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CURRENT CARE GUIDELINES FOR CARDIOPULMONARY RESUSCITATION

IMPLEMENTATION, SKILLS AND ATTITUDES

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ACADEMIC DISSERTATION

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CONTENTS

ABSTRACT

Aim: To study possible changes in resuscitation practices, especially concerning early defibrillation, the attitudes of nurses and students towards guideline implementation and the ability of nurses and students to implement the guideline recommendations in clinical practice after publication of the Current Care (CC) guidelines for cardiopulmonary resuscitation (CPR) 2002.

Material and methods: Resuscitation practices in Finnish health centres; especially concerning rapid defibrillation programmes, as well as the implementation of CC guidelines for CPR, was studied with a mail survey sent to the chief physicians of every health centre in Finland (Study I). Studies II and III compared CPR skills that require an automated external defibrillator (AED), and included Objective Stuctured Clinical Examination (OSCE) of the resuscitation skills of nurses and nursing students in Finnish and Swedish hospitals and institutions. Studies IV and V employed a survey to investigate attitudes toward CPR-D and cardiopulmonary resuscitation guidelines among medical and nursing students and secondary hospital nurses. Study VI compared nurses receiving different CPR training using a randomised trial that included an OSCE of the resuscitation skills of nurses in Finnish hospital.

Results: Nearly half of the health centres studied employed resuscitation practices with no basis on resuscitation guidelines at all, whereas 40.7% used CC guidelines for CPR, and a minority used international or other guidelines. The proportion of health centres with at least one AED (56.0% to 66.0%) and allowing nurses to perform defibrillation without the presence of a physician (24.0% to 42.0%) had grown compared to the proportion in a similar study from 2001. The CPR-D training in basic life support and advanced life support (69.0% and 76.0% respectively) provided in the majority of health centres was appeared to be insufficient (Study I).

Only 49.0% of the nurses from Finnish hospital were able to defibrillate. A total 70.0 % of nurses from Swedish hospital passed the OSCE test, compared to only 27.0% of those from Finnish hospital. Resuscitation techniques revealed significant differences (Study II). Of the students from Swedish institution, 47.0% passed the OSCE test compared to 13.0% from Finnish institution. Again, the difference was statistically significant (Study III). Nurses receiving instructor-led traditional small-group CPR-D training performed better than did those receiving an Internet-based course, but both groups failed to defibrillate within 60 s (Study VI).

As many as 70.0% of fourth-year medical students, 85.8% of final-year and 70.0% of final-year nursing students felt confident of their ability to perform basic life support, whereas 24.0% of fourth-year medical students, 84.0% of

final-year medical students, and 22.7% of nursing students felt the same about defibrillation. The perceived ability to defibrillate correlated significantly with a positive attitude towards nurse-performed defibrillation and negatively with fear of damaging the patient's heart through defibrillation (Study IV).

Educational intervention increased positive attitudes towards CPR-D and negative attitudes towards guidelines and role of the nurses. Altogether 64.0 % of nurses hesitated to perform defibrillation due to anxiety, and 27.0% due to fear of injuring the patient (Study V).

Conclusions: Although a significant change occurred in resuscitation practices in primary health care after the publication of national resuscitation guidelines, insufficient training in CPR-D remained common Finnish health centres. The assessment of CPR skills in Finnish and Swedish hospital provided important information for further education in order to improve resuscitation performance. According to the cardiopulmonary resuscitation guidelines the CPR-D skills of nursing students in Finnish and Swedish institution were inadequate. Current methods of teaching are unlikely to improve the ability of students to perform adequate and rapid CPR-D.

The attitudes of medical students improve thorough their study years, but nursing students require more support. More information and more frequent training are needed to diminish anxiety among nurses concerning defibrillation. Negative beliefs and attitudes toward defibrillation affect the attitudes of nursing students and nurses toward cardiopulmonary resuscitation guidelines.

CPR-D education in Finnish hospital increased the participants' self-confidence concerning CPR-D skills, but failed to reduce their anxiety. CPR-D-education should address this anxiety also.

Basic education provides nursing students with inadequate CPR-D skills. Thus, frequent training in the workplace is of vital importance. Internet learning alone cannot substitute for traditional instructor-led small-group learning, and tutored hands-on training is needed to adequately learn practical CPR-D skills.

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following original publications, which are referred to in the text by their corresponding roman numerals.

I Nurmi J, Mäkinen M, Rosenberg P, Castrén M. Impact of the national cardiopulmonary resuscitation guidelines in primary health care: a nation-wide mail survey. Scand J Trauma Resusc Emerg Med 2007; 15; 136-40.

II Mäkinen M, Aune S, Niemi-Murola L, Herlitz J, Varpula T, Nurmi J, Castrén M. Assessment of CPR-D skills of nurses in Göteborg Sweden and Espoo Finland: Teaching leadership makes a difference. Resuscitation 2007; 72: 264-9.

III Mäkinen M, Axelsson Å, Castrén M, Nurmi J, Lankinen I, Niemi-Murola L. Assessment of CPR-D skills of nursing students in two institu tions – Reality versus recommendations in the guidelines. Eur J Emerg Med 2010, 17: 237-239.

IV Niemi-Murola L, Mäkinen M, Castrén M. Medical and nursing students' attitudes to cardiopulmonary resuscitation and current guidelines. Resuscitation 2007; 72:257-63.

V Mäkinen M, Niemi-Murola L, Kaila M, Castrén M. Nurses' attitudes to wards cardiopulmonary resuscitation and national resuscitation guidelines – Nurses hesitate to start CPR-D. Resuscitation 2009; 80; 12, 1399-1404.

VI Mäkinen M, Castrén M, Tolska T, Nurmi J, Niemi-Murola L. Teaching basic life support to nurses. Eur J Anaesthesiol 2005; 22: 1-5.

ABBREVIATIONS

AED	Automated external defibrillator
AED-BLS	Basic life support using an automated external defibrillator
AGS	Attitudes toward Guidelines Scale
AHA	American Heart Association
ALS	Advanced life support
BLS	Basic life support
CA	Cardiac arrest
CC	Current Care
CCG	Current Care guidelines
CD-ROM	Compact disc Read-Only memory
CPG	Clinical Practice guidelines
CPR	Cardiopulmonary resuscitation
CPR-D	Cardiopulmonary resuscitation using an automated external defibrillator
EBMG	Evidence-based medicine guidelines
ECCE	Evaluation of Current Care effectiveness
EMS	Emergency medical services
ERC	European Resuscitation Council
HT	Hypertension
ILCOR	International Liaison Committee on Resuscitation
OSCE	Objective Structural Clinical Examination
PAD	Public-access defibrillation
SP	Standards of physical examination
SPR	Suomen Punainen Risti (Finnish Red Cross)
VAM	Voice advisory method
VF	Ventricular fibrillation
VT	Ventricular tachycardia
WHO	World Health Organization

TABLES

FIGURES

1. INTRODUCTION

Clinical guidelines for evidence-based practice are systematically and increasingly developed statements to assist practitioners and patients with decisions about appropriate health care and to improve the quality of health care by decreasing inappropriate variation in care and promoting effective treatments into practice[1, 2]. Clinical practice guidelines are being introduced throughout medicine in the hope that guidelines will enhance the knowledge, attitudes, and behaviour of practitioners and will optimise the quality of care. They have gained acceptance as tools for implementing research evidence in practice, reducing inappropriate variation in health care, and thus improving the quality of care[3, 4]. General acceptance has not always led to the implementation of guidelines in clinical practice, however, and uncertainty about their effectiveness and how best to introduce them into practice remains. Putting the guidelines into wide practice requires evidence about improving care and patient outcomes[5, 6].

The first Finnish national cardiopulmonary resuscitation guidelines were published in 2002 in the evidence-based "Current Care" guidelines series of the Finnish Medical Society Duodecim and updated in 2006 (www.kaypahoito.fi)[7–9]. The guidelines are based on international resuscitation guidelines published in 2000 and include some significant changes from previous practices in resuscitation[8, 9]. Because of the potentiality of cardiac arrest in every health care facility, every health care personnel member should adopt the resuscitation guidelines.

Unexpected cardiac arrest is a major cause of premature death in industrialised countries. In Finland, over 13 000 people suffer heart attacks at a median 65 years of age annually. The majority of these cases occur out-of-hospital is due mainly to ventricular fibrillation (VF). Two in three of these patients survive to hospital, 10.0% of these survivors die from myocardial infarction in hospital, and 20.0% of survivors to hospital discharge die within two years[10]. Bystander CPR in appropriate settings can reduce mortality by one half. Survival rates for unexpected cardiac arrest depend on the quality of education potential caregivers receive and on the validity of treatment guidelines as well as a well-functioning chain of survival, which includs early access, early CPR, early defibrillation, and early advanced care[9–11].

Although the CC guidelines are well received, their implementation has been rather passive, there is certainly room for improvement[12, 13]. The influence of publishing resuscitation guidelines on clinical practice remains poorly investigated, although studies regarding other guidelines have shown that they usually have only limited impact on the behaviour of caregivers[14]. The lack of improvement in the outcomes of cardiac arrest patients may be because few adhere to resuscitation guidelines in clinical practice. Challenges in introducing

guidelines into clinical practice seem to depend on the type of health problem the guideline targets, the type of health care setting, and the implementation strategy used[3, 19–25]. To date several studies[19–24] have evaluated the implementation or impact of guidelines in Finland, but formal evaluation of the effectiveness of the implementation strategies adopted by nurses or the factors that may be associated with nurses´ participation in resuscitation is lacking.

A 2000–2001 study described different levels of care in the organisation of CPR training and in-hospital resuscitation management in Finnish hospitals. The study revealed a lack of regular training in resuscitation for physicians and nurses, and that 25.0% of hospitals had no appointed person in charge of organising CPR management. In addition, the study showed that few hospitals have ALS resuscitation mannequins which provide nurses and physicians with interactive resuscitation training with AEDs[25–26,]. Deficiencies in resuscitation skills exist among nursing students[27], nurses[28], physicians[29–30] and also anaesthesiologists[31]. Their level of skills retention is generally poor[27–32]. Moreover individual beliefs, attitudes and knowledge are known to influence professional behaviour. Despite of training and the availability of equipment, nurses may hesitate to use AEDs in resuscitation situations[33, 34]

To promotion of better CPR and earlier defibrillation is urgently needed[35] and the way in which CPR is taught deserve more attention. The speed and competence of the first responder are factors that contribute to the initial survival of a person following cardiac arrest. The attitudes of individual nurses may influence their speed and level of involvement in a true emergency situation. A study in four Finnish hospitals showed that delay to defibrillation is the only time interval of importance for the survival of the patient[25]. More training for hospital personnel, can be probably improve outcomes, and nurses can perform regular defibrillation before the arrival of a resuscitation team. Training could also lead to a more positive attitude towards defibrillation and make their role in resuscitation more prominent.

This thesis was conducted as part of a larger research initiative of the Evaluation of Current Care Effectiveness (EC-CE) consortium, established in Helsinki in 2003 to study factors important to the implementation of CC guidelines. This multidisciplinary group assesses the processes and outcomes of guideline implementation from different viewpoints (those of physicians, other health professionals and patients) in primary and secondary care settings. The consortium comprised of four sub-projects: 1) evaluating the implementation of the Hypertension Guideline, 2) evaluating the implementation of the Resuscitation Guideline, 3) evaluating a facilitator system in guideline implementation, and 4) developing a generic model for evaluating guideline implementation. This project was accepted as part of the Health Services Research programme

launched by the Academy of Finland in 2003, which enabled intensive collaboration between PhD students and experienced researchers in the ECCE consortium. To date, this consortium has produced two theses[36, 37].

The present thesis was written as part of this larger research initiative of the Evaluation of Current Care Effectiveness (ECCE) consortium to study factors important to the implementation of the Resuscitation Guideline. The aims of this study were to gain knowledge of the CC guidelines for CPR implementation in Finnish primary and secondary care and to study possible changes in resuscitation practices, especially concerning early defibrillation, and to obtain more focused knowledge of nurses 'and studets' attitudes towards guideline implementation as well as the ability of nurses and students to implement the guideline recommendations in clinical practices.

The present thesis offers valuable information about factors important to the implementation of the CC guidelines, especially to the implementation of the CC guidelines for CPR published 2002. Important changes have taken place in cardiopulmonary resuscitation practices, especially concerning new practices such as defibrillation by nurses, the purchase of AEDs, and CPR and defibrillation training in primary health care. The changes detected, though moderate, are encouraging. Assessment of the CPR skills of nursing students and nurses with OSCE provide new information for education before graduation and for further education in hospitals. This thesis also showed the value of an instructor-led small-group CPR-D course and repeated training. An educational programme increased not only knowledge, but also confidence in skills and created positive attitudes towards nurse defibrillation. Both knowledge and skills are needed to perform effective CPR.

2. REVIEW OF THE LITERATURE

2.1 CLINICAL GUIDELINES

2.1.1 EVIDENCE-BASED MEDICINE AND CLINICAL GUIDELINES

Evidence-based medicine (EBM) guidelines emerged in 1987 from the need for an evidence-based data source relating to clinical diagnosis and work[38–39]. EBM is the conscientious, definite, and judicious use of the current best evidence in deciding about the care of individual patients[39] and is increasingly accepted by professional associations, as well as by international health care organisations such as the WHO[40–41]. One important instrument of EBM is the clinical guidelines, as these are scientifically developed statements to designed to assist practitioners in updating their knowledge so as to provide every patient the best available care in a wide variety of clinical situations[3, 39, 42].

The serve several objectives: guidelines improving health care by promoting recommended and discouraging inadvisable practices, providing greater availability of and access to medical knowledge, and promoting of cost-effective strategies. The recommended methodology for guideline design and development requires that the recommendations be based on selected and critically valued data, with the final inclusion of valid, important and applicable evidence based on explicit pre-defined criteria[3, 43].

The growing number of publications in the literature shows that clinical practice guidelines play an increasingly important role as a support tool for clinical decision-making. The methodological quality of guidelines varies substantially, which raises credibility issues, and the subsequent lack of change in medical practice has raised the need on for methodological rules governing the design and development of guidelines[43].

Clinical practice guidelines can be defined as an attempt to distill a substantial body of medical expertise into a convenient, usable format[39]. The guidelines have been introduced to draw research and clinical practice closer together. Professionals can rely on guidelines and confidently use them for decision-making concerning individual patients. The guidelines may provide evidence-based instructions for diagnostic or screening tests or interventions[44]. Such guidelines are also increasingly regarded as an important part of quality systems in health care[45]. Guidelines involve continuing professional education, peer review and audit procedures[44]. Clinical guidelines help practitioners to improve their professional practice and the quality of care as well as patient outcomes in many ways[3, 40, 42, 44].

Guidelines can be effective and alter the process and outcome of care[3, 40–41, 44]

provided that guidelines are successfully implemented into clinical practice[2, 45]. Although the development of guidelines for medical staff, nursing staff and other health care professionals has been considerable in recent years, this does not necessarily mean that guideline recommendations are actually followed[3, 20, 46–47].

2.1.2 FINNISH CURRENT CARE GUIDELINES

Finland was among the first countries to compile a collection of national clinical guidelines, the Duodecim Current Care Guidelines (CC Guidelines; www.kaypahoito.fi). The Finnish Medical Society Duodecim, founded in 1881 to promote and support medical research and continuous medical education, as well as to manage, organise, carefully prepare and finish the process of guideline development. The CC guidelines are to serve locally by drawing up house rules for one organisation or regionally by defining clinical pathways unique to the health care district. These evidence-based guidelines have been available for 15 years.

The CC guidelines are disseminated through scientific and professional journals and via the Internet. All CC guidelines and evidence summaries in Finnish are freely accessible via the Internet. According to the Duodecim database, Finnish health care professionals and patients read these guidelines three times per minute. The electronic version allows linking the guidelines to locally developed implementation programmes or shared care models. Moreover, the dissemination of guidelines includes a wide variety of publications directed at specific audiences. Various kinds of study and teaching materials based on the guidelines have been produced and published for health care professionals and students, including e-learning courses. For citizens, short and easily understandable versions of the guidelines are published in electronic format, usually in both Finnish and Swedish (www.kaypahoito.fi and www.terveyskirjasto.fi).

Evidence-based Finnish CC guidelines have been produced since 1994, and the first guideline was published in 1997 on celiac disease. The national guideline programme Käypä hoito (Current Care) has since its start in 1995 produced 98 evidence-based clinical practice guidelines (CPGs) by the end of 2010, which have been published on paper, CD-ROM, and the Internet (at www.duodecim.fi/kh/) in various formats. More recently, summary versions of some guidelines have been translated into English and can be accessed freely on the Internet (www.kaypahoito.fi in English[48]).

The board of CC selects the appropriate topics, mainly drawn by specialists in medicine, for further preparation of the CC guidelines. Preparation of CC guidelines is based on public funding. Guideline working groups consist of clinical experts, experienced physicians (most of whom have a background in clinical research and training in the specific fields)

a general practitioners and allied health professionals. The process begins with a literature search performed by an experienced medical librarian. Systematic reviews are the best available source of evidence for guidelines. The largest and most frequently updated collection of systematic reviews is maintained by the Cochrane Collaboration[49]. A critical appraisal of the literature is based on criteria originally outlined by the EBM Working Group[39]. The available evidence is graded from A to D according to its reliability and quality (Table 1)[48–49].

Financial resources are needed to produce this large collection of guidelines. The financial and collective support of the Medical Society Duodecim has guaranteed the continuity of the work. A high level of information technology in Finland and the uniform clinical culture, in addition to well-standardised medical education are other facilitators. The editorial process has been built on the interest and well-defined visions of the editors, most of whom are practicing physicians with clear ideas of the information needed in clinical practice. The guideline collection guarantees that most searches locate relevant information essential for the implementation of guidelines and which provides answers to specific questions[21].

CC Guidelines are a part of the national health policy. Guideline implementation is carried out by incorporating them into health providers' electronic information systems and through targeted projects. The largest active implementation project concerned six guidelines on common infectious diseases using problem-based training methods and academic detailing in 30 primary care units (www.mikstra.fi).Dissemination provided the guidelines in electronic format for the 20 hospital districts as the basis for their own locally planned care pathways, which were also distributed electronically[21, 50].

Crucial for the editing of the Finnish guidelines was the choice of the electronic publishing format at the very beginning of the process. Electronic guidelines are probably used in Finland, more fre-

Table 1 The level of available evidence for guidelines

Level	Evidence	
Level A	Strong research-based evidence	Multiple, relevant, high-quality studies with homogenous results (e.g. two or more randomised controlled trials or a systematic review with clearly positive results)
Level B	Moderate evidence	One randomised controlled trial or multiple adequate studies
Level C	Limited research-based evidence	Controlled prospective studies
Level D	No evidence	Retrospective studies or a consensus reached in the absence of good-quality evidence.

quently than anywhere else in the world, based on the logbook data at www.duodecim.fi/kh/. According to the log files from October 2004, the guidelines in the Finnish version of EBMG were assessed more than 150 000 times per month. The physicians that use EBMG consult it, on average, three times daily [42]. To broader our knowledge of developments in medicine, electronic information sources are more user-friendly than paper formats,[42, 51] and the acceptance of guidelines is greater via CDs and the Internet[52].

The key factors influencing the usability of guidelines are that the guidelines cover a broad spectrum of problems, offer practical advice, are easy to use and are frequently updated[53]. In addition the decision to link the guidelines to systematic reviews has guaranteed the quality of the evidence, and the Cochrane reviews have become well known in our country because of the links and evidence summaries available in EBMG.[54] After the first electronic guidelines were published in 1989, the guidelines have been reviewed extensively and rewritten several times. The content of the source database has also been updated regularly to guarantee the quality.[42] The development of clinical practice guidelines requires substantial international resources.[55] Less attention has focused on the process of assessing the timing of updates to the guidelines, although consensus about methods for developing evidence-based guidelines is growing. Changes in evidence, the value of the evidence, the resources available for health care, and improvements in current performance are all possible reasons for updating clinical guidelines[56]. In addition clinical questions from users and editors also serve as an important reason to revise and update the guidelines[42]. For example the National Guideline Clearing House requires that guidelines published there must be updated at least every five years (http://www.guideline.gov/about/inclusion.aspx).

2.2 GUIDELINES FOR CARDIOPULMONARY RESUSCITATION

2.2.1 HISTORY OF GUIDELINES FOR CARDIOPULMONARY RESUSCITATION

"Resuscitation has developed over thousands of years, following a circuitous course of brilliant experimentation, serendipitous observation, slow adoption, and forgotten-then-rediscovered wisdom, which converged in the 1950s to bring about the era of modern CPR"[57]. A relatively primitive CPR technique has grown into one dictated by data from evidence-based medicine. Recent advancements include changes in resuscitation guidelines, the development of new equipment (e.g. an impedance threshold device), and new treatments such as the initiation of early therapeutic hypothermia. Continued advancements in cardiopulmonary resuscitation through new technology can only be ex-

pected to lead improved outcomes[58].

