**Exposure and confidence with critical non-airway procedures: a global survey of paediatric emergency medicine physicians**

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**Contributors statement page**

Dr. Craig conceptualized and designed the study, collected data, drafted the initial manuscript, and reviewed and revised the manuscript.

All other authors (Dr Auerbach, Dr Cheek, Dr Babl, Dr Oakley, Dr Nguyen, Dr Rao, Dr Dalton, Dr Lyttle, Dr Mintegi, Dr Nagler, Dr Mistry, Dr Dixon, Dr Rino, Dr Kohn Loncarica and Dr Dalziel) designed the study, collected data, and reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

**Abstract**

**Background:**

Children rarely experience critical illness, resulting in low exposure of emergency physicians (EPs) to critical procedures. Our primary objective was to describe senior EP confidence, most recent performance and/or supervision of critical non-airway procedures. Secondary objectives were to compare responses between those who work exclusively in PEM and those who do not, and to determine whether confidence changed for selected procedures according to increasing patient age.

**Methods:**

Survey of senior EPs working in 96 emergency departments (EDs) affiliated with the Pediatric Emergency Research Networks (PERN). Questions assessed training, performance, supervision, and confidence in 11 non-airway critical procedures, including CPR, vascular access, chest decompression and cardiac procedures.

**Results:**

Of 2,446 physicians, 1,503 (61%) responded to the survey. Within the previous year, only CPR and insertion of an intraosseous needle (IO) had been performed by at least 50% of respondents: over 20% had performed defibrillation / DC cardioversion. More than 50% of respondents had never performed or supervised ED thoracotomy, pericardiocentesis, venous cutdown or transcutaneous pacing. Self-reported confidence was high for all patient age groups for CPR, needle thoracocentesis, tube thoracostomy, IO insertion and defibrillation / DC-cardioversion. Confidence levels increased with increasing patient age for central venous and arterial line insertion. Respondents working exclusively in PEM were more likely to report being at least somewhat confident in defibrillation / DC cardioversion, IO insertion, and central venous line insertion in particular age groups; however, they were less likely to be at least somewhat confident in ED thoracotomy and transcutaneous pacing.

**Conclusions:** CPR and IO insertion were the only critical non-airway procedures performed by at least half of EPs within the previous year. Confidence was higher for these procedures, and needle and tube thoracostomy. These data may inform the development of continuing medical education activities to maintain pediatric procedural skills for emergency physicians.

**Introduction**

Worldwide, millions of ill and injured children require emergency care each year. In the United States alone, more than 27 million children visited emergency departments (EDs) in 2014.[1](#_ENREF_1) Critically ill children require timely and effective life-saving interventions to ensure optimal outcomes. Those trained in emergency medicine (EM) should be able to perform critical procedures required to treat a range of conditions in children, up to and including complex resuscitation.[2](#_ENREF_2)

ED presentations for critical illness are uncommon in children living in high-income countries.[3](#_ENREF_3) As a result, individual EM or pediatric EM (PEM) clinicians’ exposure to critical and resuscitative procedures such as endotracheal intubation, central venous access, or advanced life support is infrequent.[4](#_ENREF_4) Mittiga and colleagues found that only 0.22% of visits to a single large pediatric ED required a critical procedure. In their study, senior trainees (PEM fellows) performed a median of three critical care procedures annually with orotracheal intubation comprising 56% of all procedures.[5](#_ENREF_5) Some senior trainees, and most attending physicians, did not perform any such procedures in a given year.[5](#_ENREF_5) Similarly, in an Australian study across three EDs (one tertiary pediatric hospital and two community hospitals), less than 0.1% of pediatric presentations required a critical procedure over the twelve-month study period, with endotracheal intubation accounting for 73% of all such procedures.[6](#_ENREF_6) This rarity of experience with critical procedures raises questions about the ability of individual emergency physicians to maintain skills if relying solely on clinical exposure.[7](#_ENREF_7)

Significant attention has been paid to assessment and improvement of PEM physicians’ airway procedural skills, particularly endotracheal intubation.[8-15](#_ENREF_8) However, there has been much less emphasis on skills maintenance for critical *non-airway* procedures. Competency with non-airway procedures is relevant to all providers who evaluate and treat critically ill children, and may directly impact the clinical outcomes of patients. However, it is unknown how frequently EM physicians globally perform these critical procedural skills. Understanding physicians’ frequency of performance of these procedures may guide the creation of national and international approaches to skills training and maintenance.

Our primary objective was to perform an international survey of physicians who regularly care for children in emergency settings to assess their recent performance or supervision, and confidence in undertaking various non-airway critical procedures. Secondary objectives were to compare responses between emergency physicians who exclusively care for children and those who do not; to determine whether confidence varied according to patient age group for selected procedures; and to make comparisons across different geographic regions.

**Methods**

Study design

This was a multicenter, international cross-sectional survey of senior physicians working in EDs affiliated with Pediatric Emergency Research Networks (PERN),[16](#_ENREF_16) and is presented according to the STROBE statement on reporting of observational studies.[17](#_ENREF_17)

Survey development

The survey was administered using SurveyMonkey (<http://www.surveymonkey.com>). The final survey, which took 10-15 minutes to complete, was piloted by the investigators (with representatives from each network), and by ten EM physicians in three hospitals within Melbourne, Australia.

The survey was developed iteratively, through rounds of investigator contribution and refinement, underpinned by a review of relevant literature.[4](#_ENREF_4),[6](#_ENREF_6),[18](#_ENREF_18) Questions included respondent demographics, postgraduate training background (PEM, pediatric, EM), hours of clinical work, and proportion of clinical work in PEM. Specific questions addressed most recent performance, supervision, and confidence in performing various critical procedures, including 11 non-airway procedures.

The final consensus list of critical procedures was based upon the use of the procedure for the stabilization of airway, breathing or circulation, and inclusion in standard reference texts as essential skills in resuscitation.[19](#_ENREF_19) Critical non-airway procedures encompassed the following interventions: Cardiopulmonary resuscitation (CPR), needle thoracocentesis, tube thoracostomy, defibrillation / DC-cardioversion, transcutaneous pacing, intraosseous needle insertion, venous cutdown, central venous catheter insertion, arterial line insertion, pericardiocentesis, and ED thoracotomy.

