

# Current status and needs for changes in critical care training: the voice of the young cardiologists

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## Aims

The implementation of the 2013 European Society of Cardiology (ESC) Core Curriculum guidelines for acute cardiovascular care (acc) training among European countries is unknown. We aimed to evaluate the current status of acc training among cardiology trainees and young cardiologists (<40 years) from ESC countries.

## Methods and results

The survey (March–July 2019) asked about details of cardiology training, self-confidence in acc technical and non-technical skills, access to training opportunities, and needs for further training in the field. Overall 614 young doctors, 31 (26–43) years old, 55% males were surveyed. Place and duration of acc training differed between countries and between centres in the same country. Although the majority of the respondents (91%) had completed their acc training, the average self-confidence to perform invasive procedures and to manage acc clinical scenarios was low—44% (27.3–70.4). The opportunities for simulation-based learning were scarce—18% (5.8–51.3), as it was previous leadership training (32%) and knowledge about key teamwork principles was poor (48%). The need for further acc training was high—81% (61.9–94.3). Male gender, higher level of training centres, professional qualifications of respondents, longer duration of acc/intensive care training, debriefings, and previous leadership training as well as knowledge about teamwork were related to higher self-confidence in all investigated aspects.

## Conclusions

The current cardiology training program is burdened by deficits in acc technical/non-technical skills, substantial variability in programs across ESC countries, and a clear gender-related disparity in outcomes. The forthcoming ESC Core Curriculum for General Cardiology is expected to address these deficiencies.

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**Keywords**

Cardiology training • Acute cardiovascular care training • Critical care training • Simulation-based learning • Leadership training • Gender disparities in training

**Take-home messages**

- The survey performed by Young Members of the Acute Cardiovascular Care Association (ACVC) of the European Society of Cardiology (ESC) was aimed to evaluate the current status of acute cardiovascular care training among cardiology trainees and young cardiologists (<40 yr) from ESC countries. The results of our observational study proved that the current critical care training program of cardiologists is burdened by deficits in technical/non-technical skills, substantial variability in programs across Europe and a clear gender related disparity in outcomes.

**Introduction**

Over the past two decades, the clinical profile of patients with cardiovascular diseases has significantly changed.<sup>1–3</sup> Improved prevention and therapy of cardiovascular diseases has enabled many patients with severe cardiovascular conditions to survive and enjoy longer lives. The ageing of European populations and these successes of cardiovascular medicine have led to a higher number of elderly patients with several comorbidities requiring cardiovascular care.<sup>1–8</sup> At the same time, invasive cardiac procedures, including structural and electrophysiological interventions as well as device therapy have become cornerstones of treatment strategies, requiring comprehensive periprocedural care.<sup>7,9–12</sup> Managing these complex patients with a history of procedures, implanted devices, and multiple comorbidities in an acute setting poses particular challenges. This has prompted the creation of a new type of acute cardiac care units (ACCU) providing a range of advanced treatments of the most complex critical cardiac conditions.<sup>1–3,13–16</sup> Furthermore, medical educators are not always aware of generational changes and of the medical educational needs that this entails [41]. As a consequence, cardiology trainees and young cardiologists are frequently faced with complex clinical scenarios in acute cardiac care and the need for advanced training in this respect has arisen.

The European Society of Cardiology (ESC) anticipated these developments by including training in acute cardiovascular care (acc) in the 2013 Core Curriculum for the General Cardiologist<sup>17</sup> as well as by forming and expanding the remit of the Acute Cardiovascular Care Association (ACVC).

Despite the common efforts of the ESC in cooperation with National Cardiac Societies, implementation of the ESC Core Curriculum guidelines for acc training differs greatly between countries. To map the current status of acc training and needs of trainees, we surveyed the self-assessed knowledge, skills, and confidence of cardiology trainees and young cardiologists in acc, and their exposure and access to training opportunities.