Based on research findings, the National Academy of Sciences National Research Council (NAS-NRC) Conference on CPR in 1966 recommended the first guideline for the training of medical, health, and other professional personnel in the external chest compression technique according to the standards of the American Heart Association (AHA)[13], (Table 2). The first guideline encouraged practice with mannequins, but disapproved of teaching resuscitation to laypersons. The training of laypersons was formally sanctioned only in 1974. To unify resuscitation prac-

Table 2. History of guidelines on cardiopulmonary resuscitation [8, 9, 13, 59-63]

Guideline	organisation / organisations	Year / Updated	Statement
Standards for training cardiopulmonary resuscitation (CPR).	NAS-NRC	1966	Statement by the ad hoc committee on the recommended training of medical, allied health, and other professional personnel in the external chest compression technique according to the standards of the AHA.
Standards for cardiopulmonary resuscitation and emergency cardiac care (ECC).	AHA, NAS-NRC	1974	The second recommendations on CPR, including the extension of CPR training programmes to the general public, training in different levels of life support, and standardised performance testing.
Standards and guidelines for cardiopulmonary resuscitation and emergency cardiac care	AHA	1980/1986	Updated standards and guidelines published by AHA.
Guidelines for CPR Adult advanced life support. The 1998 European Resuscitation Council. Guidelines for adult advanced life support.	AHA, ERC, ILCOR	1992/1998	ERC published guidelines for CPR.
Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care – an international consensus on science.	AHA, ERC, ILCOR	2000/2005	The first international guidelines on CPR published by the ILCOR.
Finnish Current Care guidelines for CPR-D.	Suomen Elvytysneuvosto, SPR	2002/2006	The first Finnish Current Care guidelines for cardiopulmonary resuscitation based on international guidelines.

tices worldwide, the first international guidelines on CPR, Guidelines 2000, were published in 2000 by the International Liaison Committee on Resuscitation (ILCOR)[60].

During the evolution of the guidelines on CPR, the majority of changes in recommendations have been relatively small. The tidal volume in ventilation has been reduced, the rate of chest compressions has been increased, the timing of defibrillation has been made earlier, and pharmacotherapy has been rendered less complicated. The international Guidelines 2000, however, include some significant departures from earlier practices[6, 13, 64]. The goal of these guidelines was to enable nurses as well as physicians to use an automated external defibrillator (AED). Although the published guidelines introduce newly developed resuscitation techniques to clinical practice, the outcome of cardiac arrest patients has not significantly improved[65–66]. Effective education programmes are needed for the wide implementation of rapid defibrillation and the use of AEDs. Implementing such major changes into clinical practice was considered a challenge.

We have seen the advent of new and important resuscitation studies and programmes since the publication of the Guidelines 2000[5, 6, 35, 66–69]. Such studies pointed out the importance of simplifying CPR techniques and guidelines, including the elimination of the pulse check by layperson, and the need for a simple form of basic life support (BLS) CPR that reduces interruptions of chest compressions. Automatic external defibrillators, even in the hands of first responders, have proved both effective and safe[70]. Randomised clinical trials of amiodarone for refractory ventricular fibrillation have shown positive results in improving survival to hospital admission[71]. Other studies have focused on new techniques and devices. The impedance threshold device improves haemodynamics during chest compressions and, when combined with compression-decompression CPR, has improved short-term survival[72]. Finally, mild hypothermia appears to be the first effective therapy for decreasing central nervous system injury when administered after resuscitation[73]. It is important to note, however, that these guidelines do not apply to all rescuers or to all victims in all situations. The leader of a resuscitation attempt must adapt the application of the guidelines to unique circumstances[74].

2.2.2 RECENT INTERNATIONAL GUIDELINES FOR CPR

Recent international guidelines are based on evidence evaluation from the 2005 International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. The evidence evaluation process that served as the basis for these guidelines was carried out in collaboration with the International Liaison Committee on Resuscitation (ILCOR)[60]. Their

recommendations confirm the safety and effectiveness of many treatments, acknowledge that others may not be optimal, and recommend new treatments that have undergone evidence evaluation[75–77].

Evaluating the quality of CPR is possible thanks to recent developments in defibrillator technologies. New technology have shown that the quality of professional cardiopulmonary resuscitation is far from guideline requirements with regard to factors such as chest compression depth and rate, ventilation rate, and pauses in chest compressions[78–81]. The effects of factors influencing cardiopulmonary resuscitation quality on patient survival are presently undergoing thorough and detailed examination. Our deeper knowledge of resuscitation quality problems, especially regarding unwanted pauses in chest compressions, has placed greater emphasis on chest compressions in cardiopulmonary resuscitation protocols, including the 2005 Guidelines[82–84]. The 2005 CPR guidelines brought major changes to the basic life support algorithm. To improve perfusion of the coronary vessels and the brain, the ERC reduced hands-off time, thereby raising the chest compression ratio from 15:2 to 30:2. In mannequin setting up, both the total number of chest compressions and shorter hands-off time improved basic life support performed according to the ERC guidelines of 2005[82–83]. In late 2010, the American Heart Association will publish new guidelines for CPR training, and education to improve the quality of care given by lay rescuers and health care providers.

2.2.3. FINNISH CURRENT CARE GUIDELINES FOR CPR

Finnish National Guidelines for CPR were published in Finland in 2002 as part of the evidence-based clinical practice guidelines series Current Care by the Finnish Medical Society[85]. They were based on the ILCOR guidelines 2000. The main recommendations concerning the organisation of cardiac arrest management were as follows:

- In the event of VF/VT rapid defibrillation should be encouraged and should be performed within three minutes of the CA in institutional settings. Defibrillation should be included in duties and in the resuscitation training of all nursing and medical staff. Defibrillation training should also be made available to staff other than medical or nursing personnel (e.g. personnel in hospital reception and cafeterias).

- The primary drug is amiodarone, which it should be used for prolonged or recurrent VF or pulseless VT. Lidocaine can also be used if amiodarone is unavailable.

- Data collection and the quality assurance of CA management should be carried out using a special form for data collection of resuscitation attempts, including sufficient data for uniform Utstein style reporting. A

physician or nurse responsible for the co-ordination of resuscitation activities should collect the resuscitation forms and analyse the resuscitation performance annually using definitions of the Utstein reporting style for in-hospital CAs and out-hospital CAs.

- DNAR orders should be clearly indicated in patients' records, and staff responsible for patient care should be informed.

The Finnish CC guidelines for CPR updated in 2006 were based on the ILCOR guidelines 2005. The primary goal of these changes was to simplify CPR for both lay rescuers and health care providers in order to maximise the potential for early resuscitation. The important changes were: a universal compression-ventilation ratio (30:2) recommended for all single rescuers, the lifting of the emphasis on lay rescuers assessing pulse or signs of circulation in an unresponsive adult victim instead of taking the absence of normal breathing as the key indicator for commencing CPR, and lastly, the removal of the protocol in which lay rescuers provide an adult victim rescue breathing.

2.3 IMPLEMENTATION OF CLINICAL GUIDELINES

2.3.1 IMPLEMENTATION

Implementation is an active process, and effort has focused on enhancing the adoption of guidelines[16]. The goal of implementing interventions is to harmonise practioners' behaviour according to guideline recommendations. Changing behaviour requires a positive attitude towards intended change and familiarity with the guidelines[86–87] as well as support from leaders and peers in addition to the ability to act according to guideline recommendations[88]. Thus the effectiveness of interventions[89–90] and the availability and source of the guidelines greatly influence their implementation[91–92].

Implementation is generally considered a local issue and is a process that aims to produce standards on governing implementation strategies and to enhance our knowledge of facilitators and barriers in using tools for healthcare improvement. Nowadays, more and more clinical guidelines are being developed for health care professionals, but this does not mean that these guidelines are actually implemented. In Finland, studies on the implementation of guidelines are not equal to demand. The available evidence on the implementation of other Current Care guidelines is somewhat contradictory: the resuscitation guideline had not been implemented to any significant extent[92–93], whereas

the asthma guideline had achieved its main objectives[22]. The kinds of changes that had to be implemented may be partly distributed to differences between the studied guideline topics. For the asthma guideline, the National Asthma Programme had already endorsed the treatment practices since 1994[23]. The CC guidelines for cardiopulmonary resuscitation recommended major changes in responsibilities and in the equipment to be used; this may make implementation more difficult.

Effective strategies often have multiple components, and the use of one single strategy, such as reminders only or an educational intervention is less effective [14]. Besides, as mentioned previously, characteristics of the guidelines themselves affect actual use[24]. For instance, guidelines that are easy to understand, can easily be followed, require no specific resources, and have a greater chance of implementation. In addition, characteristics of professionals (e.g., awareness of the existence of the guideline and familiarity with its content) or environmental characteristics (e.g. a lack of support from peers or superiors, as well as insufficient staff and time)[94] likewise affect implementation.

2.3.2 BARRIERS AND FACILITATORS

Local barriers or facilitators are related to the Clinical Practice guidelines (CPG), for the individual clinician, and the professional context is related to the effectiveness of CPG diffusion to physicians. According to Saillour-Glenisson and colleagues[94], the retrieved barriers or facilitators were classified into three categories. The characteristics of the guideline (form, compatibility, trainability, scientific basis, observability, adaptability, legal implications), the characteristics of the physician (knowledge of CPG; attitude towards and agreement with CPG; psychological, socio-demographic and economic characteristics; job satisfaction; training) and the physician environment (divided into the physician human environment, patient influence, pair influence, the organisational environment of the physician, the internal environment, and the external environment).

Cabana and colleagues[95] offered a differential diagnosis for why physicians fail to follow practice guidelines. They identified barriers to physician adherence to practice guideline and defined a barrier as any factor that limits or restricts physician adherence to a guideline. They focused on barriers that could be changed through intervention. Before a practice guideline can affect patient outcomes, it must first affect physician knowledge, then attitudes and, lastly behaviour. Although behaviour can be influenced without affecting knowledge or attitude, changing behaviour by influencing knowledge and attitudes is probably more effective than indirect behaviour manipulation alone[34, 94-97]. Cabana and colleagues found seven categories of barriers to implementation after classifying possible barriers into common themes. The barriers affected

physician knowledge (lack of awareness or lack of familiarity), attitudes (lack of agreement, lack of self-efficacy, lack of outcome expectancy) or behaviour (lack of time and organisational constrains).

Several studies have examined attitudes among nurses and other healthcare professionals,[37, 96–102] who have reported more positive attitudes towards guidelines than have physicians. Studies have also shown that nurses adhere more closely to guidelines than do physicians[37, 98–100]. Studies concerning attitudes and beliefs towards cardiopulmonary resuscitation and defibrillation among medical students[101] or young doctors[102] are scarce, however. Guidelines are not always followed in real situations despite training and the availability of equipment[28, 103]. Individual beliefs, attitudes and knowledge have been shown to influence professional behaviors[97]. Consequently, individual or organisational attitudes may have generated a reluctance to perform as recommended. Changing practitioners' behaviour in a manner which is consistent with guideline recommendations is the goal of implementing interventions. Potential barriers at each stage of behavioural change for guideline implementation have been assessed and placed within a knowledge-attitude-behaviour framework[97.98, 104]. According to previous studies, effective implementation depends on three conditions. Firstly, all healthcare professionals must be familiar and aware of guidelines. Secondly, they must have positive attitudes towards the use of guidelines as a tool to improve the quality of clinical care. Thirdly, these behaviour-related barriers, such as lack of time and organisational constrains, must be addressed[94–96, 104].

In a recent Finnish survey, three alternate models of the antecedents and possible moderators of the use of clinical guidelines were developed and tested among health care professionals. According to the results, important factors influencing general positive or negative attitudes towards guidelines include the usefulness, practicality and availability of the guidelines[96–97]. Based on these factors the validated Attitude towards Guidelines Scale (AGS) was constructed to measure attitudes towards guidelines. The scale contains seven items, each of which is measured according to a subscale of two questions: general attitude, usefulness, lack of individual or team competence, lack of organisational competence, impracticality and availability. Elovainio and colleagues[97] also reported that those with high job motivation were prepared to use guidelines even when they had neutral attitudes towards guidelines. Relevance and outcome expectancy are also important components of the attitude scale[99].

Attitudes toward guidelines have proved to be important predictors of guideline use. Attitudes, familiarity and the use of guidelines have improved after educational interventions[99, 100]. Even the familiarity and overall positive attitudes regarding guidelines offer no guarantee that health care professionals will change their clinical practice. Important facilitating factor in implementation in-

cluded motivation and opportunities to improve care[99–100], others perceptions such as support from leaders and peers and as well as ability to act according to guideline recommendations[88], the availability of guidelines and the effectiveness of interventions[89–93].

2.4 CPR EDUCATION

2.4.1 PRINCIPLES OF CPR EDUCATION

The International Liaison Committee on Resuscitation (ILCOR) has identified three factors that influence the outcome of cardiac arrest: the quality of the guidelines, the local "chain of survival" and the quality of the training for CPR providers. This enables them to put the theory of CPR into practise[13, 29]. In addition, ILCOR recommended that initial training in basic life support (BLS) be included in the basic studies of all health care professionals. Different levels of standardised training programmes are organised by the ERC and different national resuscitation councils. The content, material and training requirements for instructors of these programmes are standardised,[75] and resuscitation guidelines are updated frequently, which increases the need for retraining.

Training should be based on the principles of education and learning[105]. The ERC recommends training in small groups (four to eight members) interactive discussion and hands-on practice for skills and clinical scenarios in problem solving and team leadership[75, 106]. The ratio of instructors to candidates should range from 1:3 to 1:6, depending on the type of course. The course should be taught by trained instructors who have undertaken the relevant specific ERC course in teaching and assessment (Table 3)[75].

Candidates should activate core knowledge before the course by reading the course manuals or following an interactive CD designed for this purpose. The course should aim to improve the competence of the trainee. Training may incorporate sophisticated mannequins, simulators and virtual reality techniques [82,107], and should include a test of core knowledge and an ongoing assessment of practical skills, such as airway management, BLS and defibrillation.

2.4.2 TEACHING CPR TO MEDICAL AND HEALTH CARE STUDENTS

ILCOR recommends that health care professionals receive their initial training in BLS as students[29]. In addition, the European Resuscitation Council published guidelines for training in resuscitation in their formal courses, but international or national guidelines for teaching during basic education are still lacking. CPR education plays a major role in impairing the primary skills of students, although the early stages of education processes also have their weaknesses[82, 108]. Teaching and learning CPR is difficult because it requires both knowledge and

Table 3. Principles of training in resuscitation, European Resuscitation Council Guidelines for Resuscitation [75].

Course	Target candidates	Ratio of instructors to candidates	Duration of the education	Course content	Teaching methods	Assessment
Basic Life Support BLS	Clinical and non clinical health care professionals, guards, school teachers etc.	1:6 AED and mannequin	Half a day (4h)	Basic life support and defibrillation with semiautomatic defibrillator (AED)	Hands-on practice and a minimum number of lectures	Each candidate is assessed individually
Immediate Life Support ILS	Majority of health care professionals, including medical and nursing students	1:6 (Maximum of 30 candidates). Mannequin and AED or manual defibrillator for each group of six candidates	More than one day	Causes and prevention of CA. Starting CPR. Defibrillation (AED or manual defibrillator). Basic airway skills (pocket mask and laryngeal mask)	CA demonstration. Hands-on practice by the teaching station in the groups. Lectures	Continuous assessment Candidates must show their competence
Advanced Life support ALS	Doctors, senior nurses working in emergency areas at the hospital, and members of medical emergency or cardiac arrest teams	1:3 Group size 6-8 candidates, up to 32 candidates. Four AED or manual defibrillator. Four ALS mannequins with ECG simulator and airway. Practical rooms. Lecture room. Faculty room.	2–2.5 days	Competence in BLS is required. Candidates study the ALS course manual beforehand. Highlight the causes of CA. Identify sick patients. Periarrest problems. Safe defibrillation. Defibrillation (AED or manual defibrillator). ECG interpretation. Management of airway, ventilation and periarrest rhythms. Simple acid/ base balance. Post resuscitation care.	Very few formal lectures. Hands-on skills. Clinically based scenarios. Team leader approach. CASTeach station for practice. Interactive group discussions. Mentor/mentee sessions.	Each candidate is assessed individually. Testing scenario at end of the course. Ongoing assessment of the management of sick patients. 75% required to pass this test.

psychomotor skills. A variety of methods has been used for training in resuscitation. The absence of frequent practice, the retention of knowledge and suboptimal skills, however, are the main weaknesses. The performance and quality of CPR have been poor even immediately after CPR courses, and these skills decrease rapidly[27, 29, 32–35, 80–84].

In different Finnish institutions as well as within institutions of the same level, the amount of CPR education varies a considerably. Education methods differed, as did methods for assessing the quality of CPR performance.[108] In 2007 an internet survey[108] was administered to medical professionals at Finnish institutes that teach CPR to providers of emergency medical services. The range of theory lessons in CPR was 2 to 28 h (median 8 h), the range for small-group training was 3 to 40 h (median 10 h) and the size of the small groups varied significantly (2 to 18 students). In medical schools, the number of students in small groups was the largest (18 students) whereas the amount of small-group training and number of theoretical lessons comprised the least (2 h), and in Finnish nursing schools theoretical lessons comprised a median 3 h (vs. a median 6 h of basic and 8 h of advanced CPR lessons in European medical schools in 1997). In medical school practice, training comprised median 7 h, and in nursing school practice, training comprised a median 6 h (vs. a median 12 h of basic and 8 h of advanced CPR practice in European medical schools in 1997). Medical and nursing students in Finland received far fewer lessons and less practice training than did students in other European medical schools[109].

In Finnish medical school, cardiopulmonary resuscitation education is based on the CC guidelines for CPR[9]. During the fourth study year, students receive an introduction lecture on advanced life support (ALS) followed by mandatory 3-h small-group teaching (ALS and defibrillation) in groups of six to eight students and a voluntary course in the fifth year. During the final (6th) study year, students have a practical skills examination about ALS with a focus on working both as a member and as a leader of the resuscitation team[110]. In Finnish nursing school, CPR education is also based on the CC guidelines for CPR[9]. During the first study year, students attend lectures about BLS (mouth-to-mouth ventilation, without defibrillation) followed by interactive learning and hands-on training in groups of eight to ten students. During the second study year, students attend lectures about BLS at hospital (mouth-to-mask ventilation with adults and children) followed by hands-on practice and a voluntary course in the third, final year[111].

The methods of CPR education varied widely not only among various institutions teaching different grades of EMS provider students, but also within institutions of the same level[108]. The methods of teaching chest compression depth and rate varied; the technological, objective methods in estimating adequate depth and rate saw infrequent use. According to the survey, the methods of

teaching adequate chest compression rate included instructor's visual estimation in 28.5% of institutions, stopwatch in 33.3%, metronome in 9.5%, and mannequin graphics in 28.5%[108]. The methods of teaching adequate chest compression depth included the instructor's visual estimation in 33.3% of institutions, mannequin light indicators 23.8% and mannequin graphics in 52.3%[108].

2.4.3 TRAINING AND RETAINING OF CPR SKILLS

After graduation, health care personnel continue to develop their skills and abilities[105]. Adult learning differs from education at the undergraduate level, because learners often already have profound basic and practical knowledge of the subject[112–113]. Adult learners are often critical of their learning goals and find it difficult to study or commit to memory facts or information they find irrelevant. Before learning something new, adult learners must sometimes consciously invalidate their previous knowledge. Thus, the teacher should know the audience and its level of expertise, the topic, the format and the outcome, and the latter should also be measured. Traditional educational methods and lectures may not be the best possible method for adult learners. Adult learners often appreciate interaction with learning materials, with the speaker, with other learners and reflection-in-action. ILCOR recommends that resuscitation training follow the principles of adult learning[29].

Modern learning technologies broaden the teacher's opportunities to choose the method that agrees best with learning goals and the assessment of a specific course[104–107]. Simulations are widely used in medical education and in the assessment of medical personnel performance[113–117]. Simulation-based education can serve as a part of medical education in patient care settings. Recurrent variation in clinical practice and simulated learning sessions learning is best facilitate[113]. The best available evidence from the literature suggests that high-fidelity medical simulation facilitates learning under suitable conditions[114].

Several factors improve the feasibility of simulation-based education. Identifying repetitive practices is a key feature and educational curriculum integration is essential in the effective use of simulation-based exercises[115]. The range of difficulty level is an important variable in the effectiveness of simulation based medical education. The adaptability of providing faithful reproduction through the use of sound in simulations is also highly valued when accompanied by a wide variety of clinical conditions in a controlled environment with multiple learning strategies. Debriefing is the most important feature of full-scale simulation sessions. It is also important that learners be active participants who make, detect and correct errors without adverse consequences and benefit from reproducible, standardised educational experiences in valid simulations with clearly stated goals[115–117].

Many different types of simulation

devices serve a wide variety of functions, ranging from a simple part-task or procedural trainers, which most commonly serve to develop a basic psychomotor skill, to virtual reality devices, which employ computer technology to provide visual and auditory feedback that closely resembles the clinical experience[118]. Recently, new devices have been introduced to encourage self-directed learning. One of these devices is a modified Skillmeter Resusci Anne, which employs an automatic voice-based feedback system, or voice advisory method (VAM), without the presence of an instructor. The VAM system is a novel approach to psychomotor skill acquisition. The most important difference from traditional CPR training is that the WAM system provides immediate online feedback, which does not deviate from the set guidelines, and errors in performance will not go unnoticed[119]. The Little Anne mannequin was also developed for training without supervision, and the device itself provides basic feedback[120].

Internet learning has several advantages over traditional learning methods. Learning is available at the optimal time and place for the learner, and discussion forums and online assessment are also available[104, 121–122]. The internet network provides access to the best institutions in the world, and learners can construct a community of learning[122]. Recent literature suggests that multicomponent electronic continuing education interventions can be effective in changing health professionals' practice patterns and improving their knowledge[121]. Young physicians seem to adopt online continuing medical education more rapidly than do others, and female physicians adopt this learning method more rapidly than do males[122].

This modern educational tool has also inspired CPR-D instructors. In previous studies, performance, rather than knowledge[123–124] improved more after computer simulation than after a theoretical textbook review. Video self-instruction with a mannequin has proved more effective than a traditional CPR training[125]. Internet-based CPR-D education has served to teach defibrillation as part of BLS[125–127]. The Finnish Medical Society Duodecim has developed a distant learning programme based on the national current guidelines and studies in this field (http://www.kaypahoito.fi/web/web/kh/verkkokurssit).