Respondents were asked to categorize their most recent performance and supervision of each procedure by selecting the most appropriate choice from within the last 3 months, within the last 6 months, within the last year, within the last 5 years, more than 5 years ago, or never. Procedural confidence was ranked on a 5-point Likert scale which was labeled as 1=not at all confident, 3=somewhat confident, and 5=very confident. For vascular access procedures, respondents were asked to rate their confidence for five different age groups: <3 months, 4-12 months, 1-5 years, 6-11 years, and 12 or more years.

Ethics approval

The survey was approved by the Monash Health Human Research Ethics Committee as low-risk research and given ethical approval in accordance with the National Health and Medical Research Council’s National Statement on Ethical Conduct in Human Research.[20](#_ENREF_20) Where required, additional local or regional institutional review board / ethics approval was obtained prior to distribution at each hospital.

Setting

Participating hospitals were affiliated with one of the following pediatric emergency medicine research networks: Pediatric Emergency Medicine Collaborative Research Committee (PEM-CRC, USA), Pediatric Emergency Care Applied Research Network (PECARN, USA), Pediatric Emergency Research Canada (PERC, Canada), Pediatric Emergency Research in the United Kingdom & Ireland (PERUKI, UK & Ireland), Pediatric Research in Emergency Departments International Collaborative (PREDICT, Australia and New Zealand), Research in European Pediatric Emergency Medicine (REPEM, 15 countries in Europe and the Middle East), and Red de Investigación y Desarrollo de la Emergencia Pediátrica de Latinoamérica (RIDEPLA, South America).

Survey distribution and data collection.

Each of the six networks contributing to PERN had at least one study investigator, who invited hospitals within their network to participate in the study. A nominated site representative at each hospital distributed the survey to eligible staff. The survey was circulated between April 2015 and March 2016, depending upon the opportunity for distribution within each research network, with two reminders sent at weekly intervals.

The survey was distributed to physicians who would be considered to be working in a supervisory / “senior” capacity in the ED at any time during their usual working week, defined as those who work without direct supervision at any point in a 24 hour cycle. It was expected that this senior role would be fulfilled by different levels of staff in different settings; therefore, distribution occurred via the site representative with local knowledge.

Statistical analysis

Categorical descriptive data are presented as number and percentage. To simplify analysis, and due to the infrequency of responses for the categories of within the last 3 months, within the last 6 months, and within the last year, it was decided to combine these categories into “within the last year”. Also, confidence was dichotomized into “confident” (with a ranking of at least 3 on the 5-point Likert scale) and “not confident” (a ranking of 1 or 2).

Comparisons were made between respondents who identified 100% of their clinical work as PEM and respondents who did not work all of their clinical time in PEM. Significance was determined using Chi-squared test or Fisher’s exact test as appropriate; a Bonferroni correction was applied to account for the multiple comparisons undertaken, with a p-value of 0.002 comparable to a p value of 0.05 from a single comparison. Similar analyses were performed when comparing responses between each research network and all other networks combined. Data were analyzed using IBM SPSS Statistics for Mac (version 23, IBM Corporation, Armonk, NY, USA).

**Results**

The survey was distributed to 2,446 physicians at 101 hospitals; five hospitals were later identified as being unable to participate and did not contribute data. Of the physicians invited 1,602 (65%) completed at least demographic details, and 1,503 (61%) provided information on most recent performance and supervision, and self-rated confidence for the 11 non-airway critical procedures (Table 1)

The majority (1,271; 84.6%) of respondents had specialist qualifications, although the specialty varied: the most common was dual qualification in pediatrics and PEM (574; 38.3%), followed by EM alone (257; 17.1%) and pediatrics alone (242; 16.1%). Most respondents (1,450; 96.5%) had been involved in pediatric life support training in the last five years, either as an instructor or a participant (Table 2).

The non-airway critical procedural experience for the study population is summarized in figures 1 (performance) and 2 (performance or supervision). Only two procedures (CPR and insertion of an intraosseous needle) had been performed by at least 50% of respondents within the previous year. The only other procedure performed by at least 20% of respondents was defibrillation / DC cardioversion. More than 50% of respondents had never performed or supervised ED thoracotomy, pericardiocentesis, venous cutdown or transcutaneous pacing.

Self-reported confidence was high for CPR, a frequently performed procedure, but was also high for needle thoracocentesis and tube thoracostomy (Figure 3). Confidence appeared to increase with increasing patient age for central venous line and arterial line insertion (Figure 4), but was high in all age groups for insertion of an intraosseous needle and DC-cardioversion / defibrillation (Figure 5).

Those working exclusively in PEM, as compared to those also caring for adults, were more likely to report being at least somewhat confident in defibrillation / DC cardioversion of children aged 11 years or less, for intraosseous needle in children aged 4-12 months, and central venous line insertion in children aged 4 months to five years. They were also less likely to report never having done many of the procedures listed. Self-reported confidence was higher in ED thoracotomy and transcutaneous pacing for those not working exclusively in PEM. Comparisons between each research network and all other research networks are presented within the appendix.

**Discussion**

Successful completion of rarely performed procedures may make the difference between life and death for pediatric emergencies. However, when a critical non-airway procedure is required – apart from CPR and intraosseous needle insertion - our findings suggest that most PEM physicians are unlikely to have recent hands-on experience. Most respondents had never performed or supervised ED thoracotomy, pericardiocentesis, venous cutdown or transcutaneous pacing. These findings provide important information to guide continuing medical education activities for emergency physicians who care for children.

Our results suggest that a practicing PEM physician can reasonably expect to insert an intraosseous needle, or perform CPR within the next twelve months. Both these procedures were associated with high levels of self-assessed confidence. In addition, both procedures require a limited number of reproducible steps, and are likely to be amenable to “rapid-cycle deliberate practice” – a process of repeated supervised attempts at resuscitation procedures with specific feedback and coaching, which has been shown to improve quality of life-support interventions.[21](#_ENREF_21)

The successful use and familiarity with powered intraosseous needle systems may be partially responsible for the limited exposure of PEM physicians to central venous line insertion. In addition, arterial and central venous lines are used more often in the PICU setting. As these interventions are rarely time-critical, it may be reasonable to defer these procedures to more experienced intensive care or anesthesiology colleagues, who can undertake the procedure in more controlled conditions. However, for uncommon time-critical conditions such as cardiac tamponade, cardiac arrest from penetrating trauma, and tension pneumothorax, there will be occurrences when a child requires an emergent but life-saving procedure, and the only person available is an inexperienced proceduralist.