**Methods**

The survey initiated by the Young National Ambassadors (YNA), registered members of the Young Community of the ACVC, was conducted between March 2019 and July 2019. The survey was developed in collaboration with ACVC Board Members and ESC staff. The

survey design adhered to the EQUATOR (Enhancing the QUALity and Transparency Of health Research) guidelines and was reviewed by the ACVC Board.<sup>18</sup>

Fifty five best-match and eight open questions were structured into three domains: baseline characteristics, technical skills, and non-technical skills. Baseline characteristics questions included age, gender, and details of cardiology training. Regarding technical skills, participants were asked if they were confident performing specific invasive procedures and managing patients in specific acute clinical settings, whether they had access to simulation training, and whether they felt they needed further training in the field. The skills investigated were mainly the third level of the Core Curriculum competence for cardiology training (i.e. the trainee must be able to independently recognize the indication, perform the procedure, interpret the data, and manage the complications).<sup>17</sup> Non-technical skills studied were related to leadership and teamwork. Acute cardiac care units/coronary care units (CCU) were defined according to the recent ACVC definition as level 1–3 intensive cardiovascular care units that are dedicated to and specialized in the management of acute cardiovascular conditions. Intensive care unit (ICU) was defined as a facility that provides intensive care for general, not cardiac related, emergency, and severe conditions.<sup>19</sup> The complete content of the survey is presented in [Supplementary material online, Table S1](#).

The link to the survey was emailed to all YNA who were responsible for disseminating it to cardiologists <40 years old and cardiology trainees in their own countries. The survey link was also disseminated via social media—ACVC LinkedIn and ACVC Twitter official account as well as YNA ACVC Facebook group. All data were entered into a SurveyMonkey, secure data capture web-based application, which along with Microsoft Excel 2018 were used to perform statistical analyses and to generate graphics.

A descriptive analysis of the survey results was performed. Depending on the type of question the results were presented as numbers and percentages of the total number of the respondents; continuous data were presented as median and interquartile range. Subsequently, bivariate descriptive analysis was performed to test an empirical association between self-confidence in technical and non-technical skills and selected aspects of the training. Variables studied included the level of training centres (tertiary vs. secondary hospital), work environment (patients managed by cardiologists vs. intensivists vs. both), level of professional qualification—cardiology residents vs. cardiology fellows (senior trainee cardiologists in the final years of subspecialty training) vs. fully qualified young cardiologists <40 years old, the year of training (residents ≤third year vs. >third year), duration of ACCU and ICU training, training on ACCU vs. ACCU + ICU, teamwork training vs. no teamwork training, and gender. Additionally, multivariable logistic regression analysis was performed to

