Point-of-Care Ultrasound (POCUS) Practices in the Helicopter Emergency Medical Services in Europe

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Research Article

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Abstract

**Background:** The extent to which Point-of-care of ultrasound (POCUS) is used in different European helicopter EMS (HEMS) is unknown. We aimed to study the availability, perception, and future aspects of POCUS in the European HEMS.

**Methods:** A survey about the use of POCUS in HEMS was conducted by a multinational steering expert committee and was carried out from November 30, 2020 to December 30, 2020 via an online web portal. Invitations for participation were sent via email to the medical directors of the European HEMS organizations including two reminders.

**Results:** During the study period, 69 participants from 25 countries and 41 different HEMS providers took part in the survey. 96% (n=66) completed the survey. POCUS was available in 75% of the responding HEMS organizations when needed (56% always, and 19% occasionally). 17% were planning to establish POCUS in the near future. Responders who provided POCUS used it in approximately 15% of the patients. Participants thought that POCUS is important in both trauma and non-trauma-patients (73%, n=46). The extended focused assessment sonography for trauma (eFAST) protocol (77%) was the most common used protocol. A POCUS credentialing process including documented examinations was requested in less than one third of the HEMS organizations.

**Conclusions:** The majority of the HEMS organizations in Europe are able to provide different POCUS protocols in their services. The most used POCUS protocols were eFAST, FATE and RUSH. Despite the enthusiasm for POCUS, comprehensive training and clear credentialing processes are lacking in about two thirds of the European HEMS organizations.

**Background**

Point-of-care of care ultrasound is a **Physiological, On spot Clinical examination that is Unique and Safe** [1]. It has been used in acute care settings since more than thirty years [2]. The small size, light weight, portability, improved quality of imaging, ability to store images, and the relatively low cost are clear advantages of the hand-held portable ultrasound machine [3]. These advantages make POCUS useful in many acute point-of-care settings including pre-hospital resuscitation, emergency departments, intensive care units, and operation theatres [4, 5]. POCUS performed in the pre-hospital and mass casualty incidents may affect the clinical decisions, notifications, transport modes, and hospital destination [3]. Pre-hospital POCUS was established two decades ago in various pre-hospital emergency medical services (EMS) in Europe, Australia, and North America [6, 7]. It was available in 9% of the French EMS units [8] and in 4.1% in the USA and Canada [9]. Furthermore, 21% of EMS services in the USA and Canada considered implementing it [9]. Pre-hospital POCUS is not widely used possibly due to limited availability and lack of strong evidence of its clinical value [10–12]. The extent to which POCUS is used in different European helicopter EMS (HEMS) is unknown. There exist no data on applied POCUS protocols, its training and credentialing methods, and the opinions of health care providers in the HEMS on its value. We aimed to
study the availability, perception, and future aspects of POCUS in the European HEMS using an online survey.

**Methods**

A multinational steering expert committee developed a questionnaire about the use of POCUS in HEMS. The ten-minutes survey consisted of 24 questions regarding demographics, availability, present and future use of POCUS in HEMS, importance of POCUS in different conditions, used POCUS protocols, and if there were any necessary credentialing POCUS processes for medical providers (Suppl Table 1). The survey was provided online via the web portal SurveyMonkey®. To ensure that every participant could only answer the survey once, the IP-address was recorded, whereas all data were analyzed anonymously. The invitation link and the QR-code for the survey was sent via email to the medical directors of the European HEMS organizations of 28 countries across Europe and a second and third reminders were sent to non-respondents. The survey was available online from November 30 to December 30, 2020 and it was possible to answer it with any mobile device (smartphone, tablet) or PC.

Descriptive analysis was done using the analysis tools provided by SurveyMonkey® and the statistic software GraphPad Prism 9.0 (GraphPad Software, San Diego, CA, USA). Data were presented as median (range) and mean (SD) for ordinal and continuous data, and number (%) for categorical data. If data were missing, valid percentages were calculated from the available data. The study is in line with the current European general data protection regulation (GDPR).