2.5 ASSESSMENT OF CPR SKILLS

2.5.1 CPR PERFORMANCE AND NON-TECHNICAL SKILLS

The importance of good quality CPR, which is effective in confirming the absence of signs of circulation, response to simulation, breathing and detectable pulse, effective chest compression and the delivery of shocks with a defibrillator, is highlighted in international resuscitation guidelines, but in reality the clinical quality of CPR is often poor[27, 31, 35, 128–131].

Poor knowledge and skill retention following cardiopulmonary resuscitation training for nursing and medical staff have been documented over the past 20 years[131-145]. Many studies have clearly demonstrated that medical professionals, retention of resuscitation skills is generally poor even shortly after training[27, 32, 78–79] and what is taught in training sessions is seldom rehearsed. Whether skills and knowledge taught in the classroom are effectively transferred into the clinical area is therefore questionable[83–84, 146]. Recent studies have shown that CPR training is insufficient at various levels of care and that health care professionals have difficulty in following CPR guidelines (i.e. compression and ventilations)[27, 29-30]. The CPR skills of both physicians and nurses have proved inadequate[29–30].

Recent data from in- and out-of-hospital cardiopulmonary arrests reveal that health care teams frequently deviate from the guidelines during resuscitation efforts[27, 78–79, 129–130]. These discrepancies between the current state of evidence-based resuscitation guidelines and the quality of basic and advanced life support actually delivered represent a missed opportunity and provide a significant target for optimising patient outcomes through improved educational effectiveness[146].

The complexity of patient care demands a wide range of skills from health care professionals. A set of skills such as non-technical skills must be used integrally with medical knowledge and clinical technique. Good professionals always possess such competencies. According to Flin and colleagues, the components of effective teamwork include task management, teamwork skills, situation awareness and decision making[147]. Non-technical skills play an important and central role in clinical practice and considerably influence performance and patient safety[147–150]. These non-technical skills (Anesthetists Non-Technical Skills, ANTS[147]) have been divided into subgroups: cognitive skills (decision making, planning and situation awareness) and social skills (team work, communication and leadership). These groups of skills are necessary for effective and safe performance in patient care[147–150]. A team is required to perform CPR and defibrillation effectively, but basic life support (BLS) and advanced life support (ALS) courses are still based on the training of practical individual skills, (i.e. compressing and ventilation)[75]. Successful performance of resuscitation, however, depends on the effective integration of both practical and team work skills[148–150].

Rall and Gaba[115] have also described crisis resource management skills, which can serve in both simulated crises and in real events. They list 15 key points, some of which Flin and Flecther[149] also described: know the environment, anticipate and plan, call for help early, exercise leadership and followership with assertiveness, distribute the workload, mobilise all available resources, communicate effectively, use all available information, prevent and manage fixation errors, cross and double check eve-

rything, use cognitive aids, re-evaluate repeatedly, use good teamwork, allocate attention wisely, and set priorities dynamically[144].

2.5.2 METHODS OF ASSESSING CPR SKILLS

An emerging need for evaluating guidelines also calls for an objective assessment[82, 151–152]. Guidelines for BLS and ALS are regularly updated,[13,153–154] and some recommendations may be contradictory or difficult to implement in practice[154–156]. BLS and ALS knowledge and skills have been tested using written and practical tests as well as in many other ways[109, 157–158]. Testing the practical applicability of new guidelines prior to publishing would also be useful[25, 82, 152]. Objective assessment methods are needed to evaluate the skills of individuals trained to provide life support[151, 158–159] and comparable, validated methods should be used.

Medical teachers are expected, to an increasing extent, to base their practice on evidence and to assess the outcomes of education[82, 160–161]. An ideal assessment method would be valid and comparable across studies[157]. Assessment programmes must match the competencies being taught and the teaching formats being used[161–162]. Several methods for assessment of cardiopulmonary resuscitation skills are available[162]. The Cardiff Assessment of Response and Evaluation (CARE) was the most widely used method and has been recommended in the ILCOR statement[82, 134, 141–142]. The Cardiff Test of BLS and AED have a standardised checklist with well-defined outcomes and satisfactory inter- and intra-observer reliability[82, 162]. However, reliability of the check list used may differ among professionals and as well as laymen and may be affected by translation[144]. Reliability should therefore be calculated after every study.

These scales were developed to enhance patient safety and they serve to evaluate team performance in simulated crises. They are detailed and provide useful information, but do not define levels of desired performance in such situations. In addition, to best of our knowledge, no formative scales exist to evaluate group work skills during resuscitation. The need for evaluating life support skills extends beyond medical schools and CPR courses. The practical skills of health professionals and rescuers should be refreshed and evaluated annually[103, 151]. Various methods are used to teach life support programme to health care professionals and laymen. However, the effectiveness of conventional training has fallen into question[103]. Many participants cannot perform effective CPR even immediately after training,[27, 32, 78–79] and the retention of skills can be poor[78–79, 103]. Frequent evaluation has been recommended to guarantee the quality of CPR performance[151]. Testing CPR performance should be included as a routine quality assurance procedure after training[156].

Instruments and a clear standard are needed to document the quality of

CPR-D skills. A reliable testing method with a standard passing level would help trainers to compare the results and check the retention of skill of individuals and groups. To provide an overview of assessment methods, researchers conducted a systematic search[162]. We, researchers searched the Electronic database MEDLINE from 1990 to February 2005 as well as the Cochrane database (issue 1, 2005) without language restrictions. MESH (The Medical Subject Headings) terms were used for resuscitation, defibrillation, heart arrest, sudden cardiac death or ventricular defibrillation, clinical competence, mental competency, task performance and analysis. We consulted a librarian when planning the search strategy.

We manually searched the journal *Resuscitation*, the most frequent source of original studies, as well as *Medical Teacher* and *Medical Education* for educational studies from 1990 to February 2005. We identified more publications from the reference lists of original studies and reviews[29,103] and searched by the authors' names. Our search strategy yielded 746 hits of which 153 fulfilled the primary search criteria. We then evaluated and retrieved the full texts of these. We considered relevant those studies that included educational intervention, study populations of adult life support providers randomised and divided into groups, and an evaluation or assessment of the performance. We excluded studies concerning paediatric and trauma resuscitation. The number of participants or criteria used to assess the outcome was unrestricted (Figure 1.).

The Best-Evidence Medical Education (BEME) coding sheet for the educational quality of studies (range 1 = low, 5 = high) were used when assessing and classifying the RCTs[163]. The Evidence-Based Medicine working group criteria was used to complete the evaluation regarding blinding, randomisation, similarity of the groups, and follow-up.

The studies designed to assess CPR skills from 1990 to 2005 found that the assessment methods used varied widely, which makes comparisons between studies difficult (Table 4); most studies had methodological shortcomings, and half of the studies lacked any evaluation of the reliability and level of evidence. Blinding was rare, the randomisation method was unclear, performance before and after the intervention went uncompared, the scenario was not standardised, and follow-up was absent from many of the studies. In the review, most studies compared participants with each other rather than against a standard or defined passing level. However, comparing students to others for clinical competency licensing tests, which aim to ensure that candidates are safe to practice is unacceptable[156,164]. Assessing the quality of CPR-D performance will reguire qualified studies with well-defined study populations, standardised study settings, and clearly and fully expressed, comparable outcomes.[29, 81, 154].

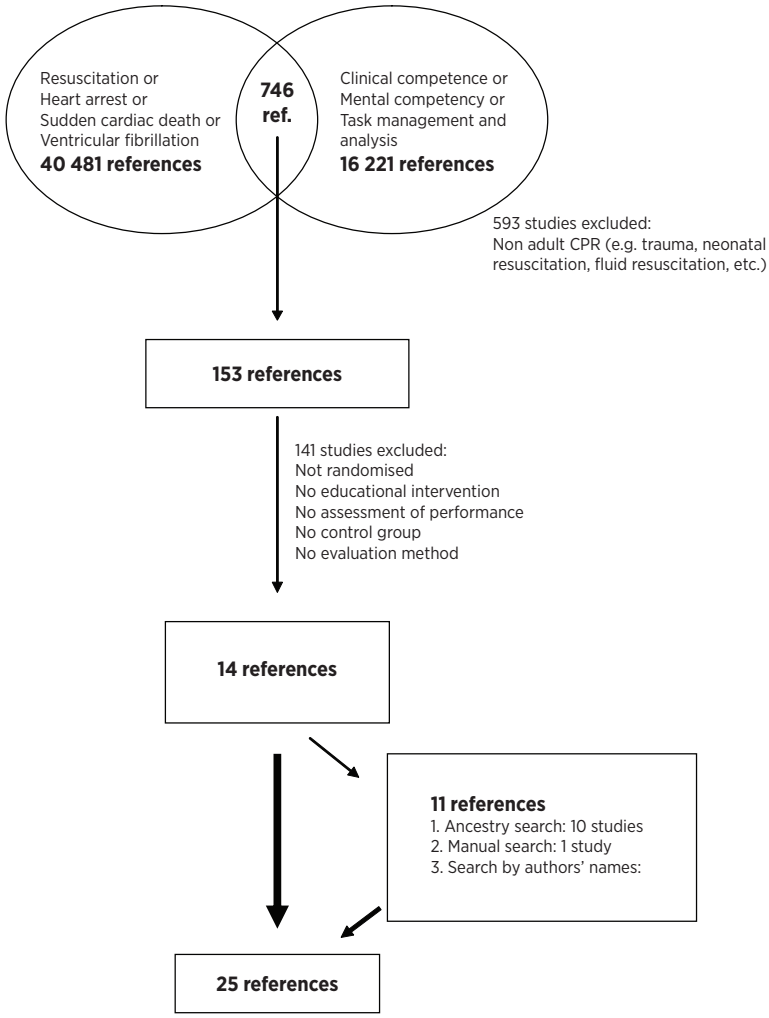


Figure 1. Flowchart of the search strategy[162]

Performance-based assessment

Performance-based assessment is not a new concept; one has to demonstrate to an examiner and be observed while performing the task being certified. Miller[169] proposed a framework for clinical assessment which progresses thorough four levels: knows, knows how, shows how and does. This same framework can serve in the assessment of any set of skills. Students and professionals could be assessed at the four levels identified in Miller's pyramid, and appropriate assessment instruments should be selected for each level, Figure 2 shows.

Objective Structural Clinical Examination

Harden and Cleeson introduced the idea of the Objective Structural Clinical Ex-

Table 4. Methodology and outcomes of the studies included in the rewiev[162].

TRIAL (ref. number)	METHODS	INTERVENTION	PARTISIPANTS	NO. OF SUBJECTS	FOLLOW UP	OUTCOMES	VALIDITY SCORE (1-5)
144. Jansen JMJ. et al. 1997	Pre-test and post-test Check-list, printout	CPR instruction	General practitioners	71	None	CPR performance, comparison between three scoring methods	4 (g, h, k)
160. Ward P. et al. 1997	Post-test Check-list, printout	CPR instruction Comparison of two check-lists	Medical students	169	2 months	CPR performance, retention of skills	3
165. Handley AJ et al. 2003	Pre-test and post-test Printout	CPR instruction	Nurses	36	None	CPR-D performance	4 (a, e, g, h, j)
131. Donnelly PD 1998 et al.	Post-test Video, printout	CPR instruction	Laymen	42	6-8 months	CPR performance, retention of skills	4 (g, h, k)
136. Todd K. et al. 1998	Post-test Check-list, printout, questionnaire	CPR instruction Video vs. traditional	Medical students	91	2-6 months	CPR knowledge, attitudes and performance	5 (a, c, d, e, j, k)
140. Todd K. et al. 1999	Post-test Printout, check.-list, questionnaire	CPR instruction Video vs. traditional	Laymen	107	2 months	CPR knowledge, attitudes and performance	5 (a, b, c, d, e, i, j, k)
123. Schwid HA. et al. 1999	Post-test Video, check-list	CPR instruction Computerized simulation vs. textbook	Anaestesia residents and faculty	45	10-11 months	CPR-D performance	3
124. Atkinson et al. 1999	Post-test Printout	CPR instruction Video vs. traditional vs. telephone	Laymen	38	None	CPR-D performance	3 (e,f)
137. Liberman M et al. 2000	Post-test Video, printout	CPR instruction Video vs. traditional	Nursing students	61	None	CPR-D performance	4 (j)
132. Assar D et al. 2000	Post-test Test-sheet	CPR instruction Staged teaching vs. traditional	Laymen	495	None	CPR performance	4 (c, e, g, h)
166. Batcheller AM. et al. 2000	Post-test Check-list, printout, questionnaire	CPR instruction Video vs. traditional	Laymen	202	None	CPR performance Self-rated confidence	4 (e, g, h, k)
133. Donnelly P. et al. 2000	Post-test Video, printout	CPR instruction Comparison of three methods	Laymen	250	6 months	CPR performance, retention of skills	3 (g, h)
141. Chamberlain D. et al. 2001	Pre-test, post-test Video, printout, check-list	CPR instruction Staged teaching vs CPR instruction	Laymen	495	None	CPR performance, retention of skills	4 (c, e, g, h)
119. Wik et al. 2001	Standardized desing	Computer	Paramedic	35	None	CPR-D performance, ideal performance defined	4 (e,g,h)
134. Chamberlain D. et al. 2002	Post-test Video, printout, check-list	CPR instruction Staged teaching vs. traditional	Laymen	166	6-9 months	CPR performance, retention of skills	3 (c, e, f)
79. Wik L. et al. 2002	Pre-test, post-test Standardized desing	Computer	Laymen	35	6 months	CPR performance, ideal performance defined	4 (i)

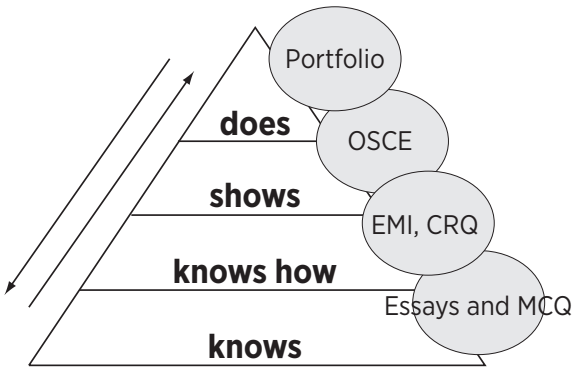
TRIAL (ref. number)	METHODS	INTERVENTION	PARTISIPANTS	NO. OF SUBJECTS	FOLLOW UP	OUTCOMES	VALIDITY SCORE (1-5)
135. Celenza T. et al. 2002	Survey, post-test Check-list, printout	CPR instruction	Laymen	100	-	CPR knowledge and performance, retention of skills	3 (g, k)
145. Swor R. et al. 2003	Post-test check-list, video, questionnaire	CPR instruction Chest compression vs. traditional	Laymen	74	3 months	CPR performance, knowledge and attitudes	5 (a, b, c, e, g, k)
139. Woollard M et al. 2003	Post-test Video	Compression-only vs. standard telephone CPR instructions	Laymen	59	None	CPR performance	4 (f, g, h, i, j)
142. Smith A. et al. 2004	Post-test Video, printout	CPR instruction Staged teaching vs. traditional	Laymen	495	6 - 12 months	CPR performance, retention of skills	3 (e, f, g)
151. Wik L. et al. 2003	Pre-test, post-test Video, printout	CPR instruction	Laymen	104	13 months	CPR-D performance, retention of skills	4 (e, g, h, j)
138. Handley AJ et al. 2003	Post-test printout, check-list	CPR instruction, traditional	Nurses	36	None	CPR-D performance, retention of skills	4 (i)
143. Castrén M. et al. 2004	Post-test Check-list	CPR instruction Comparison between instructors	Laymen	38	2-3 weeks	CPR-D performance	3 (d, h, j)
167. Callejas S et al. 2004	Post-test Video, photopgraph	Defibrillation instruction Video vs. untrained group	Laymen	256	None	Defibrillation performance	3 (e, h)
168. de Wries W. et al. 2005	Audio data	Defibrillation instruction	Laymen	127	11 months	Defibrillation performance, retention of skills	3 (d, g)

Methodology of the studies included in the review and outcomes of these trials. The RCTs were assessed and classified using the Best Evidence Medical Education (BEME) Coding sheet for educational quality of studies (range 1 = low, 5 = high) a = randomization method, b = flow chart, c = power analysis, d = blinding, e = standardized design, f = demographic and background data, g = ideal performance defined, h = ineffective performance defined, i = follow up clarified, j = confidence intervals, k = reliability calculated.

amination (OSCE)[170–171]. The key feature of the OSCE is that each student performs in five-minute stations the same series of tasks and receives a grade based on a standardised scoring schema[172–174]. OSCE is now considered the prototype of performance-based assessment and has proved to be a valid and reliable method of testing the practical skills of students. OSCE remains unchallenged in its position as the assessment instrument for the levels in Miller's pyramid[169].

Since its inception in the 1970s, OSCE has become popular and is now part of the US Medical Licencing Examination for all United States medical graduates,[177] and in more recent years has been increasingly utilised to assess students of nursing and other health professions. This growing utilisation has led to a debate within the literature pertaining to the optimal use of OSCE as an assessment tool. The three principal universities in Dublin conducted a project to implement and evaluate a competence assessment tool for use among nursing students and their assessors while on clinical placements. The survey data reveal generally positive attitudes to the structure of the tool and positive experiences of its operation in practice. However, respondents indicated dissatisfaction with the amount of time spent completing the assessment tool and the amount of preparation needed to cmplete the assessment process[171, 178]. A number of other universities are also currently using a modified OSCE as a tool for formative and summative assessment, as a learning resource, and to identify gaps and weaknesses in clinical skills. The literature contains many publications about the procedure of setting performance standards that permit the comparison of groups with different levels of knowledge and skills[151–152, 156, 166, 174–176].

The OSCE has served mainly as a robust framework with which to assess students' practical competence. It can be used for both formative and summative purposes; to provide feedback to students and staff; and for certification, revalidation and progress[171]. Much research has focused on its reliability and potential in different disciplines and various groups of medical personnel[164, 179–181]. The number of countries that use the OSCE in student assessment is increasing[174–176]. The OSCE was first adopted in North America in a widespread manner. It was later widely adopted in the United Kingdom in the 1990s. In addition, the principle methods for clinical skills assessment in medical schools and licensure bodies across the USA, Canada,



Multiple-choice questions (MCQ) are selected-response tests where a candidate selects the response from a small number of options.
Constructed-response questions (CRQ) are questions requiring the candidate to generate an answer.
Essays require candidates to construct a long written response to a question.
The extended matching item (EMI) test tests not only knowledge, but also its application to clinical decision making, and portfolios are collections of papers and other forms of evidence that learning has taken place.

Figure 2. Miller's pyramid[169]

Australia, New Zealand and other countries is the OSCE.

Standard setting

To promote learning, assessment should be formative. Students should learn from tests and receive feedback on which to build their knowledge and skills. The key issue for any tests is the clear focus of the assessment; the test is planned based on the learning objectives, test formats are selected for the competencies to be tested (validity), sampling is adequate, clinical competencies are inconsistent across the different tasks, and tests require many examiners (reliability). It is also recommended that the end point be defined and appropriate standards be set in advance. A clear standard must be defined and set for each test item, and the minimum standard acceptable should be defined before the test[80–81, 182].

Tests for competence should be structured for each speciality in order to provide coverage for the entire profession[154]. Standard setting is important to assure the public that licence and certificate holders possess the skills and knowledge necessary to perform safe and effective patient care[183–184]. Standard setting is always a judgement process, and performance standards are method dependent. For tests of professional competence, the most important aspect of validity is content validity. The framework can be either norm-referenced (the standard is based on the performance of a selected group) or criterion-referred (the standard is defined with regard to an acceptable specific measure of performance)[185].

The Angoff procedure[80–81, 185–186] is a widely used and well-defined method that can serve to set standards for physical skills (SP) examination checklists used to score cases in SP examinations. The Angoff procedure is a prominent example of a test-centred assessment method, where hypothetical decisions based on test content serve to derive a standard. In this labourious method, panelists or experts are asked to estimate the number of examinees who would receive credit for a particular item (e.g. estimate the percentage of participants who would have each item of the clinical skills checklist correct). These estimates of different experts are averaged over every checklist item in order to calculate a standard cut-off point as an average of these estimations. Thus, the rating can be considered independent and can serve to assess different kinds of groups[183].

3. AIMS OF THE THESIS

The aims of this study were to gain knowledge of the CC guidelines for CPR implementation in Finnish primary and secondary care and to study possible changes in resuscitation practices, especially concerning early defibrillation. Another aim is to obtain more focused knowledge of nurses' and students' attitudes towards guideline implementation and nurses' and students' ability to implement the guideline recommendations in clinical practice. The national guidelines 2002 include substantial changes to previous practices in cardiopulmonary resuscitation (e.g. defibrillation training for non-physician staff is strongly recommended). Additionally, few medical professionals/nurses and nursing students adhere to cardiopulmonary resuscitation guidelines in clinical practice, and the influence of guidelines is often known to have only a limited impact on the behaviour of caregivers.

This study aims specifically to examine:

1 The implementation of the CC guidelines for CPR in Finnish health centres (I).

2 The CPR-D skills of nurses and nursing students in specific hospitals and institutions (II, III).

3 Medical and nursing students' and nurses' attitudes towards CC guidelines for CPR and CPR-D (IV-V).

4 The CPR-D skills of nurses after different CPR-D education (VI).

4. MATERIALS AND METHODS

The data of the studies were collected from four different groups of health care workers: physicians, nurses, and medical and nursing students. The purpose of using these different groups of participants was to gain knowledge of the CC guidelines for CPR implementation in Finnish primary and secondary care, as well as more focused knowledge of nurses' and students' attitudes towards guideline implementation and the ability of nurses and students to implement the guideline recommendations in clinical practice. The study was conducted as six individual studies, which are briefly described in Table 5.