How should the wider health-care system respond to the likelihood that an inexperienced proceduralist may be the only option for a child requiring a critical intervention? We recommend that each emergency department determines a strategy to ensure that emergency physicians have either the training or the ready availability of external expert personnel to perform *all* necessary critical procedures.

In an environment where such critical procedures are very infrequent, how can individual PEM physicians maintain their skills? Current evidence supports the use of a “learn, see, practice, prove, do and maintain” framework.[25](#_ENREF_25) After physicians have completed training they must continue to practice skills in order to maintain them. Deliberate practice is a regimen of effortful activity described by Ericsson to optimize improvements in skill towards expertise.[26](#_ENREF_26) This requires focused and repetitive practice with precise measurement and ongoing feedback, although this feedback is not often present in the clinical setting. Simulation-based training with deliberate practice has been shown to be effective for achieving skill acquisition,[27](#_ENREF_27) and to identify areas for improvement in resuscitation.[28](#_ENREF_28),[29](#_ENREF_29) Recently, tools have been developed to assess specific procedural skills in the simulated setting.[30](#_ENREF_30) Alternatives to traditional simulation training include live animal models[31](#_ENREF_31),[32](#_ENREF_32), and the increasingly popular use of cadaver training labs.[33-35](#_ENREF_33) Both methods appear to be highly rated by learners and provide superior fidelity, however, there are concerns regarding the use of live animal models including modulating effects of general anesthesia on the physiologic response to procedures, and concerns regarding animal welfare.[36](#_ENREF_36) Understanding the relative frequency of – and provider confidence in - non-airway critical procedures highlights educational needs for emergency physicians, which may be met by the development of targeted educational programs. These programs should be designed to ensure regular deliberate practice to improve confidence and procedural competency.

Another challenge in evaluating the success of procedural education is the determination of the clinical effects of such training. It is unknown whether high levels of confidence or recent procedural experience actually translate into fewer procedural complications or better outcomes for critically ill children. A study of pediatric residents found that after a workshop on procedural skills, the largest increases in self-reported confidence and competence were for those procedures with which they were least experienced.[22](#_ENREF_22)

Complications may also be more likely in patients with an inexperienced proceduralist; a study of tube thoracostomies at an adult trauma center found a higher rate of complications when chest drain insertion was rated as ‘difficult’.[23](#_ENREF_23) Although the optimal approach is yet to be determined, recommendations for senior emergency physicians to perform such procedures appears reasonable, while suggestions for specialized staff (such as thoracic surgeons) to be available appears impractical.[24](#_ENREF_24)

**Limitations**

Limitations of our work include bias due to physicians self-reporting their experience and confidence, and the possibility of sampling bias. As self-report, it is possible that our results either overestimate or underestimate actual practice and procedure performance. The responses gained from a survey circulated throughout global pediatric emergency medicine networks may not be representative of the wider general emergency medicine community, as most children presenting for emergency care do not attend specialized pediatric emergency departments.[4](#_ENREF_4) However, it is a strength of our study that a large number of emergency physicians were not in exclusive PEM practice, increasing the external validity of our findings.

Finally, as the survey recruited physicians largely from academic medical centers in high-income countries, these data may not represent a true global perspective. The mortality rate and incidence of critical illness in children is much higher in low- and middle-income countries, therefore, clinicians practicing in these settings are expected to have different experiences and confidence in the range of critical procedures studied.

**Conclusion**

Our study provides unique data on senior ED physician experience and confidence in non-airway procedures. These findings indicate that few physicians performed procedures beyond CPR and intraosseous insertion. Confidence was high for CPR, chest decompression, and intraosseous needle insertion, and there was little difference in confidence levels between those practicing exclusively in PEM, and those working with a mixture of adults and children. These data should inform the development of continuing medical education activities to maintain critical procedural skills for PEM practitioners.

Table 1. Response rate to survey, according to region, or country, of clinical practice.

|  |  |  |
| --- | --- | --- |
| Region | Number of invited participants | Number of responses (%) |
| United States of America | 1,062 | 613 (58) |
| Canada | 253 | 151 (60) |
| South America | 80 | 34 (43) |
| Australia / New Zealand | 283 | 184 (65) |
| United Kingdom and Ireland | 573 | 407 (71) |
| Europe | 195 | 114 (58) |
| TOTAL | 2,446 | 1,503 (61) |

Table 2. Demographic data of respondents (n=1,503).

|  |  |
| --- | --- |
|  | n (%) |
| Female\* | 831 (55.6) |
| Specialist qualifications |  |
| No specialist qualification | 232 (15.4) |
| Pediatrics and PEM | 574 (38.3) |
| EM alone | 257 (17.1) |
| Pediatrics alone | 242 (16.1) |
| PEM and EM | 80 (5.3) |
| PEM alone | 75 (5.0) |
| Pediatrics and EM | 19 (1.3) |
| Other specialty† (combined with EM, PEM or Pediatrics) | 10 (0.6) |
| Other specialty† alone | 14 (1.0) |
| Clinical hours worked per week (mean, range) | 25 (18 – 32) ‡ |
| Percentage of clinical time devoted to pediatric emergency care |  |
| 0-24% | 292 (19.4) |
| 25-49% | 214 (14.2) |
| 50-74% | 92 (6.1) |
| 75-99% | 101 (6.7) |
| 100% | 804 (53.5) |
| Life support course participation in last 5 years |  |
| Instructor | 311 (20.7) |
| Participant only | 570 (37.9) |
| Both instructor or participant | 569 (37.9) |
| Neither instructor nor participant | 53 (3.5) |

EM = Emergency medicine, PEM = Pediatric emergency medicine.

\* missing data for 8 respondents

† other specialties included anesthesiology, intensive care, and general practice

‡ median (interquartile range)

Figure 1. Percentage of respondents who had performed each procedure: comparison of those working exclusively in PEM to those working less than 100% of clinical time in PEM. (a) Performed or supervised within the last 12 months, and (b) never performed or supervised (\* denotes significant difference at p<0.002).

|  |  |
| --- | --- |
|  |  |
| a | b |

Figure 2. Percentage of respondents who had performed or supervised each procedure: comparison of those working exclusively in PEM to those working less than 100% of clinical time in PEM. (a) Performed or supervised within the last 12 months, and (b) never performed or supervised (\* denotes significant difference at p<0.002).

|  |  |
| --- | --- |
|  |  |
| a | b |

Figure 3. Percentage of respondents reporting “at least somewhat confident” for non-airway critical procedures: comparison of those working exclusively in PEM to those working less than 100% of clinical time in PEM (\* denotes significant difference at p<0.002).