**Results**

**General Data**

During the study period, 69 participants from 25 countries (89% of the invited countries) and 41 different HEMS organizations took part in the survey. The survey was completed by 96% (n=66 of 69) of the participants. Most of the participants 95.5% (n=65 of 69) were males, between 41 and 50 years old, and had a leading position within their HEMS organization (71%, n=49 of 69). Almost all HEMS programs (97.5%, n=40 of 41) were physician staffed, in which the physician was joined by a paramedic in 65% (n=26 of 40) or a flight nurse in 20% (n=8 of 40) (Table 1). An Infirmier Siamu (Infermier - French term for a nurse; Siamu - abbreviation for the French term “Soins Intensifs et Aide Medicale Urgente”; intensive care and urgent medical aid) a nurse that combines clinical intensive care medicine and preclinical emergency medicine, were part of the medical team in 7.5% (n=3 of 40), and a paramedic or flight nurse in 2.5% (n=1 of 40) respectively (missing data were in 5%, n=2). The non-physician staffed HEMS was only paramedic service.

**POCUS and HEMS organizations**

Unrestricted availability of POCUS was in 56% (n=23 of 41) of the HEMS organizations (standardized equipment at all related HEMS bases), occasionally possible in 19.5% (n=8 of 41), and not possible in
24.5% (n=10 of 41) (Table 1). The time since POCUS had been established in the different HEMS organizations ranged from less than one year up to 20 years. Of the HEMS organizations not yet providing POCUS, 70% (n=7 of 10) stated planning to integrate it in the future within a median (range) time of 2 (1 – 4) years. Responders of the HEMS providers in which POCUS was available estimated that POCUS had been used in a median (range) percentage of 15% (0.8 – 37.5) of patients (Table 2).

Regarding the credentialing process for using POCUS in the different HEMS organizations providing POCUS, 35% (n=11 of 31) has an established credentialing process. If a credentialing process was established, a POCUS-course led by an expert was requested in 9 HEMS, an additional didactic teaching of an average of 6.5 hours and hands-on training of an average of 5.5 hours were requested in four HEMS. In two of the four mentioned HEMS organizations, documented POCUS cases were needed before using POCUS in HEMS. In the other two HEMS organizations, own didactic teaching and hands-on training were requested. Generally, comprehensive training and credentialing activities are scarce in the European HEMS organizations.

Participants’ opinion

Table 3 summarizes the results of the importance of POCUS in general, in different areas and different patient conditions. Most participants think that POCUS is important in both trauma and non-trauma patients (73%, n=46 of 63), whereas 19% (n=12 of 63) think that POCUS is more important in trauma patients, while 8% (n=5 of 63) think that it was important in non-trauma patients. Standard examination protocols are being used by the majority of participants 63% (n=38 of 60), whereas 32% (n=19 of 60) do not use such protocols and 5% (n=3 of 60) were not sure. The (e)FAST protocol is the most used protocol (77%). The findings of POCUS were recorded in a reliable way (video clip or electronic database) in less than 30%, and mainly put down in writing on the mission protocols (Table 4).

POCUS devices

The most commonly used portable ultrasonography devices were, GE healthcare V-scan in 40% (n=21), FUJIFILM Sonosite iviz in 36% (n=19), Philips healthcare Lumify and Butterfly Network iQ in 6% (n=3) respectively. Some HEMS organizations use more than one POCUS device manufacturer. Most of the participants (71%, n=39) were pleased with the devices used.

Discussion

Our study indicates that more than two-thirds of the European HEMS organizations provide POCUS in their helicopters and that a considerable number is planning to establish it soon. HEMS providers appreciate the increased need for POCUS integration in pre-hospital care. To our knowledge, this is the first survey regarding the pre-hospital use of POCUS in HEMS organizations across Europe.

