e.g. *home, clinic, workplace*	7
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	No one else was present. 8/9
16.	Description of sample	What are the important characteristics of the sample? *e.g. demographic data, date*	7/8
Data collection			
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	supplemental
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	No repeat interviews were carried out. 8/9
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	9
20.	Field notes	Were field notes made during and/or after the interview or focus group?	8
21.	Duration	What was the duration of the interviews or focus group?	9
22.	Data saturation	Was data saturation discussed?	7
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	No, they were not. 9
Domain 3: analysis and findingsz			
Data analysis			
24.	Number of data coders	How many data coders coded the data?	9
25.	Description of the coding tree	Did authors provide a description of the coding tree?	Main themes. 11
26.	Derivation of themes	Were themes identified in advance or derived from the data?	9/10
27.	Software	What software, if applicable, was used to manage the data?	9/10
28.	Participant checking	Did participants provide feedback on the findings?	No, they did not. 9/10
Reporting			
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. *participant number*	11-16
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	11-16
31.	Clarity of major themes	Were major themes clearly presented in the findings?	11-16
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	11-16