Figure 4. Percentage of respondents reporting “at least somewhat confident” for central venous line and arterial line insertion according to patient age group, comparing those with exclusive PEM clinical practice to those with less than 100% PEM clinical practice (\* denotes significant difference at p<0.002).

**Central venous line Arterial line**

Figure 5. Percentage of respondents reporting “at least somewhat confident” for defibrillation / DC cardioversion and interosseous needle insertion according to patient age group, comparing those with exclusive PEM clinical practice to those with less than 100% PEM clinical practice (\* denotes significant difference at p<0.002).

**Defibrillation / DCR Intraosseous needle**

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Supplementary online material: Comparison between each research network and all other respondents.

## PREDICT Network (Australia and New Zealand), n=184 vs all other respondents (n=1319).

Table A1: Performance or supervisión of each critical procedure within the last year: PREDICT vs non-PREDICT responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | PREDICT network  n (%) | Non-PREDICT network  n (%) | P value\* |
| CPR | 129 (70.1) | 1040 (78.8) | 0.008 |
| Chest needle | 22 (12) | 250 (19) | 0.021 |
| Tube thoracostomy | 60 (32.6) | 365 (27.7) | 0.164 |
| Defibrillation / DCR | 42 (22.8) | 464 (35.2) | 0.001 |
| Transcutneous pacing | 6 (3.3) | 80 (6.1) | 0.125 |
| Intraossesous needle | 129 (70.1) | 1008 (76.4) | 0.062 |
| Venous cutdown | 1 (0.5) | 25 (1.9) | 0.188 |
| Central venous line | 39 (21.2) | 369 (28) | 0.053 |
| Arterial line | 55 (29.9) | 279 (21.2) | 0.008 |
| Pericardiocentesis | 2 (1.1) | 35 (2.7) | 0.199 |
| ED thoracotomy | 3 (1.6) | 39 (3) | 0.306 |

\* Calculated using Chi-square test

Table A2: Never performed or supervised each critical procedure: PREDICT vs non-PREDICT responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | PREDICT network  n (%) | Non-PREDICT network  n (%) | P value\* |
| CPR | 3 (1.6) | 54 (4.1) | 0.145 |
| Chest needle | 89 (48.4) | 636 (48.2) | 0.969 |
| Tube thoracostomy | 39 (21.2) | 377 (28.6) | 0.036 |
| Defibrillation / DCR | 56 (30.4) | 373 (28.3) | 0.543 |
| Transcutneous pacing | 136 (73.9) | 935 (70.9) | 0.396 |
| Intraossesous needle | 9 (4.9) | 112 (8.5) | 0.093 |
| Venous cutdown | 153 (83.2) | 1059 (80.3) | 0.425 |
| Central venous line | 32 (17.4) | 299 (22.7) | 0.128 |
| Arterial line | 24 (13) | 324 (24.6) | 0.001 |
| Pericardiocentesis | 156 (84.8) | 1007 (76.3) | 0.01 |
| ED thoracotomy | 170 (92.4) | 1147 (87) | 0.036 |

\* Calculated using Chi-square test

Table A3: Proportion of PREDICT and non-PREDICT respondents reporting “at least somewhat confident” for each procedure.

|  |  |  |  |
| --- | --- | --- | --- |
|  | PREDICT network  n (%) | Non-PREDICT network  n (%) | P value\* |
| CPR | 183 (100) | 1263 (97.9) | 0.048 |
| Pacing | 124 (67.8) | 692 (53.9) | <0.001 |
| Venous cutdown | 61 (33.3) | 258 (20.1) | <0.001 |
| Chest needle | 174 (95.6) | 1092 (85) | <0.001 |
| Tube thoracostomy | 171 (93.4) | 999 (77.9) | <0.001 |
| Pericardiocentesis | 82 (45.1) | 525 (40.9) | 0.289 |
| ED thoracotomy | 43 (23.6) | 240 (18.7) | 0.112 |
| Defibrillation / DCR <3 months | 171 (94.5) | 1076 (85.5) | 0.001 |
| Intraosseous needle <3 months | 177 (97.8) | 1173 (93.2) | 0.016 |
| CVC <3 months | 110 (61.1) | 657 (52.1) | 0.023 |
| Arterial line <3 months | 121 (66.9) | 602 (47.8) | <0.001 |
| Defibrillation / DCR 4-12 months | 169 (93.9) | 1097 (87.1) | 0.009 |
| Intraosseous needle 4-12 months | 180 (99.4) | 1179 (93.6) | 0.001 |
| CVC 4-12 months | 116 (64.1) | 709 (56.2) | 0.046 |
| Arterial line 4-12 months | 134 (74) | 631 (50.1) | <0.001 |
| Defibrillation / DCR 1-5 years | 174 (96.1) | 1126 (89.2) | 0.004 |
| Intraosseous needle 1-5 years | 179 (98.9) | 1193 (94.8) | 0.015 |
| CVC 1-5 years | 133 (73.9) | 775 (61.5) | 0.001 |
| Arterial line 1-5 years | 148 (82.2) | 702 (55.9) | <0.001 |
| Defibrillation / DCR 6-11 years | 175 (96.7) | 1137 (90.3) | 0.005 |
| Intraosseous needle 6-11 years | 179 (98.9) | 1195 (94.9) | 0.017 |
| CVC 6-11 years | 146 (80.7) | 834 (66.2) | <0.001 |
| Arterial line 6-11 years | 163 (91.1) | 766 (60.9) | <0.001 |
| Defibrillation / DCR 12 or more years | 174 (96.7) | 1148 (91) | 0.01 |
| Intraosseous needle 12 or more years | 180 (99.4) | 1189 (94.5) | 0.004 |
| CVC 12 or more years | 154 (85.1) | 877 (69.6) | <0.001 |
| Arterial line 12 or more years | 169 (93.4) | 835 (66.3) | <0.001 |