4.1 IMPLEMENTATION OF CC GUIDELINES FOR CPR IN PRIMARY HEALTH CARE (I)

In Finland, municipal health centres (N = 279) are responsible for the public health care of a population of 5.2 million (2004 estimate). Most health cen-

Table 5. Brief description of the individual studies comprising the present thesis.

Study	I	II	III	IV	V	VI
Design	Cross-sectional mail survey	Controlled trial, OSCE	Controlled trial, OSCE	Survey	Survey	Randomised controlled trial, OSCE
Framework	All public Finnish health centres, capacity of 24 000 beds	Finnish hospital, capacity of 16 wards and 437 beds and Swedish university hospital, capacity of 80 wards and 1820 beds	Finnish institution of higher education, Faculty of Health Care and Nursing. Swedish university, Department of Health	Finnish university, medical faculty and Finnish institution of higher education, Faculty of Health Care and Nursing	Finnish hospital, capacity of 8 wards and 152 beds	Finnish nursing home, capacity of 600 beds
Participants	183 head physicians	150 nurses from two hospitals	40 nursing students from two nursing institutions	71 fourth-year medical students, 56 final-year medical students, and 76 final-year nursing students	297 nurses in 2003, and 199 in 2007 from a secondary hospital	56 nurses working in a nursing home

tres (220) have their own hospitals, with total bed capacity of 24 000. In the service area of the municipality, health centre services can be provided in several locations. The aim of this study was to assess possible changes in resuscitation practices in primary care settings, especially concerning early defibrillation, two years after the publication of the CC guidelines for CPR.

Participants

A survey was mailed to the chief physicians of every health centre in Finland (N = 279).

Data collection

A survey questionnaire mailed to the health centres in May 2004, two years after the publication of the national resuscitation guidelines. The questionnaire was followed as necessary by a reminder. The addressees were asked to answer the questionnaire themselves or to forward the questionnaire to the person in charge of resuscition training and equipment in the health centre. The data were collected using a survey based questionnaire. The questionnaire focused on possible changes in practice and included questions about implementation of the guidelines. One the most important measures included the use of AEDs and defibrillation performed by nurses.

The questionnaire consisted of a number of detailed questions focusing on current cardiopulmonary resuscitation practices in the health centres and on cardiopulmonary resuscitation training after publication of the national guideline 2002. The questionnaire contained a total of 104 questions about demographic and background data (7 questions), BLS skills and training (11 questions), ALS training (10 questions), training equipment at the health centre (4 questions), supervision of competence (4 questions), organisation of resuscitation training (8 questions), recognition of cardiac arrest alarms and BLS (13 questions), defibrillation (10 questions), ALS (10 questions), instructions and guidelines (8 questions), data collection and ethical issues (19 questions) (Appendix 1).

The questionnaire also included the Attitude towards Guidelines Scale (AGS)[96–97]. Which has been developed to assess perceived barriers to and facilitators of guideline implementation as well as validity and reliability. The instrument consists of seven subscales, each of which contains two items. Each of the items was measured with a subscale of two questions: general attitude, usefulness, reliability, lack of individual or team competence, lack of organizational competence, impracticality and availability. The questions were presented using a seven-point Likert scale[186] ranging from totally disagree to totally agree (1 = totally disagree, 2 = somewhat disagree, 3 = slightly disagree 4 = neither agree nor disagree, 5 = slightly agree, 6 = somewhat agree, 7 = totally agree).

Participants rated their agreement with each item on a seven-point Likert scale and the Likert score was the sum of responses from several Likert items, (Appendix 1).

4.2 CPR-D SKILLS OF NURSES (II)

The Finnish hospital was planning to launch an educational programme to enhance the quality of in-hospital CPR. Swedish hospital has analysed and recorded in-hospital resuscitations regularly, and since 1996 have focused efforts on impairing opportunities for better survival rates from in-hospital CA. Many AEDs have been distributed in wards, and all nurses are re-trained at least once a year. The hospital has reported excellent results from in-hospital resuscitations. The aim of this study was to assess the CPR-D skills of nurses in both Sweden and Finland, and to facilitate the development of educational programmes in Finland.

Participants

The study group consisted of 110 nurses from 11 wards in Finnish hospital and 40 nurses from 13 wards in Swedish university hospital. The characteristics of participants appear in Table 1 of Study II.

Study protocol

The training curriculum in both Sweden and Finland are based on the guidelines of both the International Liaison Committee on Resuscitation (ILCOR) and the European Resuscitation Council (ERC). The educational programmes were analysed in detail by reading the curriculum and interviewing the teachers in the participating hospitals. The nurses were working at their normal tasks in the wards. At the time of the test, the head nurse asked two nurses to leave their tasks in order to participate. Nurses and nursing students participated voluntarily and anonymously, and the representatives of the institutions agreed to publication of the results. The background data on nurses working in Finnish hospital and Swedish university hospital were collected with a questionnaire consisting of questions concerning the demographic background characteristics of the respondents.

The skills of the nurses in AED-BLS were tested using the OSCE. In the OSCE, identical tasks performed by all participants in a fixed time were evaluated with checklist. An OSCE setting used in the study comprised one scenario: a case of cardiac arrest with ventricular fibrillation (VF) as the initial rhythm. The subjects were tested in pairs, each pair alone. Just before the OSCE, nurses were informed that they would be evaluated during their performance. Each pair had two minutes to read the instructions at the OSCE station door before entering the room. In the scenario, a lifeless person (a mannequin) in simulated VF was lying on the floor when the pair

entered the room. A defibrillator, a ventilation mask and an oxygen supply were available at the door. The nurses were allowed to use the defibrillator they had on their ward. A clothed mannequin and two anaesthesiologists as observers were waiting inside. The pair had five minutes to perform the task. One of the investigators was playing the eyewitness and recording the time. The other was able to move freely around the scene while recording items on the checklist.

A skills checklist consisting of 49 items was used to grade each pair. The dichotomous checklist contains the basic life support skills used by Brennan and colleagues[156], with the addition of defibrillation to the list. The steps evaluated included recognising of unresponsiveness and possible cardiac arrest, calling for help, moving the patient to an open place, opening the airway, correctly positioning the electrode pads, elapsed time from activation of the device to initial AED analysis, delivering the schock safely when needed, delivering technically correct compressions and inflations with the correct frequency and sequence, and reporting the event to professionals arriving on the scene (Appendix 2 a).

Non-technical groupwork skills were defined as secondary learning outcomes. Descriptions about expected performance were written in advance of every skill in order to help the assessors to standardise their judgements. The data about non-technical groupwork skills were collected using an instrument constructed according to recommendations included in the Anaesthetists' Non-Technical Skills ANTS[147]. The checklist consisted of nine items, namely task management (four items), teamwork (two items), situation awareness (two items), and total performance score (one item). The skills were assessed using a five-point scale (1 = not attempted, 2 = weak, 3 = neutral, 4 = good, 5 = excellent) (Appendix 2 b).

4.3 CPR-D SKILLS OF NURSING STUDENTS (III)

The CPR-D skills of newly qualified nurses in institutions in Sweden and Finland located near previously studied hospitals in these two countries were assessed using an OSCE. In the Swedish university and Finnish institution of higher education, the CPR training curriculum follows the national guidelines in two countries, their guidelines based on international guidelines. The aim of this study was to assess the CPR-D skills of nursing students.

Participants

A total of 60 nursing students from two nursing institutions participated in the study; a Swedish university, educating 60 registered nurses annually, and a Finnish polytechnic (a University of Applied Sciences, Finland), educating 160 nurses annually (90 beginning in September and 90 in January). One group of all final-year students from

Table 6. CPR training curriculum for nursing students at Swedish university and at Finnish institution of higher education.

Institution	Guideline	First year	Second year	Third year	Total hours
Swedish university, Department of Health Swedish group	National guidelines from the Swedish Society of Cardiology	Basic CPR	CPR at hospital with two-rescuer Mouth-to-mask ventilation, oxygen and suction	CPR-D at hospital with two-rescuers Mouth-to-mask ventilation, oxygen and suction, and defibrillation with AED	
		1 h lecture 2 h hands-on training session	1 h lecture 2 h hands-on training session	1 h lecture 2 h hands-on training session	9 h
Finnish institution of higher education, Faculty of Health Care and Nursing Finnish group	National Current Care guidelines from the Finnish Medical Society of Duodecim	Basic CPR Mouth-to-mouth ventilation	CPR-D at hospital with two-rescuers: adult and child Mouth-to-mask ventilation, defibrillation with AED, adult and child	CPR-D at hospital with two-rescuers: adult and child Mouth-to-mask ventilation, defibrillation with AED, adult and child	
		1–2 h lecture 2 h hands-on training session	1–2 h lecture 2 h hands-on training session	1-2 h lecture 2 h hands-on training session	6–8 h+ (voluntary studies 3-4 h)
				Voluntary alternative studies (3-4 h)	= 6–12 h, median 9 h

both institutions was recruited for the study. The study group consisted of the Swedish group (n = 30) and the Finnish group (n = 30), (N = 60 in total). Students who had previous nursing education or had worked as volunteers in emergency units were excluded from the study. In Sweden, the class consisted of 34 students, of whom 88.0% (30, 26 women and 4 men, mean age 31.0 years, range 21–48) were tested. Four students were excluded according to previously set criteria. In Finland, the class consisted of 40 students, of whom 75.0% (30, 28 women and 2 men, mean age 25.4, range 21–41) were tested; and ten students were excluded.

Study protocol

The two institutes were chosen, because the nurses in the Swedish university hospital possess good CPR-D skills and the hospital has reported excellent results of in-hospital resuscitation. With these results, we sought to analyse how much of the intergroup differences in CPR-D skills could be attributed to factors other than the CPR-D training received in the hospital. These differences may originate from the basic education in the nursing institutions within the same area; hospitals in both countries usually recruit nurses from the nearest nursing school.

The training curriculum follows the national guidelines in both countries. The guidelines are based on the guidelines of both the International Liaison Committee on Resuscitation (ILCOR) and the European Resuscitation Council (ERC). In both of the institutes, the CPR-D education programme for nurses contains courses in resuscitation over a three-year period. The educational programmes were analysed in detail by reading the curriculum and interviewing the teachers (Table 6).

Teachers of the institutions were informed about the testing days in advance. Students were tested randomly and had no a priori knowledge of the topic or nature of the test. They participated voluntarily and anonymously, and the institutions agreed to publish the results.

The background data on nursing students from Finnish institution and Swedish university was collected with a questionnaire. Identical OSCE settings were used in both countries. The OSCE setting was determined using a single scenario: cardiac arrest with ventricular fibrillation (VF) as the initial rhythm. Students were tested in pairs, one pair at a time. An OSCE- list was used to collect data on the CPR-D skills of nursing students; a dichotomous checklist consisting of 49 items focused on AED-BLS skills (Appendix 2 a). Data on non-technical groupwork skills were also collected using a checklist consisting of nine items, The skills were assessed using a five-point scale (1 = unattempted, 2 = weak, 3 = neutral, 4 = good, 5 = excellent), (Appendix 2 b).

To increase the reliability of the testing, the same examiners tested the Swedish and the Finnish students. There were three examiners in the room: two assessed CPR-D performance according to the OSCE checklist, and one was served as an eyewitness recording time. The examiner discussed any possible differences in observations after every tested pair in order to reach consensus. In Finland, the scenarios were also recorded with a videocamera.

4.4 STUDENTS' ATTITUDES TOWARDS CC GUIDELINES FOR CPR AND CPR-D (IV)

Finnish BLS and defibrillation education is based on the CC guidelines for CPR. The aim of this study was to assess possible changes in students' attitudes towards CPR guidelines over their academic years.

Participants

A group of fourth-year medical students in medical faculty at Finnish university participated in piloting the questionnaire. The final version of the modified questionnaire was mailed to 100 sixth-year medical students from the medical faculty at theUniversity of Helsinki, and 120 fourth- year nursing students from Finnish institution.

Study protocol

The data on medical and nursing students' attitudes towards cardiopulmonary resuscitation and current practice guidelines were collected using an electronic questionnaire developed by the authors. A reminder was sent via e-mail one week later. A pilot questionnaire concerning beliefs and attitudes was distributed to students just prior to a lecture. Students answered anonymously, and the completed questionnaires were collected from the participants. The questionnaire consisted of five questions concerning the demographic background characteristics of the respondents, and nine items concerning CPR-D, which were asked in two or three different formulations (= 26 questions). After statistical analyses (Cronbach's alpha), the questionnaire was modified to improve its reliability. Questions concerning attempted CPR-D were excluded. Questions concerning each student's ability to work as a member and leader of a resuscitation team as well as anxiety towards defibrillation were added to the final version of the questionnaire.

The final version of the electronic questionnaire, contained 5 questions about demographic and background data, 27 about beliefs and attitudes toward CPR-D, and 14 questions concerning attitudes towards CC guidelines for CPR (the Attitude towards Guidelines Scale (AGS) by Elovainio and colleagues)[97,186]. Students answered anonymously, and the completed questionnaires were returned electronically. The questions were presented using a seven-point Likert scale[186] ranging from totally disagree to totally agree (1 = totally disagree, 7 = totally agree) (Study IV, Tables 1–15) (Appendix 3).

4.5 NURSES' ATTITUDES TOWARDS CC GUIDELINES FOR CPR AND CPR-D (V)

Finnish hospital was planning to launch an educational programme to enhance the quality of in-hospital CPR. The timing of the study was chosen to determine the baseline before this educational intervention. The aim of this study was to assess possible changes in nurses' attitudes towards CC guidelines for CPR and defibrillation during arrests as a result of education.

Participants

The sample consisted of all nurses working in a medium-size secondary hospi-

tal in Southern Finland, which is part of the Helsinki University Central Hospital (HUCH) and the Hospital District of Helsinki and Uusimaa, Finland (8 wards, 152 beds). The study groups consisted of 297 / 361 (82.2 %) nurses in 2003 and 199 / 361 in 2007 (55.1%) working in patient wards in internal medicine, surgery, paediatrics, gynaecology and obstetrics, and geriatrics.

Study protocol

The AED-BLS provider course were conducted according to the ERC guidelines for all health care personnel except the physicians in the hospital. The Finnish Red Cross trained the instructor, who was also ERC approved. Each half-day of courses consisted of skill demonstrations and hands-on practice during which the participants were instructed to practice in pairs, after attending a minimal number of lectures. Leadership education was not included. The education was provided to groups of six to eight participants with a mannequin and AED. Each candidate received individual feedback on his or her CPR-D performance.

The data collection was carried out in two parts. The data on nurses' attitudes towards CPR-D and the current cardiopulmonary resuscitation guidelines were collected with self-administered questionnaires in 2003 and 2007 (Appendix 4). Questionnaires were emailed to the hospital, and later printed and distributed to all nurses working in the hospital. Nurses answered anonymously, and the completed questionnaires were collected from the wards and returned by mail. One reminder was sent in both years. The author developed the questionnaire by to investigate attitudes. It contained 6 questions about demographic background, 9 about educational background, and 33 attitudes-related items, totalling 48 items. The questionnaire also included a validated AG Scale by Elovainio and colleagues. 1999 (12 questions)[14, 96–97]. Each of the items was measured using a subscale of two questions: general attitude, usefulness, and reliability, lack of individual or team competence, lack of organizational competence, impracticality and availability. Responses to negatively keyed questions were reversed so that the higher scores expressed more positive attitudes. The questions were presented using a seven-point Likert scale[186] ranging from totally disagree to totally agree (1–7). (Appendix 4).

4.6 CPR-D SKILLS AND CPR EDUCATION (VI)

Finnish nursing home is a part of second largest caring institution for the elderly in Finland. No AEDs were available in the institution, and the participants, having received no previous CPR-D training were therefore chosen for the study. The Finnish Medical Society Duodecim has developed an e-learning programme based on the CC guidelines for CPR. The aim was to study the CPR-D skills of nurs-

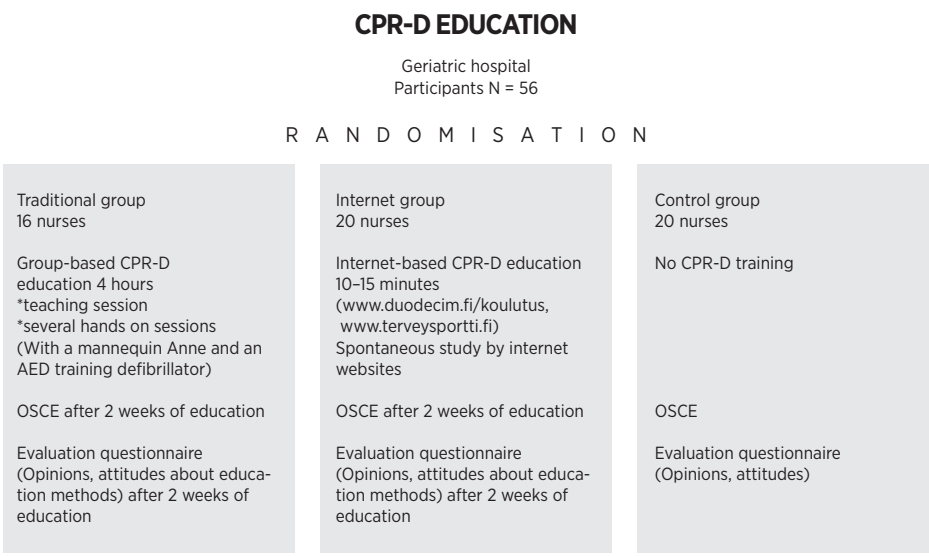


Figure 3. The flow-chart of Study VI

es after varied CPR-D education.

Participants

Nurses (n = 56) working in a nursing home volunteered for the study and were randomised into three groups: 16 nurses were participated into a traditional small group CPR-D course, 20 nurses followed the e-learning course, and 20 nurses served as the control croup.

Study protocol

The background data from nurses in a geriatric hospital were collected with a questionnaire. Nurses working in a nursing home were randomised into three groups (Figure 3). A Finnish Resuscitation Council instructor held a single small-group CPR-D course for 16 nurses (traditional group) and 20 nurses participated in the internet-based CPR-D course (internet group). A third group with no specific training in CPR-D served as the control group (control group). The internet-based CPR-D course, based on the national guidelines, was published two months before the study.

A certified trainer held a four-hour Finnish Resuscitation Council-approved traditional CPR-D course to for the 16 nurses in the traditional group. The nurses were divided into two groups, and each pair had its own mannequin and AED. The training began with a theoretical session (30 min) followed by several hands-on sessions during which the participants were instructed to practice in pairs with a mannequin and an AED training defibrillator (Laer-

dal Medical Corporation®) with self-adhesive defibrillation pads.

The internet-based CPR-D course was carried out as a self-directed study. The course began with a case or question intended to reveal possible gaps between the learner's current and needed knowledge in order to motivate the learner. The theoretical content of the course was divided into three stages: content by multimedia (video clips and pictures), a short written explanation of the multimedia, and links to the databases thereby providing additional information as needed. The interactive part of the course was carried out using questions about the content pages, and correct answers were provided. Completion of the interactive part took approximately 15–30 min. The nurses had free access to the training content and were encouraged to re-visit the site as often as they liked.

An OSCE was performed two weeks after the traditional course for all groups, and although the participants knew they would be tested, the observers were nevertheless blinded to the educational methods. The study used identical OSCE settings for all groups. The OSCE setting was determined using one scenario: cardiac arrest with ventricular fibrillation (VF) as the initial rhythm. Nurses were tested in pairs, one pair at a time. An OSCE list, a dichotomous checklist consisting 49 items focuses on AED-BLS – skills, was used to collect data on the CPR-D skills of nursing students. The data on non-technical groupwork skills were collected using the checklist consisting of nine items, The skills were assessed using a five-point scale (1 = unattempted, 2 = weak, 3 = neutral, 4 = good, 5 = excellent) (Appendix 2 b). The correct checklist items were defined as primary learning outcomes, and the groupwork skills were defined as secondary learning outcomes (Appendix 2 a).

4.7 STATISTICAL METHODS

The authors performed statistical analysis using by SPSS 12.0, 13.0 or 17.0 software. Descriptive statistics of continuous variables served as the mean (Studies I, II, III, IV, V and VI), median (Study VI), and range (Studies I, II and VI). In calculations of confidence intervals (CI) for proportions, we used the modified Wald (also called the adjusted) method[187–190] (Studies I, II and V). The modified Wald interval provides the best coverage for the specified interval when fewer than 150 samples are available.

Comparisons of categorical data between the two groups were performed using Fisher's exact test[188, 191] (Study I) and the Chi-square (Study I), as appropriate. And for multiple comparisons, we used one-way ANOVA with the Kruskal-Wallis test (Study IV, V) and Mann Whitney U-test (Study IV) when appropriate. A P-value of less than 0.05 was considered statistically significant. In comparisons of continuous data between the two groups, we used the paired and unpaired T-test as appropriate (Studies II, III and V). Correlation between the clinical checklist

and groupwork skills was tested using Spearman Rank Correlation[192] (Studies II, III, V and VI). Differences in attitudes between 2003 and 2007 were calculated using analysis of variance (ANOVA) (Study V).