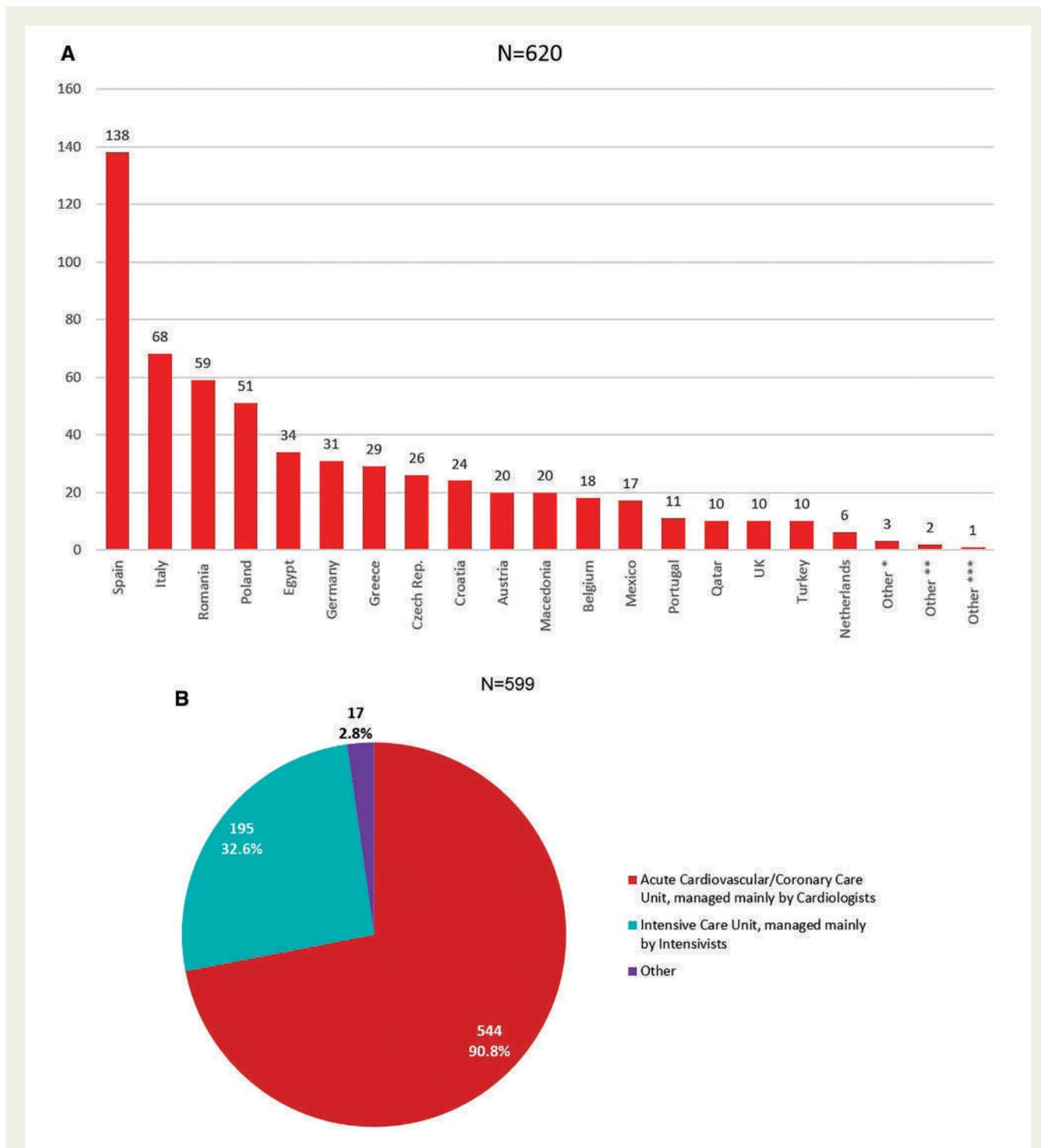
verify the potential association between demographics, selected aspects of training, and self-confidence.

### Ethical considerations

The survey conformed to the Declaration of Helsinki ethical standards.<sup>20</sup> Participation in the research was voluntary. All responses were anonymized and no sensitive information was requested.

### Patient and public involvement

This research was done without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient-relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.



**Figure 1** Fig. 1A. Number of respondents per country. \* Albania / Canada / Serbia, \*\* Armenia / Russian Federation / Sudan / Sweden / Venezuela, \*\*\* Algeria / Argentina / Denmark / France / Israel / Japan / Moldova (Republic of) / Myanmar / Pakistan / Saudi Arabia / Syrian Arab Republic/ Uzbekistan. Fig. 1B. Place of acute cardiovascular care training of the respondents.

## Results

### Baseline characteristics

A total of 614 young doctors from 39 countries participated in the survey (Figure 1A).

The median age of the respondents was 31 years (26–43) with 337 (55%) male, only 9 cardiology trainees were  $\geq 40$  years old. Most of the respondents (52%) were fourth and fifth year cardiology residents (Supplementary material online, Figure S1A and B).

The majority of the respondents (77%) worked in tertiary care centres with onsite cardiac surgery and ACCU/CCU, whereas the rest (23%) worked in secondary level hospitals. The majority of the ACCUs/CCUs (68%) were managed exclusively by cardiologists. In 26% of the facilities, patients were managed by both cardiologists and intensivists, whereas anaesthesiologists/intensivists were in charge of patients in 6% of the facilities. The vast majority of the respondents (91%) had had a rotation through some type of intensive therapy unit, usually an ACCU/CCU (91%) (Figure 1B). The median time of training on ACCU/CCU and ICU was 6 months (0–108) and 3 months (0–48), respectively. Interestingly, 20% of certified young cardiologists had not had specific acc training.