Data suggest that POCUS is feasible and useful in HEMS. Nevertheless, the evidence regarding improving direct patient outcome is weak and needs to be clarified by properly designed prospective studies [10, 11,
There are different POCUS protocols that can be used in the pre-hospital setting which include extended (e)FAST to search for intraperitoneal fluid, peri-cardiac fluid, haemothorax and pneumothorax, [19, 20], Rapid Ultrasound for Shock (RUSH) to define the cause of the shock, and Focused Assessment Transthoracic Echocardiography (FATE) to quickly evaluate the cardiac function [21–24]. Our results show, that (e)FAST is the most used protocol in HEMS.

With advancements in technology and training, the use of POCUS extended to more indications like diagnosis of eye injuries and bone fractures [25, 26]. POCUS training should be tailored towards the specific needs of the HEMS staff. The operators should be familiar with their own ultrasound machines and should be particularly knowledgeable of the sonographic artefacts that can mislead them [4, 27].

The participants thought that POCUS examinations of the chest, abdomen and heart are very important, vascular access are important, while POCUS for airway management and regional anesthesia is less important, (see Table 3). It is of interest to note that the needed POCUS skills for airway management and interventions are more advanced. Currently less than one-third of the participating HEMS organizations seems to have a credentialing process for using POCUS. The other two-third assumed that the HEMS crews can perform POCUS. Training must be standardized to maximize the benefit of POCUS. European HEMS organizations should agree on common POCUS curriculum with an accepted standard that suits their needs. Competency is a key factor in successful clinical applications [4, 28]. Using a Delphi methodology, Micheller et al. defined a total of five modalities (cardiac, thoracic, FAST, aorta, and procedural), with 32 measured competencies and 72 sub competencies [29] as the basis for the needed curriculum. Consecutive quality assurance and governance are probably more challenging, as POCUS findings are interpreted in a dynamic clinical context.

POCUS seems to be accepted and available in Europe. Besides the more frequent use of POCUS compared with North America, the survey underlines that HEMS in Europe is mainly physician staffed which can explain the frequent use of POCUS (9, 28). Some participants stated that POCUS is used in more than 30% of their patients indicating proper training in a wide range of applications.

**Limitations**

The represented study has some limitations which we would like to highlight. *First*, it was a voluntary online survey that carries the risk of selection bias of participants who encourage the use of POCUS. This may overestimate the value of POCUS. *Second*, the majority of participants are leaders in their HEMS organization, with the risk of reporting results that are preferred by them and may be different from those who use it. *Third*, we did not get the response of all invited HEMS organizations carrying the risk of selection bias. The survey was asked in a limited period of 30 days possibly explaining the small sample size. *Fourth*, female responders were few with the majority being males. *Finally*, some of the participating countries and HEMS organizations were overrepresented. This was taken into consideration when reporting availability of POCUS in the organizations but could have skewed the opinion data.
Conclusions

Our study has shown that most of the HEMS organizations in Europe are able to provide different POCUS protocols in their services. The most commonly used POCUS protocols were (e)FAST, FATE and RUSH. Despite the enthusiasm for POCUS, comprehensive training and clear credentialing processes are not available in about two thirds of the European HEMS organizations.

Abbreviations

| Abbreviation | Description                                               |
|--------------|-----------------------------------------------------------|
| COVID        | corona virus infection disease                            |
| CPR          | cardio pulmonary resuscitation                            |
| EMS          | emergency medical service                                 |
| FAST         | focused assessment sonography for trauma                  |
| FATE         | focused assessment transthoracic echocardiography         |
| FEEL         | focused echocardiography in emergency life support        |
| HEMS         | helicopter emergency medical service                      |
| n.a.         | no answer                                                 |
| POCUS        | Point-of-care ultrasound                                  |
| RUSH         | rapid ultrasound in shock                                 |
| SD           | standard deviation                                        |
| SIAMU        | Soins Intensifs et Aide Medicale Urgente                   |
|              | “intensive care and urgent medical aid”                   |
| UK           | United Kingdom                                            |

Declarations

Ethical Approval and Consent to participate: Not applicable.