Factor loading[193] (Study IV) was calculated using Principal Component analysis without rotation[186–187] (SPSS 12.0 and 13.0 SPSS Inc., Chicago, IL, USA) to examine the underlying constructs of the survey instrument in Study IV. Five scales were developed according to these results (Confident CPR-D, Defibrillation positive, Defibrillation negative, Organisation guidelines, and Competence guidelines).

Exploratory factor analyses using the Maximum Likelihood Extraction Method with the Kaiser Normalisation Rotation Method (rotation converged six iterations) was performed to examine the underlying constructs of the survey instrument in Study V (SPSS 17.0 SPSS Inc., Chicago, IL, USA). The questionnaire used in Study V of this thesis consisted of 31 items (48 - background data items = 31). Rotation served to render the output more comprehensible, which facilitated interpretation of the factors. Analyses were performed separately. At first, three items with lower correlation coefficients with the components (< 0.3) were omitted from the tool. SPSS listed the eigenvalues associated with each linear component (factor). SPSS then extracted all factors with eigenvalues greater than 1.0, which left us with three factors. The Kaiser rule is to drop all components with eigenvalues under 1.0.

The Cattell scree test was also performed in Study V. The Cattell scree test plots the components along the X axis and the corresponding eigenvalues along the Y axis. As one moves to the right toward later components, the eigenvalues drop. When the drop ceases and the curve forms an elbow, the Cattell scree test suggests dropping all further components after the one falling the elbow. Retaining five factors instead of three could therefore be justified. This analysis revealed that the initial questionnaire actually comprised five subscales. These five final factors were labelled: attitudes towards CPR-D, positive attitudes towards guidelines, negative attitudes towards guidelines, attitudes towards implementation, and attitudes towards nurses' role (Study V, Table 1).

Cronbach's alpha[194] was used to test the internal consistency of the checklist, as appropriate (Studies II, III, IV, V and VI). Cronbach's alpha will generally increase when the correlations between the items increase. For this reason the coefficient is also called the internal consistency or the internal consistency reliability of the test. Cronbach's alpha measures how well a set of items (or variables) measures a single, one-dimensional latent construct, which usually requires a reliability of 0.70 or higher. In Studies II, III and VI, performance data were collected using an OSCE checklist with a total score range from 0 to 49. The dichotomous OSCE checklist includes the basic life support skills used by Brennan and colleagues[156], and defibrillation has

been added to the list. This method is described in the studies of this thesis. In Study II, the reliability of the checklist was > 0.77 in the Finnish institution, and > 0.78 in the Swedish institution. In study III, the reliability of the checklist was > 0.67 in the Finnish hospital and > 0.86 in the Swedish hospital. In study V, the reliability of the checklist used in the secondary hospital was > 0.66 in 2003 >0.65 and in 2007 and in Study VI, reliability in the geriatric hospital was > 0.77.

In Study IV, the paper questionnaire consisted of questions concerning demographic data and included nine main items on CPR-D. Every item was enquired using two or three different formulations, the total number of questions being 26. The students were asked to answer using a Likert scale form 1 to 7 (1 = totally disagree, 4 = neither agree nor disagree, 7 = totally agree). After statistical analyses (Cronbach's alpha), the questionnaire was modified to improve its reliability. Due to their low reliability (Cronbach's alpha < 0.5), questions on attempted CPR-D were excluded.

Five expert CPR-D instructors in both Finland and Sweden independently set the pre-determined cut-off point using the widely used Angoff method (Studies II and III)[80–81]. The Angoff method, in its most basic form, is seemingly a very simple process. A group of experts are each asked to (independently) think of a group of minimally competent candidates who would border on the mastery/non-mastery cut-off. The most typical instruction is for judges to think a pool of 100 candidates who would "just barely" meet the performance criteria. This method requires the assembly of a group of subject matter experts, who are asked to evaluate each item and to estimate the proportion of minimally competent examinees that would correctly perform the item.

To calculate the Angoff cut-off point the experts decided for every point of the checklist what percentage of the participating nurses would receive credit for the particular point. This cut-off score then represents the score which the panel estimates a minimally competent candidate would receive. For example, 70 % of participants would open the airway properly. The decisions of the different experts were then averaged for every checklist item. An average was calculated for the estimations, separately for each item, as well as for the entire test. The Angoff average of 32.47 served as the cut-off point and was discussed prior to agreement. The Angoff average was calculated independently for every group and prior to each test.

5. RESULTS

5.1 IMPLEMENTATION OF CC GUIDELINES FOR CPR IN PRIMARY HEALTH CARE (I)

The response rate from the health centres was 65.6%, and the responses geographically represented the whole country. The chief physicians completed 57.4% of the forms, other physicians completed 20.8%, the head nurses completed 8.7%, and other nurses completed 13.1% of the forms. The majority of the respondents (96.2%) participated in clinical work. Ward capacity represented 69.2% of the total capacity of the health centre hospitals of the country.

In almost half (48.9%) of health centres, the resuscitation practice was based on no resuscitation guidelines, 40.7% used national guidelines, 1.1% used international guidelines, and 9.3% used other guidelines. Resuscitation training was provided for the staff after publication of the national resuscitation guidelines in the majority of health centres. Defibrillation training was organised for physicians, registered nurses and enrolled nurses, and in some health centres, for non-medical personnel in wards and offices (Table 7). Whether the training was based on the CC guidelines for resuscitation remained unknown. Although, a significant change had occurred in resuscitation practices, the BLS and ALS training was still considered insufficient in the majority of health centres (69.0% and 76.0%, respectively).

Table 7. Resuscitation training of the staff in health centres

	BLS (n) %	Defibrillation (n) %	ALS lectures (n) %	ALS hands-on (n) %
Physicians	(122) 66.7	(126) 68.9	(120) 65.6	(92) 50.3
Registered nurses	(157) 85.8	(146) 79.8	(128) 59.9	(115) 62.8
Public health nurses	(114) 62.3	(79) 43.2	(74) 40.4	(72) 39.3
Enrolled nurses	(149) 81.4	(120) 65.6	(84) 45.9	(94) 51.4
Non-medical staff in wards	(51) 27.9	(17) 9.3	–	–
Non-medical staff in offices	(34) 18.6	(20) 10.9	–	–
None	(23) 12.6	(29) 15.8	(33) 18.0	(59) 32.2

Resuscitation training of the staff in health centres during the past two years.
BLS = Basic Life Support, includes only chest compressions and artificial ventilations.
ALS = Advanced Life Support, includes the use of invasive airway methods and pharmaceutical therapy.
Numbers appear as percentages.

Table 8. Comparison of the performance in CPR and defibrillation between nurses and nursing students

Task performed	Nurses Swedish group vs. Finnish group % n = 54 vs. 110	P-value	Nursing students Swedish group vs. Finnish group % n = 30 vs. 30	P-value
3. Addresses the patient and shakes the patient's shoulders strongly enough	85.7 vs. 6.3	< 0.05	13.3 vs. 46.6	< 0.050
4. Calls or shouts for help without delay	90.5 vs. 75.0	< 0.001		
10. Supports the head and neck while moving the patient			86.6 vs. 40.0	< 0.003
11. Moving patient is done within 15 s			20.0 vs. 73.3	< 0.004
13. Feels for breathing with back of his/her hand and/or chin	85.7 vs. 56.3	< 0.05		
14. Looks for chest movements			100.0 vs. 46.6	< 0.001
20. Opens the cover and switches the power on	95.2 vs. 31.3	< 0.01	100.0 vs. 33.3	< 0.0001
21. Opens the cover and switches the power on without delay	76.2 vs. 18.8	< 0.05	60.0 vs. 13.3	< 0.011
22. Attaches electrodes/defibrillation pads correctly by pressing the electrodes firmly, leaving no air bubbles under them	47.6 vs. 6.3	< 0.05	100.0 vs. 20.0	< 0.0001
24. Lower electrode 10 cm below left axilla	66.7 vs. 18.8	< 0.001	86.6 vs. 20.0	< 0.0001
38. Notices that the patient's chest rises, and if not, opens airway	81.0 vs. 68.8	< 0.05	93.0 vs. 40.0	< 0.0052
40. Correct technique for chest compressions	90.5 vs. 68.8	< 0.05		
43. Adequate depth of chest compressions	95.2 vs. 37.5	< 0.05		
49. Continues CPR-D effectively and without interruption			40.0 vs. 6.6	< 0.015
OSCE score (mean, range), cut-off point	35.1 (12-42) vs. 26.2 (7-37)	< 0.001	32.47 (26-39) vs. 23.80 (13-35)	< 0.0001

OSCE, Objective Structured Clinical Examination. Numbers appear as percentages.

Compared to an identical study performed in 2001, the proportion of health centres allowing nurses to perform defibrillation without the presence of a physician had increased from 24.0% to 42.0% (Study I, Figure1). In the event of a cardiac arrest occurring in the ward, the performer of the first defibrillation was likely to be a nurse in 76 of the health centres, a physician in 65, and a member of ambulance staff in 27. The proportion of heath centres with at least one AED had increased from 56.0% to 66.0%. The use of AEDs and nurse-performed de-

fibrillation was unassociated with the number of beds, the person in charge of resuscitation, the availability of a physician round the clock or the availability of staff in the wards. The introduction of new practices (allowing nurses to defibrillate, proving an AED, collecting data from resuscitation attempts, and offering regular CPR training) recommended in the resuscitation guidelines and the impact of the CC guidelines for CPR on changes in resuscitation practices in the health centres was considered to be moderate.

5.2 CPR-D SKILLS OF NURSES AND NURSING STUDENTS (II, III)

Significant differences in the CPR-D skills of nurses working in the two hospitals (Study II) and nurses studying in the two institutions (Study III) were identified in several skills during testing with the OSCE. The nurses performed better than the students, and the Swedish groups surpassed the Finnish ones.

The mean OSCE score of nurses was 35/49 (range 12–42) in the Swedish group and 26/49 (range 7–37) in the Finnish group ($P < 0.001$). Of the the nurses in the Swedish group 70.0% would have passed the test and 30.0% in the Finnish group (Study II, Figure 1). Statistically significant differences were found in activating the alarm ($P < 0.001$), setting the lower defibrillation electrode correctly ($P<0.001$), and using the correct CPR technique ($P < 0.05$). The Swedish nurses performed clearly better in activating the alarm, in activating the AED and in setting the defibrillation electrodes, as well as in employing the correct CPR technique (Table 8).

The mean OSCE score of the nursing students was 32/49 (range 26–39) in the Swedish group and 23/49 (range 13–35) in the Finnish group ($p < 0.0001$). Of the students in the Swedish group, 47.0% would have passed the test and 13.0% in the Finnish group (Study III, Figure 1). The CPR-D skills of nursing students in both institutes were inadequate according to the guidelines for cardiopulmonary resuscitation. Statistically significant differences were found in several tasks (e.g. in activating the AED without delay ($P < 0.01$), setting the defibrillation electrodes correctly ($P < 0.001$), setting the lower defibrillation electrode correctly ($P < 0.001$), feeling for pulse ($P< 0.001$), and ensuring that hands are off when defibrillating ($P < 0.001$). The Swedish students performed clearly better in every task, especially in activating the AED and setting the defibrillation electrodes) (Table 8).

The time to defibrillation was on average 109 s in the Swedish group of nurses and 119 s in the Finnish group. No statistically significant difference existed between the numbers of nurses who succeeded in defibrillating under 60 s. Only half of the Finnish nurses were able to defibrillate, whereas all Swedish nurses succeeded ($P < 0.0001$) (Table 9).

The nursing students from the Swedish group performed defibrillation significantly more effectively than did

the nursing students from the Finnish group. All the Swedish students were able to defibrillate successfully, whereas only 13.3% of the Finnish students were successful. Only a few participants in both groups succeeded in defibrillating within 60 s, which is the recommendation in the guideline. The difference between the two groups was statistically significant ($P < 0.0001$) (Table 9).

Nurses in the Swedish group had significantly more effective non-technical and groupwork skills than did nurses in the Finnish group. The global performance grade in the Finnish group was 1.9/5.0 and in the Swedish group 2.8/5.0 ($P < 0.01$). Recognition of the situation as well as continuous evaluation and prioritising problems, supporting others, leadership and co-ordinating activities, and vigilance in the situation were better in the Swedish nurses.

The non-technical and groupwork skills in nursing students of the Swedish group were significantly more effective than those of the Finnish group. The global performance grade in the Swedish group was 2.9/5.0, and in the Finnish group, 2.1/5.0. Swedish students were especially more skilled in task management. In both studies, skills in leadership and co-ordination were significantly more effective amongst nurses and nursing students from the Swedish group. Good group working skills correlated with high global performance ($P < 0.01$) (Table 10).

5.3 STUDENTS' ATTITUDES TOWARDS CC GUIDELINES FOR CPR AND CPR-D (IV)

The response rate was 59.1% among fourth-year medical students, 56.0% among final-year medical students, and 63.3% among final-year nursing students.

The CC guidelines were highly valued among the students. Attitudes towards guidelines for CPR were quite positive; most final-year medical and nursing students believed that resuscitation guidelines are useful as educational tools, can improve the quality of care, and were compiled by experts. Medical students had more confidence; most final-year medical students and only half of final-year nursing students felt that their occupational competence was sufficient to adopt the latest CPR guidelines. About half of the students saw the guidelines displayed in the unit they last worked in (Study IV, Table 5).

The item "My occupational competence is insufficient to adopt the latest CPR guidelines" correlated significantly with one's willingness to defibrillate ($P < 0.01$). The item "Resuscitation guidelines oversimplify medical practice" correlated significantly with students' confidence in their ability to perform BLS ($P < 0.01$). Negative attitudes towards defibrillation correlated with perceived organisational attitudes towards guidelines (Study IV, Table 7).

Education changed medical students' attitudes towards CPR-D to more positive ones, whereas the final-year

Table 9. Comparison of defibrillation performance between nurses and nursing students

Task performed	Nurses Swedish group vs. Finnish group % n = 54 vs. 110	P-value	Nursing students Swedish group vs. Finnish group % n = 30 vs. 30	P-value	Nurses Traditional group vs. Internet group vs. Control group % n = 26 vs. 30 vs. 30	P-value
Successful defibrillation within 60 s	5.0 vs. 1.8	Ns	13.0 vs. 0.0	Ns	12 vs. 10 vs. 10	Ns
Successful defibrillation	100 vs. 49	< 0.05	100 vs. 13.3	< 0.001	100 vs. 100 vs. 100	Ns
Time to defibrillation, mean	109 s vs. 119 s	Ns	93.5 s vs. 217 s	< 0.001	90 s vs.165 s. vs. 106 s	Ns

Traditional group received a traditional CPR-D course, the internet group received the internet-based CPR-D course, and Control group served as the control group with no previous CPR-D course.Ns: non-significant. Numbers appear as percentages.

Table 10. Comparison of the groupwork and non-technical skills of nurses and nursing students

Task performed	Nurses Swedish group vs. Finnish group n = 54 vs. 110	P-value	Nursing students Swedish group vs. Finnish group n = 30 vs. 30	P-value	Nurses Traditional group vs. Internet group vs. Control group n = 26 vs. 30 vs.30	P-value
Task management						
1. Recognising the situation without delay	4.5 vs. 2.7	< 0.001	3.6 vs. 3.4	Ns	3.3 vs. 3.2 vs. 2.9	< 0.05
2. Continuous evaluation of the patient	3.4 vs. 2.8	< 0.05	3.8 vs. 2.4	< 0.001	3.2 vs. 3.0 vs. 2.4	
3. Prioritising problems, supporting others	2.9 vs. 2.2	< 0.01	3.5 vs. 2.4	< 0.001	3.0 vs. 2.7 vs. 2.8	Ns
4. Following the protocol	3.1 vs. 2.7	Ns	3.4 vs. 2.2	< 0.001	3.5 vs. 2.6 vs. 2.7	< 0.05
Teamwork						
5. Leadership, co-ordinating activities	3.3 vs.1.8	< 0.01	2.9 vs. 1.8	< 0.002	2.7 vs. 2.8 vs. 2.6	Ns
6. Communication	3.1 vs. 2.6	Ns	2.6 vs. 2.4	Ns	3.2 vs. 3.4 vs. 2.7	Ns
Situation awareness						
7. Vigilance, anticipating	2.9 vs. 2.2	< 0.01	2.6 vs. 2.4	Ns	2.8 vs. 2.7 vs. 2.5	Ns
8. Adequate medical knowledge	2.5 vs. 2.3	Ns	2.2 vs. 1.5	< 0.003	3.2 vs. 2.1 vs. 2.4	Ns
Global performance	2.8 vs. 1.9	< 0.01	2.86 vs. 2.14	< 0.001	3.0 vs. 2.6 vs. 2.4	Ns

The traditional group received a traditional CPR-D course, The internet group received an internet-based CPR-D course, and the Control group served as the control group with no previous CPR-D course.Ns: non-significant
The skills were graded using a Likert scale: 1 = unattempted, 2 = weak, 3 = neutral, 4 = good, 5 = excellent.
Ns: non-significant, mean.

nursing students' attitudes were similar to those of the fourth-year medical students. Of the fourth-year students, 70.0% felt confident about their ability to perform BLS compared to 85.8% of the final-year medical students and 70.0% of the final-year nursing students. Of the fourth-year students 24.0% felt confident about their defibrillation skills compared to 84.0% of the final-year medical students and 22.7% of the nursing students.

Fewer than half of the medical students and the nursing students felt confident about their ability to work as a member or leader of a resuscitation team (Table 11). Their perceived inability to perform BLS correlated significantly with resuscitation-related anxiety ($P < 0.01$). The students' confidence in their own BLS skills was positive enough to suggested annual rehearsals of these skills ($P < 0.01$). The ability to perform BLS correlated with the confidence to work as a member or leader of a resuscitation team ($P < 0.01$). The perceived ability to defibrillate correlated significantly with a positive attitude toward nurse-performed defibrillation ($P < 0.01$) and negatively with a fear of damaging the patient's heart with defibrillation ($P < 0.01$) (Table 11). Medical students' attitudes toward nurse-performed defibrillation became more positive with increasing knowledge and were significantly more positive than the nursing students' attitudes. Those students who have participated in a real CA situation often felt significantly more capable of engaging in CPR-D and serving as a member of a resuscitation team. They also held a more positive attitude towards nurse defibrillation. Almost half of the final-year medical students and over half of the nursing students strongly felt that the amount of CPR-D education is insufficient ($P < 0.001$) and wished for more hands-on practise, especially in a simulator.

5.4 NURSES' ATTITUDES TOWARDS CC GUIDELINES FOR CPR AND CPR-D (V)

The response rate was 82% (297/361) among the nurses in 2003 and 53% (199/361) in 2007.

The demographic data from two sets of years were partly comparable (Study V, Table 1).

Statically significant differences were found in the nurses attitudes before and after the CPR-D training at the hospital. Attitudes towards guidelines for CPR were quite positive; nurses felt that resuscitation guidelines could improve patient care as well as interactions between health care personnel and patients. The training programme did not change already positive attitudes or attitudes towards implementation, but did increase negative attitudes towards the guidelines in the organisation. The nurses felt less often that the new guidelines were about to change nursing roles during resuscitation, and nurses were less certain of their role than before the training (Table 12).

The scale "Attitudes towards CPR"

Table 11. Medical and nursing students' attitudes towards CPR and defibrillation.

	Disagree %	Neutral %	Agree %	P-value
2. Only a doctor can defibrillate				
Fourth study year	70.0	30.0	0	< 0.001
Sixth study year	72.2	26.0	1.9	
Nursing students	62.7	32.0	5.3	
3. I am able to work as a member of a resuscitation team				
Fourth study year	-	-	-	0.05
Sixth study year	0	53.7	46.3	
Nursing students	17.6	62.2	20.3	
5. I can perform BLS				
Fourth study year	2.8	26.7	70.4	0.01
Sixth study year	0	14.3	85.7	
Nursing students	1.3	26.7	72.0	
6. I know how to defibrillate				
Fourth study year	32.4	43.7	24.0	0.001
Sixth study year	0	16.1	83.9	
Nursing students	26.7	50.7	22.7	
10. The Nurse's role has become more active after publication of the guidelines				
Fourth study year	-	-	-	< 0.001
Sixth study year	0	61.1	3.,9	
Nursing students	2.7	66.2	31.1	
12. Defibrillation is performed by the first health care professional on the scene				
Fourth study year	20.0	47.2	32,9	< 0.05
Sixth study year	3.7	22.2	74.1	
Nursing students	24.0	40.1	36.0	
15. I am able to work as a leader of a resuscitation team				
Fourth study year	-	-	-	0.01
Sixth study year	5.6	53.7	40.8	
Nursing students	52.7	44.6	2.8	
25. The change in the nurse's role is positive				
Fourth study year	-	-	-	< 0.001
Sixth study year	0	38.9	61.1	
Nursing students	2.7	41.9	55.4	

Medical students in fourth study year (N = 71), sixth study year (N = 56) and nursing students (N = 15) The following modified Likert scale (1-7) was used: Disagree 1-2, Neutral 3-5, Agree 6-7. Questions 10 and 25 were excluded from the first draft of the questionnaire distributed to the fourth year students. Numbers appear as percentages.