### Technical skills

Respondents reported that most of the invasive procedures remained challenging. Central venous catheter (CVC) insertion was the only procedure perceived as easy and manageable, whereas the proportion reporting confidence in the other procedures ranged from 27% to 50% (Figure 2A).

In terms of managing patients in acute clinical settings, most of the surveyed reported being fairly well confident managing non-invasive mechanical ventilation (70%). Far fewer (29–48%) reported confidence in other clinical scenarios. Furthermore, despite the fact that 79% of the respondents reported having access to short-term mechanical circulatory support (MCS) in their institutions, only 32% were confident managing MCS (Figure 2B).

Opportunities to learn techniques and procedures with simulators were scarce. Respondents had previous simulator training for endotracheal intubation in 51% of cases, but for other procedures fewer than 20% of the respondents could access simulators (Figure 2A and B). Of those who had had access, between 66% and 83% found simulators learning useful for their clinical practice.

Finally, overall 84% of the respondents expressed a need for further training in the invasive procedures and in acute cardiac clinical scenarios (Figure 2A and B). Management of MCS was the clinical setting in which the responders most felt the need of additional training (94%). Interestingly, there were also high levels of need for further training reported in the procedures in which respondents reported being confident—CVC access and non-invasive mechanical ventilation (NIMV) (Figure 2A and B).

### Non-technical skills

Only 32% of the respondents reported previous training in leadership in emergency clinical situations (Figure 3). The respondents had had the chance to lead emergency clinical scenarios on 10 occasions on average. Despite this relatively low level of experience, 64% of respondents felt comfortable acting as a leader (Figure 3). Finally,

elements of teamwork in acute settings were relatively poorly recognized. Only 46% doctors recognized a clear allocation of roles among team members during emergencies, and only 49% of respondents had participated in debriefings after emergency situations (Figure 3).

### Association between gender, work environment, previous training, and the self-confidence in technical skills

All investigated factors differentiated to some extent the surveyed population in terms of self-confidence in technical skills. Significantly higher rates of self-confidence in management of highly specialized clinical scenarios, including cardiac output (CO) monitoring, MCS, and renal replacement therapy (RRT), were noted among respondents from tertiary care centres than among those from secondary level centres (Supplementary material online, Tables S2 and S5). Furthermore, respondents from centres where the critically ill were managed exclusively by cardiologists reported higher levels of confidence than those from centres with joint management or where management was primarily by intensivists (Supplementary material online, Table S2).