\* Calculated using Chi-square test

## PERUKI Network (United Kingdom and Ireland), n=407 vs all other respondents (n=1096).

Table A4: Performance or supervisión of each critical procedure within the last year: PERUKI vs non-PERUKI responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | PERUKI network  n (%) | Non-PERUKI network  n (%) | P value\* |
| CPR | 301 (74) | 868 (79.2) | 0.03 |
| Chest needle | 59 (14.5) | 213 (19.4) | 0.027 |
| Tube thoracostomy | 79 (19.4) | 346 (31.6) | <0.001 |
| Defibrillation / DCR | 88 (21.6) | 418 (38.1) | <0.001 |
| Transcutneous pacing | 9 (2.2) | 77 (7) | <0.001 |
| Intraossesous needle | 307 (75.4) | 830 (75.7) | 0.904 |
| Venous cutdown | 6 (1.5) | 20 (1.8) | 0.643 |
| Central venous line | 82 (20.1) | 326 (29.7) | <0.001 |
| Arterial line | 105 (25.8) | 229 (20.9) | 0.042 |
| Pericardiocentesis | 11 (2.7) | 26 (2.4) | 0.713 |
| ED thoracotomy | 11 (2.7) | 31 (2.8) | 0.895 |

\* Calculated using Chi-square test

Table A5: Never performed or supervised each critical procedure: PERUKI vs non-PERUKI responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | PERUKI network  n (%) | Non-PERUKI network  n (%) | P value\* |
| CPR | 22 (5.4) | 35 (3.2) | 0.046 |
| Chest needle | 222 (54.5) | 503 (45.9) | 0.003 |
| Tube thoracostomy | 162 (39.8) | 254 (23.2) | <0.001 |
| Defibrillation / DCR | 154 (37.8) | 275 (25.1) | <0.001 |
| Transcutneous pacing | 340 (83.5) | 731 (66.7) | <0.001 |
| Intraossesous needle | 30 (7.4) | 91 (8.3) | 0.555 |
| Venous cutdown | 333 (81.8) | 879 (80.2) | 0.481 |
| Central venous line | 163 (40) | 168 (15.3) | <0.001 |
| Arterial line | 142 (32.9) | 206 (18.8) | <0.001 |
| Pericardiocentesis | 345 (84.8) | 818 (74.6) | <0.001 |
| ED thoracotomy | 365 (89.7) | 952 (86.9) | 0.14 |

\* Calculated using Chi-square test

Table A6: Proportion of PERUKI and non-PERUKI respondents reporting “at least somewhat confident” for each procedure.

|  |  |  |  |
| --- | --- | --- | --- |
|  | PERUKI network  n (%) | Non-PERUKI network  n (%) | P value\* |
| CPR | 396 (99.2) | 1050 (97.8) | 0.059 |
| Pacing | 217 (54.5) | 599 (56) | 0.604 |
| Venous cutdown | 118 (29.6) | 201 (18.8) | <0.001 |
| Chest needle | 355 (89.4) | 911 (85.1) | 0.034 |
| Tube thoracostomy | 334 (84.3) | 836 (78.1) | 0.009 |
| Pericardiocentesis | 173 (43.5) | 434 (40.7) | 0.334 |
| ED thoracotomy | 131 (32.8) | 152 (14.2) | <0.001 |
| Defibrillation / DCR <3 months | 318 (81.5) | 929 (88.6) | <0.001 |
| Intraosseous needle <3 months | 375 (95.9) | 975 (92.9) | 0.039 |
| CVC <3 months | 179 (45.8) | 588 (55.9) | 0.001 |
| Arterial line <3 months | 208 (53.2) | 515 (41.9) | 0.166 |
| Defibrillation / DCR 4-12 months | 325 (83.3) | 941 (89.6) | 0.001 |
| Intraosseous needle 4-12 months | 374 (95.9) | 985 (93.7) | 0.113 |
| CVC 4-12 months | 190 (48.7) | 635 (60.4) | <0.001 |
| Arterial line 4-12 months | 212 (54.2) | 553 (52.7) | 0.611 |
| Defibrillation / DCR 1-5 years | 343 (87.7) | 957 (91) | 0.067 |
| Intraosseous needle 1-5 years | 378 (97.2) | 994 (94.7) | 0.045 |
| CVC 1-5 years | 212 (54.2) | 696 (66.3) | <0.001 |
| Arterial line 1-5 years | 232 (59.6) | 618 (59) | 0.833 |
| Defibrillation / DCR 6-11 years | 350 (90) | 962 (91.5) | 0.356 |
| Intraosseous needle 6-11 years | 379 (97.2) | 995 (94.8) | 0.051 |
| CVC 6-11 years | 246 (62.9) | 734 (69.9) | 0.011 |
| Arterial line 6-11 years | 263 (67.3) | 666 (63.7) | 0.213 |
| Defibrillation / DCR 12 or more years | 359 (91.8) | 963 (91.7) | 0.95 |
| Intraosseous needle 12 or more years | 380 (97.4) | 989 (94.3) | 0.013 |
| CVC 12 or more years | 279 (71.4) | 752 (71.6) | 0.921 |
| Arterial line 12 or more years | 308 (78.8) | 696 (66.3) | <0.001 |

\* Calculated using Chi-square test

## United States of America (PEM-CRC and PECARN networks), n=613 vs all other respondents (n=890).

Table A7: Performance or supervisión of each critical procedure within the last year: USA vs non-USA responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | USA network  n (%) | Non-USA network  n (%) | P value\* |
| CPR | 301 (74) | 868 (79.2) | 0.03 |
| Chest needle | 59 (14.5) | 213 (19.4) | 0.027 |
| Tube thoracostomy | 79 (19.4) | 346 (31.6) | <0.001 |
| Defibrillation / DCR | 88 (21.6) | 418 (38.1) | <0.001 |
| Transcutneous pacing | 9 (2.2) | 77 (7) | <0.001 |
| Intraossesous needle | 307 (75.4) | 830 (75.7) | 0.904 |
| Venous cutdown | 6 (1.5) | 20 (1.8) | 0.643 |
| Central venous line | 82 (20.1) | 326 (29.7) | <0.001 |
| Arterial line | 105 (25.8) | 229 (20.9) | 0.042 |
| Pericardiocentesis | 11 (2.7) | 26 (2.4) | 0.713 |
| ED thoracotomy | 11 (2.7) | 31 (2.8) | 0.895 |