Table 12. Nurses' attitudes towards guidelines

	2003 n = 297	95% CI	2007 n = 199	95% CI	P-value
Scale 2. Positive attitudes towards guidelines					
14. Resuscitation guidelines can improve the quality of health care	5.7 (1.2)	5.6-5.9	6.2 (2.1)	5.9–6.2	< 0.0001
15. Resuscitation guidelines are a convenient source of advice	5.7 (2.2)	5.5-6.0	4.8 (2.2)	4.8–5.2	< 0.0001
16. Resuscitation guidelines are useful as educational tools	6.0 (2.0)	5.8-6.3	4.5 (2.3)	4.5–4.9	< 0.0001
18. Resuscitation guidelines can improve the interaction between patients and health care personnel	5.1 (2.2)	4.9-5.9	6.5 (0.9)	6.4–6.6	< 0.0001
Scale 3. Negative attitudes towards guidelines					
21. Resuscitation guidelines are not valued in our organisation	2.6 (2.7)	2.3-3.0	6.0 (1.1)	5.9–6.2	< 0.0001
22. Most of our team members have disapproving attitudes towards resuscitation guidelines	3.1 (2.7)	2.8-3.4	5.8 (2.5)	5.5–5.9	< 0.0001
23. Resuscitation guidelines oversimplify medical practice	3.1 (2.9)	2.9-3.5	2.2 (1.3)	2.1–2.4	< 0.0001
Scale 4. Attitudes towards implementation					
24. I did not see the guidelines in the unit I last worked in	4.8 (3.4)	4.5-5.3	2.1 (1.3)	2.0–2.3	< 0.0001
25. Resuscitation guidelines are difficult to find when needed	4.1 (3.1)	3.8-4.5	2.4 (1.3)	2.0–2.4	< 0.0001
27. I have read the Duodecim Current guidelines	1.9 (2.7)	1.6-2.2	2.9 (1.6)	2.7-3.2	< 0.0001
Scale 5. Attitudes towards nurse's role					
28. The nurse's role is changing due to new resuscitation guidelines	5.0 (2.0)	4.8-5.3	3.6 (2.1)	3.3–3.9	< 0.0001
29. I feel that this change of role is positive	5.1 (2.0)	4.9-5.4	4.7 (1.9)	4.5–5.0	< 0.053
30. All healthcare personnel should be able to perform defibrillation, when needed	4.3 (2.4)	4.0-4.6	2.2 (1.5)	2.0–2. 5	< 0.0001
31. I feel that the first person to arriving the resuscitation scene should perform at defibrillation	4.8 (2.3)	4.6-5.1	3.0 (1.9)	2.8–3.3	< 0.0001

Questions concerning attitudes towards the CC guidelines for CPR in 2003 and 2007, item by item.The following modified Likert scale (1-7) was used: Disagree 1-2, Neutral 3-5, Agree 6-7. (1 = totally disagree, 2 = somewhat disagree, 3 = slightly disagree 4 = neither agree nor disagree, 5 = slightly agree, 6 = somewhat agree, 7 = totally agree). Figures appear as the mean of the given Likert score, (SD).

Table 13. Nurses' attitudes towards CPR and defibrillation

	2003 n = 297	95% CI	2007 n = 199	95% CI	P-value
Scale 1. Attitudes towards CPR-D					
1. I hesitate to perform defibrillation, because I am unsure that I recognise the rhythm correctly	5.0 (2.3)	4.8-5.4	1.7 (1.0)	1.6-0.9	< 0.0001
2. I hesitate to perform defibrillation, because of my anxiety about the situation	3.5 (2.2)	3.3-3.8	5.5 (1.3)	5.3-5.7	< 0.0001
3. I hesitate to perform defibrillation, because I fear injuring the patient	4.7 (2.3)	4.5-5.0	3.6 (2.0)	3.3-3.9	< 0.0001
4. I hesitate to perform defibrillation, because the patient might die and I would feel guilty	3.4 (2.5)	3.2-3.8	3.2 (2.3)	2.9-3.4	< 0.147
5. I hesitate to perform defibrillation, because I am not ready	5.2 (2.2)	5.0-5.5	4.2 (1.8)	4.0-4.5	< 0.0001
6. I hesitate to perform defibrillation with the device we have available	5.0 (2.3)	4.8-5.4	2.6 (1.6)	2.4-2.9	< 0.0001
7. I hesitate to perform defibrillation, because I don't want to take the lead in the situation	4.4 (2.5)	4.2-4.8	3.5 (2.3)	3.2-3.8	< 0.0001
8. I hesitate to perform defibrillation, because the resuscitation team is on its way	4.3 (2.5)	4.1-4.6	3.4 (2.4)	3.0-3.6	< 0.0001
9. I am able to perform defibrillation	2.7 (2.2)	2.5-3.0	5.5 (1.4)	5.3-5.7	< 0.0001
10. I am competent to lead a resuscitation team	2.7 (1.8)	2.5-2.9	3.6 (1.8)	3.3-3.8	< 0.0001
11. I am competent to work in a resuscitation team	3.9 (1.9)	3.7-4.2	4.6 (1.5)	4.5-4.9	< 0.0001
12. My professional competence is insufficient to adopt the latest resuscitation guideline	4.2 (2.9)	3.9-4.6	5.7 (1.2)	5.6-5.9	< 0.0001
13. I feel that a doctor should perform defibrillation	4.8 (2.4)	4.6-5.2	2.7 (1.8)	2.5-3.0	< 0.0001

Questions concerning attitudes towards cardiopulmonary resuscitation and defibrillation 2003 and 2007, item by item.The following modified Likert scale (1-7) was used: Disagree 1-2, Neutral 3-5, Agree 6-7. (1 = totally disagree, 2 = somewhat disagree, 3 = slightly disagree 4 = neither agree nor disagree, 5 = slightly agree, 6 = somewhat agree, 7 = totally agree). Figures appear as the mean of the given Likert scale. (SD)

correlated significantly with the scale "Negative attitudes towards guidelines" in the workplace. Fear that the patient might die and that the nurse would feel guilty about it was the most important factor. Knowledge of the rhythms associated with resuscitation correlated significantly with one's willingness to defibrillate. The nurses found their level of CPR education, more sufficient after the training, but were dissatisfied with the training in CPR-D and cardiac rhythms. The scales "Attitudes towards CPR", "Negative attitudes towards guidelines", "Attitudes towards implementation" and "Attitudes towards the nurse's role" significantly correlated with nurses' ages and their most recent CPR-D training. Training based on the CC guidelines for CPR correlated significantly with all scales.

The training generated positive attitudes towards CPR-D ($P < 0.000$). Nearly half of the nurses agreed with the item "Only a doctor should defibrillate" before the training, whereas only 10.5% agreed after the training. Nurses felt more confident about their ability to perform the defibrillation themselves after the training than before (61.2% vs. 16.3%). Over a quarter of the nurses hesitated to perform defibrillation due to

Table 14. Comparison of performance in CPR and defibrillation between nurses randomised in to three groups.

	Traditional group	Internet group	Control group	P-value
The task performed	(n = 16)	(n = 20)	(n = 20)	
Shakes the patient for a response	30*	10	0*	< 0.05
Checks that EMS has been called	25	0	10	
Questions witness about the event	25*	30*	0	< 0.05
Checks for possible movement of the chest	100*	100*	0*	< 0.0001
Upper AED electrode in the right place	87	100	100	ns
Lower AED electrode in the right place	100*	60*	50*	< 0.01
Checks that ventilations are effective and opens the airway again, if necessary	100*	70	40*	< 0.001
Correctly places compressions	100*	40*	40*	< 0.001
Correct technique	100	70	80	ns
Correct compression rate	75	45	40	ns
Feels the pulse close to the thyroid cartilage, on one side	62	80*	20*	< 0.001
Opens the airway, gently tilts the head back and/or lifts the patient's chin	87*	80*	40*	< 0.01

AED: automated external defibrillator; EMS: emergency medical team.
*Indicates the groups with statistically significant difference.
Figures appear as the percentages.

anxiety, and nearly two thirds for fear of injuring the patient (Table 13).

5.5 CPR-D SKILLS AND CPR EDUCATION (VI)

The study group consisted of 56 nurses, of whom 16 attended a traditional CPR-D course, 20 participated in an internet-based CPR-D course, and 20 served as the control group. None of the nurses had previous experience of AED.

CPR-D was not always adequately performed even after recent small-group training. The nurses working in the nursing home, having received traditional CPR-D training, performed better than the control group (median score 34 vs. 26, $p < 0,0001$). The traditional group performed better than the other groups in shaking the patient for a response, checking that the emergency medical team has been called, placing the lower AED electrode in the right place, ensuring that the ventilation was effective, and using the correct CPR technique. Of the nurses who received traditional small-group CPR-D education, 80.0% would have passed the test with a cut-off point of 32.47, compared to half of the internet group and none of the control group nurses. Nurses receiving the internet-based course performed similarly to the traditional group in verifying breathing, placing the upper AED electrode correctly, and opening the airway as well as compressing with the correct technique, though not with the correct rate. They also forgot to check that the EMS team has been called. The overall performance was weakest in the control group (Study VI, Figure 1) (Table 14).

All participants in the internet-based group and in the control group forgot to check whether the emergency medical team had been called. Only one pair in the Internet-based group continued CPR after the team had arrived on the scene.

In all groups, nurses who had participated in a small-group CPR-D course (traditional group), nurses who had taken an internet-based CPR-D course (internet group), and nurses who received no specific training (control group) were able to use the AED, but failed to defibrillate the patient within 60 s. Only one pair in the traditional group and one in the control group performed defibrillation within 60 s (mean 1 min 30 s and mean 1 min 46 s, respectively). The internet-based group had difficulties (mean time to defibrillation, 2 min 45 s). The differences between the groups were not statistically significant (Table 9).

Those nurses working in the nursing home who had received traditional CPR-D training performed more effectively in task management, teamwork and situation awareness than did the other groups. Significant differences were found in recognition of the situation and following the protocol ($P < 0.05$) Groupwork skills correlated with clinical performance ($P < 0.01$)(Table 10).

6. DISCUSSION

6.1 DISCUSSION OF RESULTS

6.1.1 IMPLEMENTATION OF CC GUIDELINES FOR CPR IN PRIMARY HEALTH CARE (I)

The health centre questionnaire study demonstrated that two years after the publication of the CC guidelines for CPR, the majority of health centres had at least one AED and had organised training for physicians and nurses. Some health centres had also trained their non-medical personnel to use AEDs. Nearly half of the health centres allow nurses to perform defibrillation without the presence of a physician. Before publication of the national resuscitation guidelines in 2002, AEDs were seldom used, and few health centres allowed nurses to perform defibrillation[19]. According to the results, the publication of CC guidelines for CPR appears to have significantly impacted resuscitation practices in health centres, as more health centres now have at least one AED or provide an early defibrillation programme.

One of the main goals of the national guidelines is to encourage and train nurses to use in health care institution setting early defibrillation with AEDs[9, 13, 64]. The survival rate to discharge depends heavily on the interval between collapse and the first defibrillation[25]. In institutional settings the target time interval from collapse to defibrillation is three minutes. Therefore, the organisation of resuscitation services and hospital equipment should ensure the rapid defibrillation of every patient. Defibrillation should be considered the first link in an "in-hospital chain of survival" where a defibrillator immediately affects the patient upon diagnosis of cardiac arrest[35].

According to the results, health centres that prohibit nurses to perform defibrillation are the large ones with a physician available at all times. Only in relatively few health centres was a physician available round the clock, and in over half of the health centres, nurses are prohibited to perform the first defibrillation without the presence of physician. Obviously, rapid defibrillation proved impossible in the majority of health centres. Having a physician on the premises at all times is a poor excuse for prohibiting nurses to defibrillate, since every minute affects the patient outcome[195]. AEDs are safe even in the hands of laypersons[196–198] but nurses hesitate to defibrillate when unsupervised[28].

Previous studies have shown that the basic CPR education is inadequate [28–30]. The demand for changes in training protocols, organising both regular training and the evaluation of resuscitation skills at work is therefore strong[18, 28–30]. Organised training in CPR for physicians and nurses was implemented in the majority of health centres after publication of the guidelines. However, the training

was often irregular and still proved insufficient. Large health centres more often have a substantial number of vacant posts, so finding the personnel or the time to organise frequent training and supervising may be difficult. The extent to which the training was based on current guidelines remains unknown. Some groups of nurses are more frequently trained; in one study, for example, half of the nurses working in a monitored ward had received training during the past year[18].

Cardiopulmonary resuscitation guidelines had been implemented into clinical practice in nearly half of Finnish health centres. The types of interventions used to implement cardiopulmonary resuscitation guidelines, however, were not studied. The size and the range of services of health centres varied, but were otherwise unassociated with guideline implementation (the use of AEDs and nurse-performed defibrillation), as in previous studies[20, 24, 37, 100].

The guidelines were adapted to local circumstances by creating a house rule guideline in a minority of health centres. In half of the health centres, practices varied between physicians, and no guidelines were used. In health centres that had introduced new practices (e.g. defibrillation by nurses), the role of national resuscitation guidelines triggered a particular change estimated to be only moderate. However, practices aimed at performing early defibrillation have been included only in national resuscitation guidelines and international guidelines 2000, but not in earlier ones. We can assume that the national guidelines had a stimulating impact, although local triggers probably also played a role[7, 20–26, 51, 64, 100].

In a majority of health centres, a physician responded to the questionnaire and in a minority of cases a nurse did. The questionnaire was designed to be comprehensible to general practitioners who were clinically experienced and familiar with the clinical practice of the centre they represented. Those respondents not working in the field of acute care may have misunderstood some of the questions. Chief physicians or senior nurses may have answered the questionnaires differently, which could have affected the responses about the impact of the guidelines. The data about the impact of the national resuscitation guidelines in primary health care may have been subjected to bias.

The Current Care guidelines are published in the scientific journal *Duodecim*, in professional magazines, and on Duodecim's portal for health professionals. Patient versions of the guidelines are published in a lay health magazine and on the free internet pages (www.kaypahoito.fi). However, these sources offered no specific implementation programme. Despite free access to the internet, just under half of the health centres are currently using the national guidelines, and almost half have practices that vary among physicians[20]. When the internet and magazines are used alone, dissemination is unlikely to result in a behaviour change[200].

Although the attitudes of all respond-

ents towards the guidelines were very positive, only a minority of health centres actually used national guidelines. This study relies on self-reported, perceived attitudes, so some risk for social desirability bias is inevitable as individuals may wish to present themselves or their organisation in a favourable way. The results could therefore provide a somewhat more positive picture than is the case elsewhere, because these respondents may be more motivated than most health care professionals. Factors that may influence this change in clinical practice may be related not only to the attitudes and knowledge of the social, organisational, economic and legal context in which the clinicians work, but also to their skills[97, 201].

An active educational strategy is more attractive and effective at generating deep cognitive processing than a passive strategy[202]. Recent studies show, that the appointment of a person in charge of resuscitation training is of vital importance in the adequate and frequent training of personnel, which is necessary to guarantee the safe practice of CPR-D[25, 30 , 132, 152 203].

The respondents were those with autonomy and resources to develop the work on an institutional level[97]. However, the implementation process of the resuscitation guidelines continues to proceed too slowly[20]. Despite the positive attitudes, organizational constraints may hinder the implementation process[14, 24, 90–91, 104]. There are no guarantee that healthcare professionals will change their clinical practice even if they are familiar with and have overall positive attitudes towards the guidelines, because of what are likely the most important barriers: lack of time and lack of resources[90]. However, attitudes toward guidelines have proved to be important predictors of guideline use. After educational interventions, attitudes, familiarity, and the use of guidelines improved[86–88, 100]. The effectiveness of interventions[88–89] as well as availability and source of the guidelines greatly influences implementation[90–91]. Successful implementation also requires social interaction,[200] and the benefits of a frequent training programme should be rendered visible by, for example, testing personnel[27, 152]. An active national implementation programme is needed to inform health centres about the benefits of the national guidelines.

6.1.2 CPR-D SKILLS OF NURSES AND NURSING STUDENTS (II, III, VI)

Significant differences between the skills of the nurses from the two hospitals and nursing students from the two institutions were evident in several tasks when performance was scored in a simulated OSCE scenario. The Swedish nurses were significantly more effective than the Finnish nurses. The same significant difference was evident between the Swedish and Finnish nursing students studying in the two institutions. The CPR-D skills of both groups in the institutes and hospitals were inadequate according to the resuscita-

tion guidelines. Both groups had difficulty activating the alarm, using AED without delay, setting the lower defibrillation electrode correctly, and using the correct CPR technique with an adequate depth of chest compressions. Finnish nurses and nursing students also performed poorly in noticing a rise in the patient's chest and opening the airway. These findings are consistent with those of other recently conducted studies[27, 29, 79, 82, 92, 141–146].

The quality of cardiopulmonary resuscitation has been measured by the percentage of survivors and their quality of life[61, 83]. Unfortunately, this offers only limited information about the problems behind these figures. Several factors influence patient survival, and effective CPR-D is of major importance in the chain of survival and to the quality of life of survivors[205]. ILCOR has identified three factors that influence the outcome of cardiac arrest[29]. These are 1) the quality of guidelines, 2) the local "chain of survival" and 3) the quality of training for CPR providers. International resuscitation guidelines emphasise the importance of good quality CPR, but in reality, the clinical quality of CPR is often poor[127–129]. Poor knowledge and skill retention following cardiopulmonary resuscitation training for nursing and medical staff has been well documented over the past 20 years. Many studies have clearly demonstrated that medical professionals retention of resuscitation skills, is generally poor, even shortly after training,[79, 119, 123, 136–138, 144, 160, 165] and what is taught in training sessions is seldom rehearsed. Whether skills and knowledge taught in the classroom effectively transfer into the clinical area remains questionable[81–82]. Recent studies have shown that CPR training has been insufficient at various levels of care, health care professionals have difficulty following CPR guidelines,[17–18, 25, 28–30, 33–35] and both physicians and nurses skills in CPR are inadequate[128–130, 144, 146].

Basic education should provide the graduate with the practical skills and knowledge needed at work. However, this does not seem to be true of CPR-D skills[29–30, 79, 179, 199]. Even in hospitals that organising regular CPR-D training, the adequate CPR-D skills of health care personnel cannot be taken for granted. One third of the nurses in the Swedish group and over two thirds of those in the Finnish group scored below the cut-off point of the OSCE test. As we know from previous studies, those groups most likely use BLS and ALS skills retain them better[32, 160, 206–207]. Repeated refresher training at intervals of less than six months seems necessary for most individuals who do not perform resuscitation on a regular basis[160]. Due to limited personnel resources, arranging regular training seems difficult. Thus, arranging a course only for those who require repetition would be most cost-beneficial[152]. Assessment facilitates learning[81] and improves retention of CPR skills[160]. With OSCE testing, which takes ten min per participant, those nurses in need of a refresher course could be identified and trained.

Participation in standard training, however, does not guarantee that the trainee will learn the skills (Study VI). The standardised reporting of CPR training outcomes is necessary to compare both the quality of performance after various training methods[207–208], and the performance of individuals, as well as to set an absolute value for assessing professional competence[106, 159, 185]. The Angoff method is well defined,[80– 81] and the cut-off point, which is set prior to testing, offers a good standard to work with in both institutions and hospitals. Using the standard could possibly motivate both those nurses passing the test as well as those reguiring additional training.

Rapid defibrillation may not happen without extra training and rehearsal. The nurses working in the two hospitals scored overall higher than did the students in the present study, reflecting the importance of training in the workplace[209]. At the Swedish university hospital systematic efforts have aimed to improve survival rates for in-hospital CA. The hospital has recorded and analysed their in-hospital resuscitations systematically, has allocated one AED for every six wards, and retrained nurses in the use of AED at least once a year. The educational programme has also been improved over the years and clearly focuses on attempts to shorten the latency to defibrillation[107, 195, 210–212]. One of the strongest independent predictors for increased survival is rapidly started cardiopulmonary resuscitation[29, 34–35, 66, 74, 83]. The Swedish hospital began its training programme eight years before the Finnish Hospital began its training programme. In Sweden, the educational focus on shortening the delay to defibrillation was clearly evident in the prompt start of CRP-D. Swedish nurses had a shorter delay in defibrillation than did the Finnish ones, even if the Swedish nurses first checked the patient's condition before fetching the AED. The Finnish nurses hesitated in recognising the situation and failed to defibrillate, and their technique was also partly deficient. As we know from our previous study, not every hospital or health care centre provides CPR-D training, and nurses need encouragement and more information about defibrillation. It would be advantageous if the basic education of nurses were to focus on a prompt start of CPR-D already from the beginning of studies. Simplifying the content of the CPR-D training curriculum and focusing on the basics of CPR-D might also prove useful.

The Swedish nurses and nursing students also had more effective overall non-technical skills than did the Finnish ones. This could be due to leadership education or better clinical performance, which has been shown to correlate with good communication skills[213]. In particular, skills in leadership and co-ordination were significantly more effective amongst the Swedish groups. As mentioned previously, the educational programme in Sweden differed somewhat; nurses using the defibrillator are taught to take the leadership role in a resuscitation situation[212]. In Finland, leadership

was not defined in advance, and thus was not taught to the nurses at all. This could create tension in the team that expects a physician to arrive on the scene. It would be useful to incorporate leadership in to the basic education of CPR-D for all nursing students and nurses. Clear leadership in cardiopulmonary resuscitation situation seems to improve the performance of the pairs. This finding is consistent with reports that successful performance of resuscitation depends on the effective integration of both practical and teamwork skills, that non-technical skills play an important and central role in clinical practice, and that these skills considerably influence performance and patient safety[147–150].

6.1.3 ATTITUDES TOWARDS CC GUIDELINES FOR CPR AND CPR-D (IV, V)

Attitudes towards CC guidelines for CPR

Attitudes towards guidelines for CPR were quite positive among students and nurses. Most of the final-year medical and nursing students believed that resuscitation guidelines are useful as educational tools, can improve the quality of care, and are compiled by experts. Nurses also believed that resuscitation guidelines could improve patient care and, additionally, that guidelines could improve interactions between healthcare personnel and patients. The training programme did not change positive attitudes or attitudes towards implementation, but did increase negative attitudes towards the guidelines in the organisation.