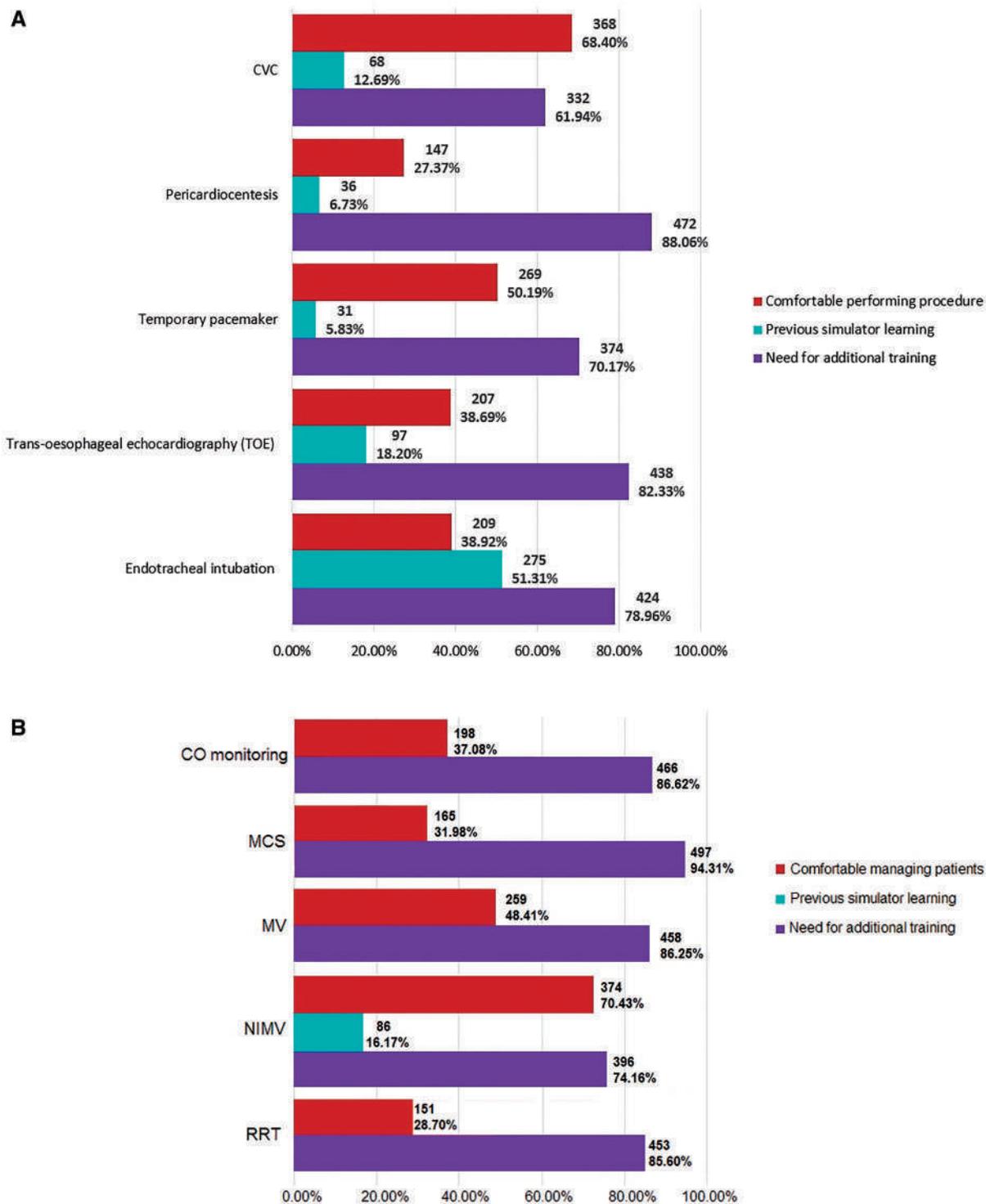
The self-confidence in most of the investigated technical skills increased with age, the level of professional qualifications as well as with the duration of training on ACCU and ICU, being the highest among fully qualified young cardiologists and those trained for more than 12 months in ACCU and for more than 6 months in ICU (Supplementary material online, Tables S3 and S5 and Figures S2 and S3). Surprisingly, combined training in ACCU and ICU did not bring about additional self-confidence when compared to training performed solely in ACCU (45% vs. 44.5%).

The greatest number of significant differences in self-confidence were related to gender, with females being substantially less likely to report confidence in all of the technical skills, as well as acting as a leaders in emergency clinical scenarios than males (Supplementary material online, Table S5 and Figure S4). Participation in routine debriefings after emergencies was the second factor that differentiated the study population the most in terms of technical skills as well as leadership abilities. Additionally, previous simulators and leadership training also resulted in a higher proportion reporting confidence (Supplementary material online, Tables S4 and S5).

## Discussion

This survey provides structured information on the current status of acc training in Europe and highlights training needs. It provides unique feedback from a real-life sample on the implementation of the ESC guidelines for cardiology training across the ESC countries and demonstrates the need for improvement that will be addressed in the next Core Curriculum for cardiology.<sup>17</sup>

It should be pointed out that the majority of doctors surveyed were in the final years of cardiology training and had already undergone training in acc. Furthermore, three quarters of the respondents performed their training in tertiary centres with ACCU, cardiac surgery, and MCS onsite, which suggests that the professional environments of the majority of the responders were favourable towards