\* Calculated using Chi-square test

Table A8: Never performed or supervised each critical procedure: USA vs non-USA responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | USA network  n (%) | Non-USA network  n (%) | P value\* |
| CPR | 5 (0.8) | 52 (5.8) | <0.001 |
| Chest needle | 243 (39.6) | 482 (54.2) | <0.001 |
| Tube thoracostomy | 108 (17.6) | 308 (34.6) | <0.001 |
| Defibrillation / DCR | 107 (17.5) | 322 (36.2) | <0.001 |
| Transcutneous pacing | 377 (61.5) | 694 (78) | <0.001 |
| Intraossesous needle | 22 (3.6) | 99 (11.1) | <0.001 |
| Venous cutdown | 478 (78) | 734 (82.5) | 0.03 |
| Central venous line | 53 (8.6) | 278 (31.2) | <0.001 |
| Arterial line | 75 (12.2) | 273 (30.7) | <0.001 |
| Pericardiocentesis | 417 (68) | 746 (83.8) | <0.001 |
| ED thoracotomy | 505 (82.4) | 812 (91.2) | <0.001 |

\* Calculated using Chi-square test

Table A9: Proportion of USA and non-USA respondents reporting “at least somewhat confident” for each procedure.

|  |  |  |  |
| --- | --- | --- | --- |
|  | USA network  n (%) | Non-USA network  n (%) | P value\* |
| CPR | 592 (99.3) | 854 (97.4) | 0.006 |
| Pacing | 361 (60.9) | 455 (52.1) | 0.001 |
| Venous cutdown | 110 (18.5) | 209 (23.9) | 0.014 |
| Chest needle | 539 (90.7) | 727 (83.3) | <0.001 |
| Tube thoracostomy | 489 (82.3) | 681 (78.1) | 0.048 |
| Pericardiocentesis | 277 (46.7) | 330 (37.8) | 0.001 |
| ED thoracotomy | 84 (14.1) | 199 (22.8) | <0.001 |
| Defibrillation / DCR <3 months | 538 (93.1) | 709 (82.3) | <0.001 |
| Intraosseous needle <3 months | 564 (97.4) | 786 (91.3) | <0.001 |
| CVC <3 months | 364 (62.9) | 403 (46.7) | <0.001 |
| Arterial line <3 months | 297 (51.3) | 426 (49.5) | 0.499 |
| Defibrillation / DCR 4-12 months | 545 (94.3) | 721 (83.6) | <0.001 |
| Intraosseous needle 4-12 months | 565 (97.6) | 794 (92.1) | <0.001 |
| CVC 4-12 months | 392 (67.7) | 433 (50.2) | <0.001 |
| Arterial line 4-12 months | 318 (55) | 447 (51.9) | 0.239 |
| Defibrillation / DCR 1-5 years | 549 (94.8) | 751 (86.9) | <0.001 |
| Intraosseous needle 1-5 years | 569 (98.3) | 803 (93.4) | <0.001 |
| CVC 1-5 years | 425 (73.5) | 483 (56) | <0.001 |
| Arterial line 1-5 years | 354 (61.2) | 496 (57.8) | 0.194 |
| Defibrillation / DCR 6-11 years | 551 (95.2) | 761 (88.4) | <0.001 |
| Intraosseous needle 6-11 years | 567 (97.9) | 807 (93.7) | <0.001 |
| CVC 6-11 years | 438 (75.8) | 542 (62.8) | <0.001 |
| Arterial line 6-11 years | 378 (65.5) | 551 (64.1) | 0.595 |
| Defibrillation / DCR 12 or more years | 549 (95) | 773 (89.6) | <0.001 |
| Intraosseous needle 12 or more years | 561 (97.1) | 808 (93.8) | 0.005 |
| CVC 12 or more years | 446 (77.2) | 585 (67.8) | <0.001 |
| Arterial line 12 or more years | 394 (68.2) | 610 (70.8) | 0.293 |

\* Calculated using Chi-square test

## Canada (PERC network) , n=151 vs all other respondents (n=1352).

Table A10: Performance or supervisión of each critical procedure within the last year: PERC vs non-PERC responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | PERC network  n (%) | Non-PERC network  n (%) | P value\* |
| CPR | 118 (78.1) | 1051 (77.7) | 0.909 |
| Chest needle | 26 (17.2) | 246 (18.2) | 0.767 |
| Tube thoracostomy | 49 (32.5) | 376 (27.8) | 0.23 |
| Defibrillation / DCR | 54 (35.8) | 452 (33.4) | 0.566 |
| Transcutneous pacing | 8 (5.3) | 78 (5.8) | 0.813 |
| Intraossesous needle | 121 (80.1) | 1016 (75.1) | 0.176 |
| Venous cutdown | 1 (0.7) | 25 (1.8) | 0.289 |
| Central venous line | 31 (20.5) | 377 (27.9) | 0.054 |
| Arterial line | 16 (10.6) | 318 (23.5) | <0.001 |
| Pericardiocentesis | 2 (1.3) | 35 (2.6) | 0.342 |
| ED thoracotomy | 3 (2) | 39 (2.9) | 0.525 |

\* Calculated using Chi-square test

Table A11: Never performed or supervised each critical procedure: PERC vs non-PERC responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | PERC network  n (%) | Non-PERC network  n (%) | P value\* |
| CPR | 1 (0.7) | 56 (4.1) | 0.039 |
| Chest needle | 65 (43) | 660 (48.8) | 0.178 |
| Tube thoracostomy | 19 (12.6) | 397 (29.4) | <0.001 |
| Defibrillation / DCR | 26 (17.2) | 403 (29.8) | 0.001 |
| Transcutneous pacing | 96 (63.6) | 975 (72.1) | 0.028 |
| Intraossesous needle | 3 (2) | 118 (8.7) | 0.002 |
| Venous cutdown | 123 (81.5) | 1089 (80.5) | 0.788 |
| Central venous line | 16 (10.6) | 315 (23.3) | <0.001 |
| Arterial line | 32 (21.2) | 316 (23.4) | 0.547 |
| Pericardiocentesis | 114 (75.5) | 1049 (77.6) | 0.56 |
| ED thoracotomy | 138 (91.4) | 1179 (87.2) | 0.138 |

\* Calculated using Chi-square test

Table A12: Proportion of PERC and non-PERC respondents reporting “at least somewhat confident” for each procedure.