The study is in line with the current European general data protection regulation (GDPR).

Consent for publication: Not applicable.

Availability of supporting data: The dataset generated and analysed during the current study are not publicly available due the ownership of the different air ambulance providers but are available from the corresponding author on request.

Competing interests: The authors declare that they have no competing interests.
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**Authors’ contributions**

P.H-C. and F. A-Z developed the study. All authors were involved the development of the questionnaire. P. H-C and M. St wrote the first manuscript draft. All authors were involved in the data analysis and the improvement of the manuscript. Statistical analysis was done by P.H-C and F.A-Z. All authors read and approved the final manuscript.

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AP³ – Switzerland

ARA (Air Rescue Austria) – Austria

BABCOCK – Spain

Centre Medical Héliporté de Bra sur Lienne (CMH) – Belgium

Czech Army – Czech Republic

Den Landsdækkende Akutlægehelikopterordning – Denmark

DRF-Luftrettung – Germany

DSA Aviation Company – Czech Republic

EMRS (Emergency Medical Retrieval Service) – Scotland UK

FinnHEMS – Finland

GAMMA AIR MEDICAL – Greek

Heli South Tirol – Italy
Helikopter Air Transport Austria - Czech Republic
Hungarian Air Ambulance Ltd. – Hungary
IDF (Israeli Defense Forces) – Israel
INEM (Instituto Nacional de Emergência Médica) – Portugal
LAR (Luxembourg Air Rescue) – Luxembourg
Lifeliner (Medical Air Assistance) - Netherlands
London's Air Ambulance – UK
National Air Ambulance Service – Russia
Norsk Luftambulanse – Norway
Northern Helicopter – Germany
NWAA (North West air ambulance) – UK
ÖAMTC Flugrettung – Austria
Polish Medical Air Rescue – Poland
REGA – Switzerland
RTS – Spain
SAMU-68 GHRMSA – France
Sécurité Civile – France
Slovenian army- Slovenia
SMURD (Serviciul Mobil de Urgență, Reanimare și Descarcerare) – Romania
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References

1. Abu-Zidan FM, Cevik AA. Diagnostic point-of-care ultrasound (POCUS) for gastrointestinal pathology: state of the art from basics to advanced. World J Emerg Surg. 2018;13:47.

2. Abu-Zidan FM, Zayat I, Sheikh M, Mousa I, Behbehani A. Role of ultrasonography in blunt abdominal trauma: a prospective study. Eur J Surg. 1996;162(5):361-5.

3. Dittrich K, Abu-Zidan FM. Role of Ultrasound in Mass-Casualty Situations. International Journal of Disaster Medicine. 2004;2(1-2):18-23.

4. Abu-Zidan FM. Point-of-care ultrasound in critically ill patients: Where do we stand? J Emerg Trauma Shock. 2012;5(1):70-1.

5. Abu-Zidan FM. Optimizing the value of measuring inferior vena cava diameter in shocked patients. World J Crit Care Med. 2016;5(1):7-11.

6. Ketelaars R, Reijnders G, van Geffen GJ, Scheffer GJ, Hoogerwerf N. ABCDE of prehospital ultrasonography: a narrative review. Crit Ultrasound J. 2018;10(1):17.

7. O'Dochartaigh D, Douma M. Prehospital ultrasound of the abdomen and thorax changes trauma patient management: A systematic review. Injury. 2015;46(11):2093-102.

8. Bobbia X, Hansel N, Muller L, Claret PG, Moreau A, Genre Grandpierre R, et al. Availability and practice of bedside ultrasonography in emergency rooms and prehospital setting: a French survey. Ann Fr Anesth Reanim. 2014;33(3):e29-33.

9. Taylor J, McLaughlin K, McRae A, Lang E, Anton A. Use of prehospital ultrasound in North America: a survey of emergency medical services medical directors. BMC Emerg Med. 2014;14:6.