Whether the wide adoption of, for example, the Hypertension (HT) Guideline is an exception concerning this specific guideline or the current trend in Finland remains unknown[18, 22, 37, 100]. Whereas the Asthma Guideline had achieved its main objectives, the CPR guideline had not been sufficiently implemented. The differences in implementation between the guideline topics studied may partly stem from the kind of changes that had to be implemented. One reason may be that the cardiopulmonary resuscitation guideline recommended significant changes in the equipment used as well as in responsibilities, which makes implementation more difficult.

The Attitudes toward Guideline scale (AGS) showed that medical and nursing students' attitudes towards guidelines were positive, especially concerning occupational competence for adopting the latest guidelines. These results are similar to those of previous studies[96–97, 100]. Cardiopulmonary resuscitation guidelines are considered useful educational tools that can improve the quality of health care, a result that is consistent with those of other studies[37, 90–91, 100]. Attitudes towards cardiopulmonary resuscitation guidelines were positive, in a way similar of previous studies[37, 97,100] and the training strengthened those attitudes. However, some felt the cardiopulmonary resuscitation guidelines

oversimplified medical practice[37, 97, 100]. In Study V, the AGS showed that the nurses were less positive about individual or team competence, organisational competence, and the usefulness of the cardiopulmonary resuscitation guidelines after CPR-D education. External barriers, such as institutional factors, have been shown to have a greater impact on the implementation of the guidelines than do individual attitudes[37, 96–97].

Current cardiopulmonary resuscitation guidelines were highly valued among students, which is in accordance with the results of previous studies[24, 37, 97, 100]. Unlike the nursing students, the graduating medical students felt competent to follow the procedures recommended in the guidelines. Positive attitudes do not necessarily correlate with practice[7, 37, 97, 100], but positive students attitudes towards nurse-performed defibrillation could help implementation of the practice guidelines for cardiopulmonary resuscitation.

Attitudes towards CPR and defibrillation

The questionnaire studies showed important changes in students' and nurses' attitudes towards current care CPR guidelines and CPR-D. Changes differed between the groups. Training changed medical students' attitudes towards CPR-D to more positive ones, and final-year nursing students' attitudes were similar to those of fourth-year medical students. Most final-year medical students and nursing students felt confident about their ability to perform BLS, and most of the final-year medical students, but only a minority of the nursing students, felt confident about their ability to perform defibrillation.

The least positive attitudes concerned the students' own confidence about their ability to work as a member or a leader of a cardiopulmonary resuscitation team. The fact that nursing students had low confidence in their occupational competence may have many causes. First, interventions in the nursing institutions were insufficient to boost the students' confidence. Second, the amount of CPR-D training was inadequate[75, 78]. Third, groupwork skills were not included in the curriculum, and leadership in cardiopulmonary resuscitation and defibrillation has traditionally fallen under the physician's responsibility. This may have led to the need to clear a new division of labour, similar sense to a previous study[100].

Negative beliefs and attitudes towards defibrillation affected the nurses' attitudes towards resuscitation. Too many nurses felt that defibrillation could do more harm than good. They stated that they hesitated to defibrillate for fear of injuring the patient or because the patient might die and the nurse would feel guilty. Anxiety, incompetence and fear of harming the patient also discouraged them from defibrillating a finding that is consistent with a recently conducted study[214]. This could be due to lack of multidisciplinary education. Nurses who hesitated to begin resuscita-

tion more often felt that only physicians should defibrillate. After the training intervention, fewer nurses felt that only a physician should perform defibrillation, and the majority felt competent to perform defibrillation themselves. The reason, that fewer than half of the nurses agreed that the new guidelines were about to positively change nurses' roles in cardiopulmonary resuscitation, remained unclear.

Final-year nursing students held beliefs and attitudes similar to those of novice fourth-year medical students. The greatest difference between them was their perceived ability to defibrillate. This is worrisome, because the role of nurses as first responders has been found to significantly decrease the delay to defibrillation[25, 35, 215]. This fear seems unfounded, because the medical students' general attitudes towards nurse-performed defibrillation were positive. A gap often crops up between what is taught and what is practiced in reality[33, 103, 216–219]. Nurse educators and critical care nurses may serve as positive role models to encourage and reinforce the crucial role nurses could play as the first health care professionals on the scene[35, 219–223].

6.1.4 CPR-D SKILLS AND CPR EDUCATION (VI)

Significant differences between the CPR-D skills of the nurses were identified when evaluating the applicability of internet-based learning as a method for teaching CPR-D. The performance of nurses who participated in the internet-based course (internet group) did not differ from those who received no CPR-D training at all (control group). The internet-based group performed as well as nurses who received traditional CPR-D training in skills based on knowledge, but their practical CPR-D skills were deficient compared to those of the traditional group. In previous studies, performance[123], but not knowledge[124–125], improved after computer simulation unlike with a theoretical textbook review; video self-instruction with a mannequin, however, proved more effective than traditional CPR training[136].

All participants in three groups successfully used the AED, but failed to defibrillate within 60 s, which is the goal according to the guidelines. In addition, too much time was spent checking vital signs. Safe, but too slow defibrillation is insufficient in professional use. Previous studies have shown that even by lay people can use successfully an AED[28, 120, 198, 220].

The internet course was designed to focus on problematic issues found in previous studies, such as correctly placing the lower AED electrode and checking that ventilation is effective[125, 152]. It seems that a video showing correct performance alone cannot replace hands-on practice. The benefit of an internet learning programme would be its design to deliver the facts of resuscitation exactly as recommended in the guidelines. However, both knowledge and skills are needed to perform effective CPR. Although an interactive

programme alone may be able to deliver knowledge, a mannequin is needed to practice the CPR skills. An internet learning programme could serve as a refresher course for those interested in updating their theoretical knowledge.

Training nurses in immediate life support is both expensive and time consuming[224]. A traditional CPR-D course should be repeated once annually, as it takes only four working hours for each participating nurse and instructor. With such a training schedule, it is rather unlikely that nurses working in a non-acute ward will retain their skills. A novel approach is needed to teach and practice CPR-D, because tests even immediately after a traditional instructor-led course with lectures, demonstrations, feedback and evaluations have been associated with poor skills performance[160, 225–228]. The literature also shows that the use of mannequins is necessary to obtain the practical skills[75, 78]. Whether the root cause lies in with the course content, the incapable instructor, the insufficient pedagogical techniques or the students remains unclear[226–228].

Training non-technical skills using simple resuscitation mannequins is challenging. As Studies IV and V show, nursing students feel they are incapable of serving as members of a resuscitation team. In Study III, the Swedish students prioritised problems, supported others and followed the protocol better than the Finnish students did. These skills could be improved with full-scale simulations, that enable the students to practice a wider range of scenarios. Exposing the nursing students to real cardiac arrests is difficult, but more information could influence their beliefs and attitudes[220–221]. Hands-on practice in a simulator could also offer the next best opportunity to manage a real situation as well as the ability to prioritise tasks[216].

6.2. VALIDITY OF THE DATA

The data collection methods should be valid and reliable. Validity means that the data collection instrument measures what it is intended to measure, and reliability relates to the degree of consistency with which something is measured. To gain an overview of the effects of implementing CC guidelines for CPR on primary and secondary care, attitudes towards guideline implementation, and the ability to implement guideline recommendations in clinical practice, we used different data collection methods and data sources. We also used different methods to improve the reliability of the study. These methods could have different weaknesses.

Studies I, IV and V, used questionnaires to collect information about implementation and attitudes. The questionnaire used in Study I was used in a similar study conducted in 2001, but the questionnaires used to collect data about attitudes were designed for Studies IV and V. The topics related to the guidelines were selected to cover the main recommendations in the guidelines 2002. The reliability of the questions was not tested. The authors developed a ques-

tionnaire for Studies IV and V to investigate attitudes, because no validated questionnaire on this subject was available. As the framework, we used the well-known AGREE instrument[45]. The questionnaire was reformulated for guideline adherence. The questionnaire also included a validated AG Scale by Elovainio and colleagues (1999)[97]. The value of the questionnaire was not been confirmed, but the factor loadings suggest that it could be a useful tool for upcoming studies.

As a previous systematic review showed[162], few high-quality studies assessing CPR-D skills exist. The cut-off point of the test was seldom reported, and the reader was uninformed about the expected or desired level of performance. The comparability of results can improved by using the same checklist in several studies, but that does not confirm the reliability of checklist used. Reliability of the checklist used may differ among professionals as well as laymen, and may be affected by translation[229–230]. Thus, reliability should be calculated after every study. Setting standards is always a judgement process, and performance standards are method dependent. For tests of professional competence, the most important aspect of validity is content validity.

Studies II, III and VI, the Objective Structured Clinical Examination checklist was used to collect data on CPR-D skills. The OSCE has been used to assess medical students' clinical skills since the mid-1970s, and in more recent years has been increasingly utilised to assess students in nursing and health professions[229]. The assessment of clinical competence in nurse practitioner programmes has advanced greatly over the past decade with the widespread use of the OSCE[229–230]. This growing utilisation has led to considerable debate within the literature pertaining to the optimal use of the OSCE as an assessment process[229]. Some studies have indicated attitudes are generally positive, as are experiences of the tool structure and operation in practice. However, other studies have also indicated dissatisfaction with the amount of time spent completing the assessment tool as well as the amount of preparation needed to carry out the assessment process[231–233].

Many variants on the original OSCE format exist, and much research has explored various aspects of their use[232]. The OSCE can be a reliable, valid and objective method, but its main drawback is that it is resource intensive[171]. To use the OSCE in a valid and reliable manner, attention must be paid to the content, test design, and implementation of the test, especially when the results will be used in high-stakes decision making[233]. The overall quality of the OSCE assessment process could be improved with increased reliability by combining assessor checklist scores and simulated patient ratings[234]. In Studies II, III and VI, Cronbach`s alpha indicated acceptable quality of data.

In this thesis, attention aimed to guarantee the reliability of the data. Studies II and III used the Angoff procedure,[80, 184–185] which is a widely used

method that can be used to set Standards on Physical examination (SP) checklists, which themselves are used for scoring cases in SP examinations. Internal consistency of the checklists used in both the assessment of skills and questionnaires evaluating attitudes, have been acceptable. Factor analyses performed with and without rotations showed high eigenvalues, and Cronbach's alphas indicated acceptable quality of the data.

Data quality was verified in several ways. The items from the questionnaires were typed on a worksheet created with Excel, and the data were entered into the data editor by reading from an Excel worksheet into an SPSS form. Then the cases that might have contained redundant information were identified and excluded by deleting them from the data file. Missing values were also identified. For any given data, there is always the possibility of different types of errors (e.g. typographical errors). To prevent the accidental modification or deletion of the original data, the file is marked as "read only". When the data were subsequently modified, the data file was saved under a different filename so the original data remained unaffected. Typed data were checked by using different types of analyses, frequency counts, and descriptive statistics such as mean, standard deviation and media. Measurement quality was assessed by analysis of the homogeneity interval consistency, which indicated the reliability of a measurement instrument. The success of the non-random sampling was checked, dropouts were identified, and items with no response were assessed during the initial data analysis.

6.3 LIMITATIONS

The results reported in this thesis reflect the skills and attitudes of the participants working or studying in these respective hospitals and institutions (Studies II, III, IV, V and VI). Whether the results can be generalised to other organisations or institutions intent on improving their CPR training remains arguable. The problems are usually similar, but the local circumstances vary. However, the instruments described in this thesis may be applicable in the assessment of the general implementation process.

Studies I, IV and V suffer from the same limitations as any study that uses self-reported data. Although self-reporting is one of the few ways to assess attitudes, desirability bias (e.g. participants provide responses they think the researcher wants or expects) is a concern.

A major limitation in Study I was that the response rate reached only 66.0%. Responses to the survey of every health centre in Finland were received from only two thirds of the health centres. Obtaining a flawless overview of the impact of the national cardiopulmonary resuscitation guidelines on primary health care was impossible, due to the low response rate. In addition, responses may not be representative of all health cen-

tres, although they may geographically represent the whole country. The data about the impact of the national resuscitation guidelines on primary health care were self-reported, were based on the subjective opinions of only one respondent per health care centre, and may be subjected to bias. The low response rate may reflect a lack of interest in the research topic among the physicians. This could have affected the results by giving more positive results about the implementation of CC guidelines for CPR.

Limitations were also related to the data collection instrument. The data were collected using a questionnaire that the authors developed for a similar study conducted in 2001. Even though the questionnaire was designed to be comprehensible to general practitioners, those respondents who were not working in acute care may not have understood all the questions as intended. This may have affected the results of Study I. Self-completed questionnaires probably create a more positive picture of guideline implementation than has actually been the case. Clinicians at least tend to overestimate their adherence to guidelines[235]. The chief physician was the respondent for 57.4% of the questionnaires, any other physician for 20.8%, the head nurse for 8.7%, and any other nurse for 13.1%.

The major limitation of Study IV is that the response rate reached only 59.1% (fourth-year students), 56.0% (sixth-year medical students), and 63.3% (nursing students). The response rate was, however, similar to those of previous studies that used electronic questionnaires[236–237]. Limitations were also related to the data collection instrument. The data were collected using a questionnaire developed by the authors that was previously unused. Thus its validity or reliability was previously untested. However, the Cronbach's alphas of the questionnaires were acceptable.

The questionnaire in Study V was distributed to the entire nursing staff of a medium-size general hospital. The original survey was planned by the hospital administration, and the idea of a follow-up questionnaire was later suggested by the authors. A Hawthorne effect[238–239] (the term is used to identify any type of short-lived increase in productivity or improvement in behaviour) cannot be excluded, but neither the administration, the educators nor the nurses knew about the second questionnaire in advance. The questionnaire was anonymous, so it was impossible to identify the participants to determine overlap between the samples. However, the annual loss of personnel from the hospital was only 4.0–6.0%, and the annual increase was 0.3%, thus suggesting a small turnover: CPR-D training was also ongoing process, which suggests we have comparable samples. The percentage of nurses answering the questionnaire was sufficient to assume that the sample is representative of the whole population of nurses working in that particular hospital.

With responses collected from medical and nursing students as well as nurses, the response rate to the questionnaires in Studies IV and V varied from

55.0% to 82.0%. Over half of the students answered the questionnaire. Similar response rates have been obtained in previous studies[29, 129]. The percentages of nurses answering the questionnaire were sufficient to ensure that the sample was representative of the whole population of nurses working in that particular hospital. In a survey-based study, it is always possible that the respondents were unwilling to answer, were too busy, too tired, simply bored or misunderstood the questions.

An implicit flaw in survey-based study (Studies I, IV and V) is that subjects who chose to respond may differ from those who did not, thus leading to selection bias. This can be addressed by follow-up studies which make repeated attempts to contact non-responders and to characterise their similarities to and differences from the rest of the group (Study IV).

Studies II, III and VI may have some limitations since the anatomy of the resuscitation training mannequin does not fully correspond to the anatomy of a real patient. There are also major sources of bias that can arise in studies examining the effects of interactions (e.g. selection bias). Selection bias could have occurred at that point were participants were allocated to groups.

The OSCE setting has limitations. For example, in a single blind OSCE examination study which compared different education methods, the examiners did not know whether the participants were "test" subjects or members of a control group. However, there was a risk that the subjects were influenced by interaction with the researcher, also known as the experimenter's bias (Study VI). The experimenters have expectations of what the outcome should be and may consciously or unconsciously influence the assessment of the performance subject (Studies II, III, VI). In studies III and VI, performance was not video recorded to certify the actions, but the number of examiners was always three to reduce the risk of errors. However, the interrater agreement was tested and was good (reliability 0.90 or higher).

In Study II, the main limitations were related to different sizes of study groups, but the Swedish and Finnish trainers agreed that their performance could be considered representative of the entire hospital. The nurses did not know in advance that they were going to be tested, they came from various types of wards in both hospitals, which improved of the reliability of the results.

In Studies III and VI, the limitations were related to the small size of the study groups, and thus the credibility of the results. In Study II, the main limitation was the absence of baseline testing. The students were selected from the two institutions in the same way. All students who were at school at the time of the study were recruited using the same inclusion criteria. In Study VI, participants were randomised into three groups, which improved the reliability of the results.

During the writing process of this thesis, International (2000)[8, 13,] and National (2002)[9] cardiopulmonary resus-

citation guidelines were updated (International in 2005[63] and National in 2006[48]). The latest international guidelines for cardiopulmonary resuscitation emphasised the concept of uninterrupted chest compressions as well as the timing, rate and quality of compressions in regard to getting back to basics in the 1960s, when basic CPR was first developed. Rescue ventilation and delays in ALS interventions are recommended so that basic CPR can be prioritised. The main changes were made in adult basic life support and in automated external defibrillation, and this thesis (Studies II, III, VI) studied the quality of CPR and rapid defibrillation. The changes in cardiopulmonary resuscitation guidelines neither influenced nor changed the results of these studies.

6.4 SUGGESTIONS FOR FUTURE RESEARCH

Further research is needed to evaluate the impact of cardiopulmonary guidelines on clinical practices and patient outcomes. A longer follow-up time is needed to determine the best way to improve the quality of care of patients with cardiac arrest. The implementation process of cardiopulmonary resuscitation guidelines offers promising results, but the pace is too slow. Identifying the local barriers and trying to eliminate them in order to enable more the successful implementation of interventions would be important. Attitudes towards learning and performing CPR-D should be clarified before starting the implementation process. The quality of the health care professionals' CPR-D skills should also be continuously evaluated in order to follow the success of the process.

Valid instruments for evaluation need to be developed to measure the quality of cardiopulmonary resuscitation education and training. Further research is needed to identify the shortcomings of CPR-D training and resources for organising CPR-D training in health care.

7. SUMMARY AND CONCLUSIONS

The present thesis addressed the implementation effects of the CC guidelines for CPR published in 2002 on primary and secondary care, especially concerning early defibrillation. Special focuses of the study were nurses' and students' attitudes towards guideline implementation and the ability to implement the guideline recommendations in clinical practices.

The main conclusions of these studies are:

1. Without a specific implementation programme, cardiopulmonary resuscitation practices in primary health care have changed significantly after publication of the current care CPR guidelines. The current care CPR guidelines were used in almost half of the health centres. The proportion of health centres with at least one AED had increased in three years. Training in CPR and defibrillation for physicians and nurses was organised in the majority of health centres after publication of the guidelines. Training was still estimated to be insufficient Since only in fewer than half of the health centres did a nurse perform the first defibrillation before a physician arrived to the patient, the goal of early defibrillation had obviously not been achieved in the majority of health centres (I).

2. The performance of CPR-D by newly qualified nurses in specific hospitals and institutions in Sweden and Finland was, according to the current care guidelines for cardiopulmonary resuscitation, not always adequate. The assessment of CPR-D skills provided valuable information for further cardiopulmonary resuscitation education in Finnish and Swedish hospitals and institutions. It showed the value of repeated training and made it clear that leadership should be incorporated into the CRP-D training of Finnish nurses. Defining and teaching leadership seems to improve cardiopulmonary resuscitation performance. Continuous postgraduate CPR-D education and training in workplaces seems to be very important, and thus significantly impacts learning and retention of skills (II-III).

3. Medical students' attitudes seem to mature over the study years. Nursing students need encouragement and more information and training, especially about defibrillation to diminish anxiety. The speed and competence of the first responder are factors contributing to the initial survival of a person following cardiac arrest. Pessimistic attitudes toward CPR-D affect students' attitudes toward current care CPR guidelines and could hinder the implementation of cardiopulmonary resuscitation guidelines (IV).

Education increased self-confidence in CPR-D skills and created positive

attitudes towards nurse defibrillation among nurses at the secondary hospital, but did not reduce anxiety about the cardiopulmonary resuscitation situation. Attention should focus on boosting the self-confidence of nurses by focusing on defibrillation training and teamwork in CPR-D training. Reasons for perceived negative attitudes in organisation must be explored. Multidisciplinary training could be one way to change negative attitudes in the organisation (V).

4. Internet-based learning cannot replace traditional instructor-led small-group learning. A video showing correct performance alone cannot substitute for hands-on practice and feedback. Although an internet-based learning programme could serve as a refresher course and effectively deliver knowledge, a mannequin is still necessary to practice CPR-D skills (VI).

YHTEENVETO (FINNISH SUMMARY)

Suomessa julkaistiin ensimmäinen kansallinen elvytyssuositus vuonna 2002 Lääkäriseura Duodecimin Käypä hoito – suositus sarjassa. Suositus on näyttöön perustuva ja se pohjautuu pitkälti kansainväliseen elvytyssuositukseen. Varhainen defibrillaatio hoitolaitoksissa on osa suosituksen keskeistä sanomaa. Suositus on vapaasti luettavissa internetin www. sivuilla.

Hoitosuositusten, kuten suomalaisten Käypä hoito –suositusten, tarkoituksena on parantaa hoidon laatua ja vähentää tarpeetonta vaihtelua hoidossa hoidonantajien ja hoitopaikkojen välillä. Suosituksia on viime vuosikymmeninä lisääntyvästi laadittu kaikissa länsimaissa, mutta suositusten noudattamisessa on huomattavia osin tuntemattomista syistä johtuvia puutteita. Yksi syy suositusten vastaiseen toimintaan on epävarmuus suositusten noudattamisen vaikutuksista hoidon tulokseen.