|  |  |  |  |
| --- | --- | --- | --- |
|  | PERC network  n (%) | Non-PERC network  n (%) | P value\* |
| CPR | 150 (100) | 1296 (98) | 1 |
| Pacing | 85 (56.7) | 731 (55.5) | 0.786 |
| Venous cutdown | 22 (14.8) | 297 (22.5) | 0.03 |
| Chest needle | 143 (95.3) | 1123 (85.3) | 0.001 |
| Tube thoracostomy | 131 (87.9) | 1039 (78.9) | 0.009 |
| Pericardiocentesis | 61 (40.7) | 546 (41.5) | 0.841 |
| ED thoracotomy | 19 (12.7) | 264 (20) | 0.03 |
| Defibrillation / DCR <3 months | 138 (95.2) | 1109 (85.7) | 0.001 |
| Intraosseous needle <3 months | 144 (98.6) | 1206 (93.2) | 0.01 |
| CVC <3 months | 70 (47.6) | 697 (53.8) | 0.153 |
| Arterial line <3 months | 57 (39) | 666 (51.5) | 0.004 |
| Defibrillation / DCR 4-12 months | 143 (97.3) | 1123 (86.9) | <0.001 |
| Intraosseous needle 4-12 months | 145 (98.6) | 1214 (93.8) | 0.017 |
| CVC 4-12 months | 81 (55.1) | 744 (57.5) | 0.585 |
| Arterial line 4-12 months | 58 (39.7) | 707 (54.6) | 0.001 |
| Defibrillation / DCR 1-5 years | 142 (96.6) | 1158 (89.4) | 0.005 |
| Intraosseous needle 1-5 years | 145 (99.3) | 1227 (94.9) | 0.016 |
| CVC 1-5 years | 94 (63.9) | 814 (63) | 0.813 |
| Arterial line 1-5 years | 71 (48.6) | 779 (60.4) | 0.006 |
| Defibrillation / DCR 6-11 years | 142 (97.3) | 1170 (90.4) | 0.006 |
| Intraosseous needle 6-11 years | 144 (98.6) | 1230 (95.1) | 0.05 |
| CVC 6-11 years | 104 (71.2) | 876 (67.6) | 0.378 |
| Arterial line 6-11 years | 78 (53.8) | 851 (65.9) | 0.004 |
| Defibrillation / DCR 12 or more years | 143 (97.3) | 1179 (91.1) | 0.01 |
| Intraosseous needle 12 or more years | 143 (97.9) | 1226 (94.8) | 0.096 |
| CVC 12 or more years | 103 (70.5) | 928 (71.7) | 0.778 |
| Arterial line 12 or more years | 81 (55.5) | 923 (71.3) | <0.001 |

\* Calculated using Chi-square test

## Europe (REPEM network) , n=114 vs all other respondents (n=1389).

Table A13: Performance or supervisión of each critical procedure within the last year: REPEM vs non-REPEM responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | REPEM network  n (%) | Non-REPEM network  n (%) | P value\* |
| CPR | 44 (38.6) | 1125 (81) | <0.001 |
| Chest needle | 14 (12.3) | 258 (18.6) | 0.093 |
| Tube thoracostomy | 10 (8.8) | 415 (29.9) | <0.001 |
| Defibrillation / DCR | 14 (12.3) | 492 (35.4) | <0.001 |
| Transcutneous pacing | 7 (6.1) | 79 (5.7) | 0.841 |
| Intraossesous needle | 34 (29.8) | 1103 (79.4) | <0.001 |
| Venous cutdown | 3 (2.6) | 23 (1.7) | 0.442 |
| Central venous line | 15 (13.2) | 393 (28.3) | <0.001 |
| Arterial line | 19 (16.7) | 315 (22.7) | 0.138 |
| Pericardiocentesis | 3 (2.6) | 34 (2.4) | 0.903 |
| ED thoracotomy | 1 (0.9) | 41 (3) | 0.196 |

\* Calculated using Chi-square test

Table A14: Never performed or supervised each critical procedure: REPEM vs non-REPEM responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | REPEM network  n (%) | Non-REPEM network  n (%) | P value\* |
| CPR | 26 (22.8) | 31 (2.2) | <0.001 |
| Chest needle | 84 (73.3) | 641 (46.1) | <0.001 |
| Tube thoracostomy | 69 (60.5) | 347 (25) | <0.001 |
| Defibrillation / DCR | 75 (65.8) | 354 (25.5) | <0.001 |
| Transcutneous pacing | 97 (85.1) | 974 (70.1) | 0.001 |
| Intraossesous needle | 51 (44.7) | 70 (5) | <0.001 |
| Venous cutdown | 97 (85.1) | 1115 (80.3) | 0.211 |
| Central venous line | 52 (45.6) | 279 (20.1) | <0.001 |
| Arterial line | 59 (51.8) | 289 (20.8) | <0.001 |
| Pericardiocentesis | 100 (87.7) | 1063 (76.5) | 0.006 |
| ED thoracotomy | 108 (94.7) | 1209 (87) | 0.016 |

\* Calculated using Chi-square test

Table A15: Proportion of REPEM and non-REPEM respondents reporting “at least somewhat confident” for each procedure.

|  |  |  |  |
| --- | --- | --- | --- |
|  | REPEM network  n (%) | Non-REPEM network  n (%) | P value\* |
| CPR | 93 (83) | 1353 (99.4) | <0.001 |
| Pacing | 24 (21.8) | 792 (58.4) | <0.001 |
| Venous cutdown | 5 (4.5) | 314 (23.1) | <0.001 |
| Chest needle | 44 (39.6) | 1222 (90.1) | <0.001 |
| Tube thoracostomy | 33 (29.7) | 1137 (83.9) | <0.001 |
| Pericardiocentesis | 10 (9.1) | 597 (44.1) | <0.001 |
| ED thoracotomy | 4 (3.6) | 279 (20.6) | <0.001 |
| Defibrillation / DCR <3 months | 55 (49.1) | 1192 (89.8) | <0.001 |
| Intraosseous needle <3 months | 64 (57.7) | 1286 (96.8) | <0.001 |
| CVC <3 months | 30 (26.8) | 737 (55.4) | <0.001 |
| Arterial line <3 months | 29 (26.4) | 694 (52.2) | <0.001 |
| Defibrillation / DCR 4-12 months | 59 (52.7) | 1207 (90.9) | <0.001 |
| Intraosseous needle 4-12 months | 71 (64) | 1288 (96.8) | <0.001 |
| CVC 4-12 months | 32 (28.6) | 793 (59.6) | <0.001 |
| Arterial line 4-12 months | 30 (27) | 735 (55.3) | <0.001 |
| Defibrillation / DCR 1-5 years | 67 (59.8) | 1233 (92.6) | <0.001 |
| Intraosseous needle 1-5 years | 76 (68.5) | 1296 (97.6) | <0.001 |
| CVC 1-5 years | 32 (28.6) | 876 (66) | <0.001 |
| Arterial line 1-5 years | 32 (28.8) | 818 (61.7) | <0.001 |
| Defibrillation / DCR 6-11 years | 69 (61.6) | 1243 (93.6) | <0.001 |
| Intraosseous needle 6-11 years | 79 (71.2) | 1295 (97.4) | <0.001 |
| CVC 6-11 years | 34 (30.4) | 946 (71.2) | <0.001 |
| Arterial line 6-11 years | 35 (31.5) | 894 (67.5) | <0.001 |
| Defibrillation / DCR 12 or more years | 72 (64.3) | 1250 (94.1) | <0.001 |
| Intraosseous needle 12 or more years | 79 (71.2) | 1290 (97.1) | <0.001 |
| CVC 12 or more years | 36 (32.1) | 995 (74.9) | <0.001 |
| Arterial line 12 or more years | 39 (35.1) | 965 (72.6) | <0.001 |