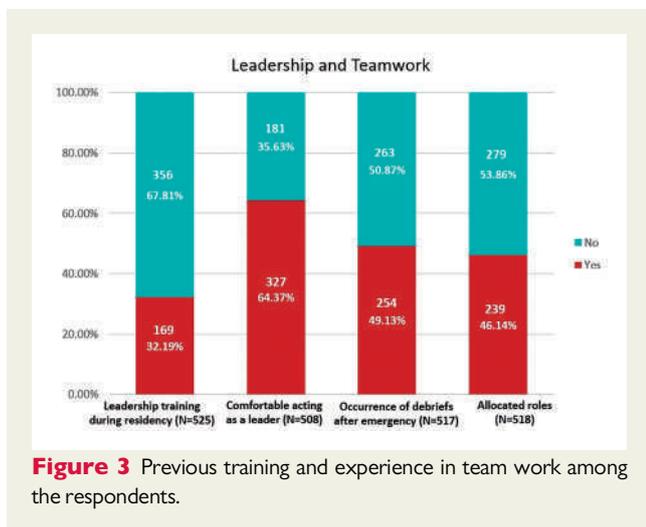


**Figure 2** Confidence, previous simulator learning and need for additional training in technical skills - performing invasive procedures among the respondents. Fig. 2B. Confidence, previous simulator learning and need for additional training in technical skills - managing acute clinical scenarios among the respondents.

acc training. Despite this, overall only 44% of respondents on average assessed themselves as being proficient in performing a range of invasive procedures and managing acute clinical scenarios.

Our findings suggest a few potential reasons for this.

Looking at technical skills, we discovered that simulation-based learning is underused across ESC countries, since fewer than 20% of our respondents had the possibility of training with simulation, even though the majority of those who had used simulators had found it



useful for their clinical practice and were more confident in performing invasive procedures. Simulation training has already been adopted into training curricula and has been demonstrated to enhance technical and non-technical skills, improve care quality, and reinforce patient safety.<sup>21–23</sup> These advantages are especially applicable to practical, procedure-orientated subspecialties such as interventional cardiology or acute cardiac care.<sup>23</sup> For those reasons, both the American College of Cardiology (ACC) and the ESC have recommended simulation training as an educational tool.<sup>24,25</sup>

In terms of non-technical skills, we found that less than half of the doctors were familiar with basic rules of teamwork even though, these skills have been shown to improve patients' safety.<sup>26</sup>

Other factors that appeared relevant to the professional self-assessment included duration of training and gender.

The results revealed that the time devoted to training on ACCU and ICU differed substantially among the respondents. The discrepancies in the duration of training concerned not only different countries but were also clearly visible between different centres in the same country. This might result from a lack of precise requirements for duration of the acc training in the last ESC Core Curriculum, which was left to the discretion of National Educational Authorities.<sup>17</sup> Nevertheless, duration of training seems to be relevant and requires standardization since we showed that more than 12 months of training on ACCU and more than 6 months on ICU training favoured a higher probability of self-confidence, whereas the average duration of training at present is below these thresholds.

The discrepancies in time dedicated to critical care cardiology internships were previously pointed out for American and Canadian training systems.<sup>26</sup> A minimum of 6 months on ACCU suggested by the survey as a reasonable duration to gain self-confidence by trainees is convergent with that mandated in the American Heart Association statement as a minimum for critical cardiac care training. It is shorter, however, than the 12 months recommended by the Task Force of the ACC Core Cardiovascular Training Statement.<sup>27,28</sup> Given the current lack of evidence on this topic and the diversity in training programs for cardiology across Europe, it is difficult to propose a standardized duration for acute cardiac care training. Nevertheless, the forthcoming Core Curriculum should aim to address this.

Among all investigated variables, the most powerful association with self-confidence concerned gender and participation in debriefings after emergencies. Females were less likely to be confident in all investigated skills and they received leadership training less frequently than males. The gender gap in favour of males was previously reported in cardiology and in critical care medicine, as well as among physicians with both of these specialties, where only 3% of double-certified cardiologist and critical care physicians in the USA are women.<sup>29,30</sup> There are likely to be many reasons for this, but improved mentorship for women during cardiology training and for women interested in critical care cardiology as well as ongoing diversity task force implementation in work environments may aid in closing the gender gap.<sup>29–31</sup>

For the first time, participation in debriefings after emergencies was identified as a factor that significantly improves self-confidence of trainees. This suggests its importance for future training programs and may be verified as a potential quality indicator of training and work in future studies in the field.