Tämän kuudesta jo julkaistusta osatutkimuksesta koostuvan väitöskirjatutkimuksen tarkoitus oli tuottaa tietoa kansallisen hoitosuosituksen implementoinnista ja selvittää sen vaikutuksia hoitokäytäntöihin. Osatutkimusten tavoitteena oli selvittää hoitosuosituksen käyttöönottoa, potilashoitoon osallistuvien terveydenhuollon ammattiryhmien peruselvytystaitoja sekä selvittää vaikutuksia elvytysvalmiuksiin ja asenteisiin perustuen edellä mainittuun elvytyksen Käypä hoito –suositukseen. Suosituksen mukaan kaikkien potilashoitoon osallistuvien tulisi pystyä peruselvytykseen mukaan lukien defibrillointi puoliautomaattisella defibrillaattorilla

Suomalaisten terveyskeskusten elvytyskäytäntöjä selvitettiin 2004 terveyskeskusten johtaville lääkäreille osoitetulla kyselylomakkeella. Tutkimus osoitti, että 40.7 % terveyskeskuksista oli käytössä elvytyksen Käypä hoito –suositus. Puoliautomaattisten defibrillaattorien määrä oli noussut ja noin 42.0 % terveyskeskuksista pyrittiin varhaiseen defibrillaatioon. Elvytyskoulutusta järjestettiin, mutta se oli harvoin säännöllistä tai riittävää.

Hoitohenkilökunnan peruselvytystaitoja selvitettiin testaamalla elvytysvalmiuksia strukturoidulla OSCE testillä ja vertaamalla peruskoulutuksen sekä työelämän antamia valmiuksia hoitosuosituksen mukaiseen elvytykseen Ruotsissa ja Suomessa. Tutkimus osoitti, että elvytystaidot olivat yleisesti heikot. Työelämässä toimivilla hoitajilla oli paremmat elvytystaidot verrattuna vastavalmistuneisiin opiskelijoihin. Tutkimus osoitti myös, että ruotsalaisten hoitajien valmiudet suosituksen mukaiseen elvytykseen olivat suomalaisten hoitajien valmiuksia paremmat. Peruselvytystaitoja selvitettiin myös Käypä hoito –suositukseen liittyvän kahden erilaisen koulutuksen jälkeen satunnaistetussa tutkimuksessa. Tutkimus osoitti, että internet kurssi ei yksinään voi korvata perinteistä pienryhmä opetusta, ohjattua harjoittelua

tarvitaan elvytystaitojen oppimiseen.

Asenteita hoitosuosituksia ja elvytystilanteita kohtaan selvitettiin lääketieteen ja sairaanhoidon opiskelijoille sekä sairaanhoitajille osoitetulla kyselylomakkeella. Tutkimus osoitti, että toisin kuin lääketieteen opiskelijat, sairaanhoidon opiskelijat eivät saavuttaneet riittäviä valmiuksia elvytyssuosituksen mukaiseen elvytykseen defibrillointi mukaan lukien. Hoitajien asenteita ja kokemuksia selvitettiin ennen ja jälkeen Käypä hoito –suositukseen liittyvää koulutusta. Tutkimus osoitti, että koulutus lisäsi hoitajien luottamusta omiin taitoihin mutta ei vähentänyt elvytystilanteeseen liittyvää ahdistusta tai potilaan vahingoittamisen pelosta aiheutuvaa epäröintiä.

Elvytyksen Käypä hoito –suosituksen julkaisemisen jälkeen elvytyskäytäntöihin on tehty huomattavia muutoksia. Elvytyskoulutuksen järjestäminen oli kuitenkin vielä riittämätöntä eivätkä elvytysvalmiudet olleet suosituksen mukaisella tasolla. Nykyinen elvytysopetus ja harjoittelu eivät takaa varhaisen defibrillaation toteutumista.

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APPENDICES

APPENDIX 1.

QUESTIONNAIRE TO HEALTH CENTRES (TRANSLATED).

- Name of health centre
- Name and contact information of respondent

Background information

- Bed capacity (n)
- Population for which services are provided (n)
- Number of patients in 2002 (n)
- Physician available 24 h/day (yes/no)
- Physicians on duty outside office hours (n, specially)
- Anaesthesia services (24h / office hours / no)
- Appointed person in charge of resuscitation preparedness (profession and speciality / no)

BLS skills and training

- Every member of the staff is competent in BLS (yes / no)
- Physicians are competent in BLS (yes / no)
- Nurses are competent in BLS (yes / no)
- Non-medical personnel are competent in BLS (yes / no)
- BLS skills are assessed (yes, who are assessed? / no)
- Health centre has written BLS instructions
- BLS training is provided to personnel (yes / no)
- BLS training is provided by physician (yes / no)
- BLS training is provided by the person appointed in charge of resuscitation preparedness (yes / no)

- BLS training is provided by appointed persons (yes / no)
- BLS training is provided on regular basis (yes / no)

ALS training

- Defibrillation training is provided for physicians (yes, for all / yes, but not for all / no)
- Defibrillation training of physicians is regular (yes / no)
- Defibrillation training of physicians is supervised (yes / no)
- Training in intubation is provided to physicians (yes / no)
- Comprehensive ALS training, including tactics of resuscitation, rhythm recognition, and resuscitation drugs, is provided for physicians (yes / no)
- Defibrillation training is provided for registered nurses (yes, for all / yes, but not for all / no)
- Defibrillation training is provided for enrolled nurses (yes / no)
- Defibrillation training is provided for cleaners (yes / no)
- Intubation training is provided for nurses (yes / no)
- Comprehensive ALS training, including tactics of resuscitation, rhythm recognition, and resuscitation drugs, is provided for nurses (yes / no)

Training equipment of the health centre

- BLS training mannequin (yes / no)
- ALS training mannequin for intubation training, rhythm simulation, annulations and defibrillation (yes / no)
- Paediatric BLS mannequin (yes / no)
- Paediatric ALS mannequin (yes / no)

Supervision of competence

- ALS skills of physicians (yes / no)
- BLS skills of physicians (yes / no)
- ALS skills of nurses (yes / no)
- BLS skills of nurses (yes / no)

Organisation of resuscitation training

- In your opinion, is the resuscitation training in your health centre sufficient and is it given systemically? (yes / no)
- If the resuscitation training in the heath centre is insufficient, please specify potential reasons
- In your opinion, is the resuscitation training in your health centre sufficient but uncoordinated? (yes / no)
- Are written instructions for resuscitation training available? (yes / no)
- Is an appointed person in charge of BLS training in health centre? (yes / no)
- Is an appointed person in charge of ALS training in health centre? (yes / no)
- Does every ward have its own appointed persons in charge of training? (yes / no)
- Does the health centre participate in resuscitation training of the ambulance staff or local fire brigade? (yes / no)

Recognition of cardiac arrest alarming and BLS

- Does every ward has instructions for recognition of cardiac arrest and starting BLS? (yes / no)
- Are the same instructions available on every ward? (yes / no)
- Is the ward staff is alarmed by shouting in cardiac arrest situations? (yes / no)
- Is the ward staff is alarmed by using an emergency alarming system? (yes / no)
- Is the ward staff is alarmed using telephone? (yes / no)
- Is the physician is alarmed by using a general in-centre broadcast? (yes / no)
- Is the physician is alarmed by using a mobile phone? (yes / no)
- Does your health centre have a resuscitation team? (yes / no)
- Does the resuscitation team has an own phone number for calls? (yes / no)
- Does the phone number of the resuscitation team vary (e.g. regarding the time of day)? (yes / no)
- In the wards, is resuscitation provided at the site where the patient collapsed? (yes / no)
- In the wards, is the patient is moved for resuscitation, for example, to a resuscitation room? (yes/ no)

Defibrillation

- Defibrillator is placed on every ward (yes / no)
- Defibrillators are shared between wards (yes / no)
- Emergency department has a defibrillator (yes / no)

- Operating department has a defibrillator (yes / no)
- Defibrillators are also placed in (tick all that apply: department of radiology, cafeteria, restaurant, elsewhere)
- All defibrillators are manual (yes / no)
- All defibrillators are automated (yes / no)
- Both manual and automated defibrillators are used (yes / no)
- In the ward, a nurse usually performs defibrillation before a physician arrives (yes / no)
- In the ward, defibrillation is usually performed by a physician (yes / no)

Advanced life support

- Approximate number of cardiac arrests per year (n)
- ALS is provided independently by ward nurses and physicians (yes / no)
- ALS is provided by a resuscitation team (yes / no)
- ALS response is organised in some other way (yes, please specify / no)
- Resuscitation team is located in the emergency department (yes / no)
- Resuscitation team is located in another department or unit (yes, please specify/ no)
- Physicians in the resuscitation team (n, specialities)
- Nurses in the resuscitation team (n, specialities)
- Resuscitation team carries its own equipment (yes / no)
- Resuscitation team uses the equipment of the ward (yes / no)

Instructions and guidelines

- Written instructions for ALS (yes / no)
- Resuscitation management is not necessarily based on guidelines or instructions (yes / no)
- Guidelines by European Council of 1998 are generally used (yes / no)
- Guidelines by American Heart Association of 1992 are generally used (yes / no)
- Guidelines published in Finnish pocket guide for acute care (Meilahden akuuttihoito-opas, Duodecim 1997) are generally used (yes / no)
- Health centre has produced its own guidelines or instructions for resuscitation (yes / no)
- Other guidelines or instructions are used in the health centre (yes, specify / no)
- Are ambulance personnel used for resuscitation? (yes, if already present / yes, ambulance is called for cardiac arrests / no)

Data collection and ethical issues

- A special form is used to document resuscitation (yes / no)
- "Do not attempt resuscitation" policy (yes / no)
- In cases where a DNAR decision is undocumented, a resuscitation attempt can be withheld based on decision taken by a nurse (yes / sometimes / no)
- In cases where a DNAR decision is undocumented, a resuscitation attempt can be withheld based on decision taken by a physician (yes / sometimes / no)
- Uniform style indicates a DNAR decision in patient charts (yes / no)
- DNAR is documented in patient notes (yes / no)
- DNAR decision requires discussion with patient or relatives by physician (yes / usually / no)
- DNAR decision requires discussion with patient or relatives by nurse (yes / usually / no)
- Other DNAR policy (yes, please specify / no)
- Instruction for termination of unsuccessful resuscitation attempt (yes / no)
- Termination of unsuccessful resuscitation attempts is decided on a case-to-case base (yes / no)
- Data are collected on resuscitation attempts (yes / no)
- Data on all resuscitation attempts are collected based on Utstein template (yes / no)
- Data on all resuscitation attempts are collected using the health centre's own data collection model (yes / no)
- Resuscitation forms are reviewed after a resuscitation attempt (yes / no)
- Debriefing is organised for personnel who participated in a resuscitation attempt (yes / no)
- Is the purchase of automated external defibrillators considered (Yes, AEDs have been purchased / yes, decision to purchase has been made / yes, decision not to purchase has been made / no)
- Resuscitation training has improved (yes, please specify / no)
- Improvement of resuscitation training is planned (yes, please specify / no)

Attitudes towards Finnish national resuscitation guidelines

Scale ranging from strongly disagree (1) to strongly agree (7).

Resuscitation guidelines are useful as educational tools	1	2	3	4	5	6	7
Resuscitation guidelines are a convenient source of advice	1	2	3	4	5	6	7
Resuscitation guidelines can improve interaction with patients and relatives	1	2	3	4	5	6	7
Resuscitation guidelines can improve the quality of health care	1	2	3	4	5	6	7
Guidelines are based on scientific evidence	1	2	3	4	5	6	7
Resuscitation guidelines are employed by experts	1	2	3	4	5	6	7
My occupational competence is insufficient for adopting the latest resuscitation guidelines	1	2	3	4	5	6	7
Most of our team members have disapproving attitudes towards resuscitation guidelines	1	2	3	4	5	6	7
Resuscitation guidelines are not valued in our organisation	1	2	3	4	5	6	7
Implementing resuscitation guidelines is too expensive for us	1	2	3	4	5	6	7
Resuscitation guidelines challenge the autonomy of care providers	1	2	3	4	5	6	7
Resuscitation guidelines oversimplify medical practice	1	2	3	4	5	6	7
Resuscitation guidelines are difficult to find when needed	1	2	3	4	5	6	7

APPENDIX 2A

BLS / AED EVALUATION CHECKLIST

	YES	NO
1. Addresses the patient or only shakes the patient		
2. Addresses the patient gently and at the same time shakes the patient's shoulders		
3. Addresses the patient and shakes the patient's shoulders strongly enough		
4. Calls or shouts for help without delay		
5. Calls the emergency number or tells someone else to request help		
6. Ensures that the request for help is received		
7. Ensures guidance to the accident place		
8. Asks questions of bystanders (an other patient)		
9. If necessary, moves the patient to a flat base lying onhis/her back		
10. Supports the head and neck while moving the patient		
11. Moves the patient in 15 seconds		
12. Opens the airway, gently tilts the head back and/or lifts the patient's chin		
13. Feels for breathing with back of hand and/or chin		
14. Looks for chest movements		
15. Checking for breathing is done in 10 seconds		
16. Checks for signs of circulation (cough, movement of the patient etc.) or checks the carotid pulse		
17. Pulls the shirt towards the patients head and exposes the chest enough to attach electrodes properly		
18. Starts CPR in 30 seconds		
19. Sets the defibrillator near the patient's head so that it is easily read		
20. Opens the cover and switches the power on		
21. Performs 19 and 20 without delay		
22. Attaches electrodes/defibrillation pads correctly by pressing the electrodes firmly, leaving no air bubbles under them		
23. Upper electrode below right clavicle without covering the nipples		
24. Lower electrode 10 cm below left axilla (the middle of the electrode)		
25. When analysing, asks to discontinue CPR and visually and verbally checks that hands are off		
26. When pressing the defibrillation button, does not look at the button but ensures that no one is in contact with the patient		
27. Begins defibrillation in 60 seconds		
28. Checks for carotid pulse (no more than 10 seconds) as requested by the AED		
29. Feels the pulse close to the Adam's apple, on one side		
30. Opens the cover of the pocket mask		
31. Connects the valve of the pocket mask to the mask (or checks that oxygen bag is attached)		
32. Connects the mask to the oxygen		
33. Adjusts the lower part of the mask between patient's lower lip and chin		
34. Adjusts the sharp part of the mask against patient's nose		

	YES	NO
35. Opens airway by tilting the patient's head and lifting the chin		
36. Holds the mask as instructed		
37. Blows / compresses steadily, like blowing a balloon		
38. The volume is right when the chest begins to rise or the fingers of one hand squeeze the bag		
39. Notices that the patient's chest rise and falls every time or, if not, opens airway more and successfully ventilates		
40. Locates the correct compression place (hand positioning), between the middle and the lower third of the sternum		
41. Correct technique		
42. Correct compression rate (100 /min) = 9 s per 15 compressions		
43. Adequate depth		
44. Compressions to rescue breaths, ratio 2:15		
45. Continues CPR together with another person		
46. Reports the initial state of the patient and procedures performed		
47. Announces the initial rhythm		
48. CPR-D continues while giving the report		
49. CPR-D continues effectively and without interruption		

APPENDIX 2 B

NON-TECHNICAL SKILLS EVALUATION CHECKLIST

Task management	1	2	3	4	5
1. Recognising situation without delay					
2. Continuous evaluation of the patient					
3. Prioritising problems, supporting others					
4. Following the protocol					
Team working					
5. Leadership, co-ordinating activities					
6. Communication					
Situation awareness					
7. Vigilance, anticipating					
8. Adequate medical knowledge					

Global performance 1 2 3 4 5

The skills were graded using a Likert scale (1 = unattempted, 2 = weak, 3 = neutral, 4 = good, 5 = excellent)

APPENDIX 3.

THE FINAL VERSION OF THE QUESTIONNAIRE CONCERNING ATTITUDES TOWARD RESUSCITATION

	Cronbach`s alpha	Factor loading
		Factor 1
2. Only a doctor can defibrillate		
12. Defibrillation is performed by the first professional in the scene		
21. Defibrillation is performed by the doctor only		
3. I can work as a member of a resuscitation team		
15. I can work as a leader of a resuscitation team		
4. I hesitate starting resuscitation due to anxiety		
13. I do not hesitate starting resuscitation		
24. I hesitate defibrillation, because I fear damaging the patient		**Factor 2**
5. I can perform BLS		
14. I am not able to perform BLS		
6. I know how to defibrillate		**Factor 3**
16. I don't know how to defibrillate		
23. I defibrillate the patient if needed		**Factor 4**
8. I know, where I can find the resuscitation guidelines		
19. It is difficult to find the resuscitation guidelines		**not classified**
7. Defibrillation may damage patients heart		
17. Defibrillation does not damage the patients heart		
10. The nurses role has become more active after publication of the guidelines		
25. The change of the nurses role is positive		
9. The prognosis of the resuscitated patient is poor		
18. The prognosis of the resuscitated patient is good		
1. CPR-D skills should be rehearsed at least once per year		
11. CPR-D skills should be tested at least once per year		
20. It is unnecessary to rehearse CPR-D skills		
21. I feel anxious when taking care of a very ill patient		
27. There is enough resuscitation education		

After factor loading, five scales were built from the items of the guestionnaire using fincipal component analysis.

APPENDIX 4.

QUESTIONNAIRE TO THE SECONDARY HOSPITAL.

Hospital_____

1. Gender
    1. Male
    2. Female

2. Date of birth_____

3. Profession
    1. Nurse
    2. Specialised nurse
    3. EMT / Paramedic
    4. Other_____

4. Department
    1. General ward
    2. Outpatient clinic
    3. Other
    4. Operating room (OAR)
    5. Intensive care unit (ICU)
    6. Cardiac care unit (CCU)

5. Working years _____

6. Area
    1. City
    2. Suburb
    3. Region

7. Latest CPR-D training
    1. < 6 months ago
    2. < 1 year ago
    3. > 1 year ago

8. The latest CPR-D training was based on CC guidelines for CPR
    1. Yes
    2. I don't know
    3. No

9. Who was the instructor in the latest CPR-D training?
    1. Physician
    2. Appointed person
    3. Nurse
    4. Physician or nurse outside of the hospital
    5. Other _____

10. Did you learn cardiopulmonary resuscitation during your basic education?
    1. Yes, it was sufficient
    2. Yes, but it was insufficient
    3. No

11. Did the resuscitation training during your basic education include defibrillation?
    1. Yes, it was sufficient
    2. Yes, but it was insufficient
    3. No

12. Have you received resuscitation training at your work?
    1. Yes, it was sufficient
    2. Yes, but it was insufficient
    3. No

13. Have you received resuscitation education in your spare time at your own cost?
    1. Yes
    2. No

14. Have you had teaching about the rhythms connected with resuscitation?
    1. Yes, it was sufficient
    2. Yes, but it was insufficient
    3. No

15. The defibrillator in my use is
    1. Semiautomated defibrillator (AED)
    2. Manual defibrillator
    3. No defibrillator

	strongly strongly disagree						agree
16. I am competent to work in a resuscitation team	1	2	3	4	5	6	7
17. I am competent to lead a resusctation team	1	2	3	4	5	6	7
18. I am able to perform defibirillation	1	2	3	4	5	6	7
19. I hesitate to begin cardiopulmonary resuscitation because of anxiety about the situation	1	2	3	4	5	6	7
20. I hesitate to defibrillate, because I don't feel I am ready yet	1	2	3	4	5	6	7
21. I hesitate to perform defibrillation with the device we have available	1	2	3	4	5	6	7
22. I hesitate to perform defibrillation, because I am not sure that I recognise the rhythm correctly	1	2	3	4	5	6	7
23. I hesitate to perform defibrillation, because I fear injuring the patient	1	2	3	4	5	6	7
24. I hesitate to perform defibrillation, because the resuscitation team is on its way	1	2	3	4	5	6	7
25. I hesitate to perform defibrillation, because I don't want to take the lead in the situation	1	2	3	4	5	6	7
26. I hesitate to perform defibrillation, because the patient might die and I would feel guilty	1	2	3	4	5	6	7
27. I feel that a doctor should perform defibrillation	1	2	3	4	5	6	7
28. I feel that the first person arriving to the resuscitation scene should perform defibrillation	1	2	3	4	5	6	7
29. All healthcare personnel should be able to perform defibrillation, if needed	1	2	3	4	5	6	7
30. The nurse's role is changing due to new resuscitation guidelines	1	2	3	4	5	6	7
31. I feel that this change of role is positive	1	2	3	4	5	6	7
32. Basic education should include defibrillation	1	2	3	4	5	6	7

	strongly strongly disagree						agree
33. Resuscitation guidelines are useful as educational tools	1	2	3	4	5	6	7
34. Resuscitation guidelines are a convenient source of advice	1	2	3	4	5	6	7
35. Resuscitation guidelines can improve interaction with patients and relatives	1	2	3	4	5	6	7
36. Resuscitation guidelines can improve the quality of health care	1	2	3	4	5	6	7
37. Guidelines are based on scientific evidence	1	2	3	4	5	6	7
38. Resuscitation guidelines are compiled by experts	1	2	3	4	5	6	7
39. My occupational competence is insufficient for adopting the latest resuscitation guidelines	1	2	3	4	5	6	7
40. Most of our team members have disapproving attitudes towards resuscitation guidelines	1	2	3	4	5	6	7
41. Resuscitation guidelines are not valued in our organisation	1	2	3	4	5	6	7
42.Implementing resuscitation guidelines is too expensive for us	1	2	3	4	5	6	7
43. Resuscitation guidelines challenge the autonomy of care providers	1	2	3	4	5	6	7
44. Resuscitation guidelines oversimplify medical practice	1	2	3	4	5	6	7
45. Resuscitation guidelines are difficult to find when needed	1	2	3	4	5	6	7
46. I have not seen Current Care guidelines for CPR in our working unit	1	2	3	4	5	6	7

47. In our working unit, the CC guidelines for CPR are in use
    1. Yes
    2. No
    3. I don't know

48. Have you read the CC guidelines for CPR
    1. Yes
    2. No
    3. I don't know