10. Portable Ultrasound Devices in the Pre-Hospital Setting: A Review of Clinical and Cost-Effectiveness and Guidelines. CADTH Rapid Response Reports. Ottawa (ON)2015.

11. Stengel D, Rademacher G, Ekkernkamp A, Guthoff C, Mutze S. Emergency ultrasound-based algorithms for diagnosing blunt abdominal trauma. Cochrane Database Syst Rev.
12. Botker MT, Jacobsen L, Rudolph SS, Knudsen L. The role of point of care ultrasound in prehospital critical care: a systematic review. Scand J Trauma Resusc Emerg Med. 2018;26(1):51.

13. Ultrasound in the Air Medical Environment. Air Med J. 2018;37(6):351.

14. Ketelaars R, Beekers C, Van Geffen GJ, Scheffer GJ, Hoogerwerf N. Prehospital Echocardiography During Resuscitation Impacts Treatment in a Physician-Staffed Helicopter Emergency Medical Service: an Observational Study. Prehosp Emerg Care. 2018;22(4):406-13.

15. Ketelaars R, Holtslag JJM, Hoogerwerf N. Abdominal prehospital ultrasound impacts treatment decisions in a Dutch Helicopter Emergency Medical Service. Eur J Emerg Med. 2019;26(4):277-82.

16. Ketelaars R, Hoogerwerf N, Scheffer GJ. Prehospital chest ultrasound by a dutch helicopter emergency medical service. J Emerg Med. 2013;44(4):811-7.

17. Mason R, Latimer A, Vrablik M, Utarnachitt R. Teaching Flight Nurses Ultrasonographic Evaluation of Esophageal Intubation and Pneumothorax. Air Med J. 2019;38(3):195-7.

18. O'Dochartaigh D, Douma M, Alexiu C, Ryan S, MacKenzie M. Utilization Criteria for Prehospital Ultrasound in a Canadian Critical Care Helicopter Emergency Medical Service: Determining Who Might Benefit. Prehosp Disaster Med. 2017;32(5):536-40.

19. Maximus S, Figueroa C, Whealon M, Pham J, Kuncir E, Barrios C. eFAST for Pneumothorax: Real-Life Application in an Urban Level 1 Center by Trauma Team Members. Am Surg. 2018;84(2):220-4.

20. Mohammad A, Hefny AF, Abu-Zidan FM. Focused Assessment Sonography for Trauma (FAST) training: a systematic review. World J Surg. 2014;38(5):1009-18.

21. Gonzalez JM, Ortega J, Crenshaw N, de Tantillo L. Rapid Ultrasound for Shock and Hypotension: A Clinical Update for the Advanced Practice Provider: Part 2. Adv Emerg Nurs J. 2020;42(4):284-92.

22. Gonzalez JM, Ortega J, Crenshaw N, de Tantillo L. Rapid Ultrasound for Shock and Hypotension: A Clinical Update for the Advanced Practice Provider: Part 1. Adv Emerg Nurs J. 2020;42(4):270-83.

23. Kodaka M. Cardiac Point-of-care Using Ultrasound. Masui. 2017;66(5):484-92.

24. Ozen C, Salcin E, Akoglu H, Onur O, Denizbasi A. Assessment of ventricular wall motion with focused echocardiography during cardiac arrest to predict survival. Turk J Emerg Med. 2016;16(1):12-6.

25. Abu-Zidan FM. Ultrasound diagnosis of fractures in mass casualty incidents. World J Orthop. 2017;8(8):606-11.

26. Abu-Zidan FM, Balac K, Bhatia CA. Surgeon-performed point-of-care ultrasound in severe eye trauma: Report of two cases. World J Clin Cases. 2016;4(10):344-50.