Furthermore, we revealed that further training in acute cardiac care is highly desirable, since the vast majority of the respondents, including those who were fully certified cardiologists, recognized the need for additional training. Notably, the willingness for further training was high even though the vast majority of the surveyed procedures were at the highest (level 3) of an acc subspecialty training. Consensus statements and opinion papers have emphasized the emerging need for a specific subspecialty of cardiac intensive care.<sup>26–28,32–35</sup> These documents concluded that current general cardiology fellowship programs do not cover cardiac intensive care adequately. Since the ACVC and corresponding organizations have already moved to set up requirements for cardiac intensive care as a subspecialty,<sup>27,28</sup> we believe that it is appropriate for European National Health and Educational Authorities to follow the same path and develop standardized guidelines for this subspecialty.

It is worth reiterating that we relied on subjective self-assessment of skills rather than on an objective test of competence. It is possible that respondents were either over or underestimating their actual ability level, given that even in procedures where high levels of confidence were reported, such as in CVC insertion and NIMV management, the majority of the respondents still felt that they would benefit from further training. Conversely, while only one-third of respondents had undergone leadership training, two-third felt confident acting as a leader in emergencies. As a result, the study emphasized also the need to incorporate self-assessment of trainees as a method to verify the quality of training as well as a part of final certification.

We hope that the new ESC Core Curriculum for cardiology will substantially reshape the training program, focusing on the assessment of meaningful clinical competence with entrustable professional activities as indicators of professional qualifications. The new approach to the Core Curriculum will permit a more individualized program of training, adapted to each trainee's needs as well as a more holistic assessment of clinical competence, actively involving trainees themselves, mentors and patients in the process of training and the assessment of their skills.<sup>36,37</sup>

We acknowledge that our survey has a number of limitations. First, there is likely to have been a degree of selection bias among those who chose to respond to a survey. Second, the number surveyed

varied greatly between different countries and is unlikely the results have been representative of all eligible cardiologists in many countries, including doctors from Scandinavia, UK, or France. Third, we cannot rule out the presence of residual confounders, such as the influence of previous undergraduate training on confidence levels. Furthermore, the routine availability of invasive cardiology, electrophysiology, or anaesthesiology in tertiary centres may also impair the level of expertise and self-confidence among the respondents. However, since most of the respondents were at the final years of their cardiology training or specialists, the investigated aspects of acc care seem to sufficiently covers required level of professional expertise at given stage of career. Finally, some of the results, namely lack of the enhancement of self-confidence by additional training on ICU on top of ACCU and by the multidisciplinary team-based structure of ACCU/ICU are difficult to interpret. However, since previous studies clearly indicated a reduction in mortality and length of stay of critically ill managed by multidisciplinary staff,<sup>38,39</sup> these aspects of training require further investigation. Similarly, high level of self-confidence in some procedures with equally high need for further training is thought provoking.

## Conclusions

The current program for acute cardiac care training in cardiology requires major change. It is burdened by deficits in the acquisition of technical and non-technical skills as well as by substantial discrepancies in training duration and gender inequality.

New model for cardiology training should emphasize the importance of technical skills, simulations from the very start of the training period, as well as empowering the mentorship teams and routine debriefings after emergencies. Standardized internships should include regular verification of the acquired knowledge, training quality, including trainee's opinion. Career advice and leadership training need to be made easily accessible to both women and men from the earliest stages of training.

The forthcoming new ESC Core Curriculum for General Cardiology is expected to cover most of these deficiencies with competency-based education and an ongoing regular assessment of entrustable professional activities. This new approach will help provide the highest quality of cardiac healthcare service as well as covering the needs of cardiology trainees and young cardiologists for continual professional development.

Finally, regular reviews of the implementation of the ESC Core Curriculum across ESC countries are vital to assure high quality and harmonized training in cardiology. We acknowledge also the need to establish a standardized critical cardiac care subspecialty, awaited by many young cardiologists.

## Supplementary material

Supplementary material is available at *European Heart Journal – Acute Cardiovascular Care* online.

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