\* Calculated using Chi-square test

## South / Central America (RIDEPLA network) , n=34 vs all other respondents (n=1469).

Table A16: Performance or supervisión of each critical procedure within the last year: RIDEPLA vs non-RIDEPLA responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | RIDEPLA network  n (%) | Non-RIDEPLA network  n (%) | P value\* |
| CPR | 34 (100) | 1135 (77.3) | 0.002 |
| Chest needle | 8 (23.5) | 264 (18) | 0.405 |
| Tube thoracostomy | 8 (23.5) | 417 (28.4) | 0.534 |
| Defibrillation / DCR | 18 (52.9) | 488 (33.2) | 0.016 |
| Transcutneous pacing | 4 (11.8) | 82 (5.6) | 0.125 |
| Intraossesous needle | 20 (58.8) | 1117 (76) | 0.021 |
| Venous cutdown | 3 (8.8) | 23 (1.6) | 0.001 |
| Central venous line | 11 (32.4) | 397 (27) | 0.49 |
| Arterial line | 11 (32.4) | 323 (22) | 0.151 |
| Pericardiocentesis | 1 (2.9) | 36 (2.5) | 0.855 |
| ED thoracotomy | 2 (2.9) | 41 (2.8) | 0.958 |

\* Calculated using Chi-square test

Table A17: Never performed or supervised each critical procedure: RIDEPLA vs non-RIDEPLA responses

|  |  |  |  |
| --- | --- | --- | --- |
|  | RIDEPLA network  n (%) | Non-RIDEPLA network  n (%) | P value\* |
| CPR | 0 (0) | 57 (3.9) | 0.637 |
| Chest needle | 22 (64.7) | 703 (47.9) | 0.052 |
| Tube thoracostomy | 19 (55.9) | 397 (27) | <0.001 |
| Defibrillation / DCR | 11 (32.4) | 418 (28.5) | 0.619 |
| Transcutneous pacing | 25 (73.5) | 1046 (71.2) | 0.767 |
| Intraossesous needle | 6 (17.6) | 115 (7.8) | 0.037 |
| Venous cutdown | 28 (82.4) | 1184 (80.6) | 0.798 |
| Central venous line | 15 (44.1) | 316 (21.5) | 0.002 |
| Arterial line | 16 (47.1) | 332 (22.6) | 0.001 |
| Pericardiocentesis | 31 (91.2) | 1132 (77.1) | 0.052 |
| ED thoracotomy | 31 (91.2) | 1286 (87.5) | 0.525 |

\* Calculated using Chi-square test

Table A18: Proportion of RIDEPLA and non-RIDEPLA respondents reporting “at least somewhat confident” for each procedure.

|  |  |  |  |
| --- | --- | --- | --- |
|  | RIDEPLA network  n (%) | Non-RIDEPLA network  n (%) | P value\* |
| CPR | 32 (97) | 1414 (98.2) | 0.604 |
| Pacing | 5 (15.2) | 811 (56.6) | <0.001 |
| Venous cutdown | 3 (9.1) | 316 (22) | 0.075 |
| Chest needle | 11 (33.3) | 1255 (87.5) | <0.001 |
| Tube thoracostomy | 12 (36.4) | 1158 (80.8) | <0.001 |
| Pericardiocentesis | 4 (12.5) | 603 (42.1) | 0.001 |
| ED thoracotomy | 2 (6.3) | 281 (19.6) | 0.059 |
| Defibrillation / DCR <3 months | 27 (81.8) | 1220 (86.8) | 0.408 |
| Intraosseous needle <3 months | 26 (81.3) | 1324 (94) | 0.003 |
| CVC <3 months | 14 (42.4) | 753 (53.4) | 0.21 |
| Arterial line <3 months | 11 (33.3) | 712 (50.6) | 0.05 |
| Defibrillation / DCR 4-12 months | 25 (75.8) | 1241 (88.2) | 0.03 |
| Intraosseous needle 4-12 months | 24 (72.7) | 1335 (94.8) | <0.001 |
| CVC 4-12 months | 14 (42.4) | 811 (57.6) | 0.082 |
| Arterial line 4-12 months | 13 (39.4) | 752 (53.4) | 0.11 |
| Defibrillation / DCR 1-5 years | 25 (75.8) | 1275 (90.4) | 0.005 |
| Intraosseous needle 1-5 years | 25 (75.8) | 1347 (95.8) | <0.001 |
| CVC 1-5 years | 12 (37.5) | 896 (63.6) | 0.002 |
| Arterial line 1-5 years | 13 (40.6) | 837 (59.6) | 0.031 |
| Defibrillation / DCR 6-11 years | 25 (75.8) | 1287 (91.5) | 0.002 |
| Intraosseous needle 6-11 years | 26 (78.8) | 1348 (95.8) | <0.001 |
| CVC 6-11 years | 12 (36.4) | 968 (68.8) | <0.001 |
| Arterial line 6-11 years | 12 (36.4) | 917 (65.4) | 0.001 |
| Defibrillation / DCR 12 or more years | 25 (75.8) | 1297 (92.1) | 0.001 |
| Intraosseous needle 12 or more years | 26 (78.8) | 1343 (95.5) | <0.001 |
| CVC 12 or more years | 13 (39.4) | 1018 (72.3) | <0.001 |
| Arterial line 12 or more years | 13 (39.4) | 991 (70.4) | <0.001 |

\* Calculated using Chi-square test