27. Abu-Zidan FM, Hefny AF, Corr P. Clinical ultrasound physics. J Emerg Trauma Shock. 2011;4(4):501-3.

28. Amaral CB, Ralston DC, Becker TK. Prehospital point-of-care ultrasound: A transformative technology. SAGE Open Med. 2020;8:2050312120932706.

29. Micheller D, Peterson WJ, Cover M, Smith G, Chapman M, Theyyunni N, et al. Defining a Theory-Driven Ultrasound Curriculum for Prehospital Providers. Air Med J. 2019;38(4):285-8.
Tables

Table 1. Overview of countries, HEMS-organizations (anonymous) and POCUS of the survey participants.
| Country          | No. of responders | No. of providers | HEMS-organizations* | Physician staffed | With Doctor in cabin | POCUS provided |
|------------------|-------------------|------------------|---------------------|-------------------|---------------------|----------------|
| 1) Austria       | 2                 | 2                | 1                   | yes               | Paramedic           | yes            |
|                  |                   |                  |                     |                   |                     |                |
| 2) Belgium       | 1                 | 1                | 3                   | yes               | Infirmier Siamu     | Yes            |
| 3) Czech Republic | 9                 | 5                | 4                   | yes               | Paramedic           | no             |
|                  | 4                 |                  |                     | yes               | Paramedic           | yes            |
|                  | 4                 |                  |                     | yes               | Paramedic           | no             |
|                  | 5                 |                  |                     | yes               | Paramedic           | no             |
|                  | 4                 |                  |                     | yes               | Paramedic           | no             |
|                  | 6                 |                  |                     | yes               | Flight nurse        | occasionally   |
|                  | 4                 |                  |                     | yes               | Flight nurse        | yes            |
|                  | 7                 |                  |                     | yes               | Paramedic           | no             |
|                  | 8                 |                  |                     | yes               | Paramedic           | no             |
| 4) Denmark       | 1                 | 1                | 9                   | yes               | Paramedic           | Yes            |
| 5) Finland       | 2                 | 1                | 10                  | yes               | Paramedic           | Yes            |
| 6) France        | 2                 | 2                | 11                  | yes               | Flight nurse        | no             |
|                  |                   |                  |                     | yes               | Flight nurse        | occasionally   |
| 7) Germany       | 13                | 4                | 13                  | yes               | Paramedic           | yes            |
|                  | 14                |                  |                     | yes               | Paramedic           | yes            |
|                  | 15                |                  |                     | yes               | Paramedic           | yes            |
|                  | 16                |                  |                     | yes               | Paramedic           | yes            |
| 8) Greece        | 1                 | 1                | 17                  | yes               | Flight nurse        | Occasionally   |
| 9) Hungary       | 1                 | 1                | 18                  | yes               | Paramedic           | Yes            |
| 10) Ireland (Republic) | 1          | 1                | 19                  | no                |                     | No             |
| 11) Israel       | 2                 | 1                | 20                  | yes               | Paramedic           | Occasionally   |
| Country      | Number | 1st Number | 2nd Number | 3rd Number | Increased? | Role of Flight Nurse | Frequency of Flight Nurse |
|--------------|--------|------------|------------|------------|------------|----------------------|--------------------------|
| Italy        | 1      | 1          | 21         | yes        | Flight Nurse| yes                  |                          |
| Liechtenstein| 1      | 1          | 22         | yes        | Paramedic  | No                   |                          |
| Luxembourg   | 1      | 1          | 23         | yes        | Infirmier  | Siamu Yes            |                          |
| Netherlands  | 6      | 1          | 24         | yes        | Paramedic  | yes                  | Flight Nurse             |
| Norway       | 5      | 1          | 25         | yes        | Paramedic  | Yes                  |                          |
| Poland       | 1      | 1          | 26         | yes        | Paramedic  | Yes                  |                          |
| Portugal     | 1      | 1          | 27         | yes        | Infirmier  | Siamu No             |                          |
| Romania      | 1      | 1          | 28         | yes        | n.a.       | occasionally         |                          |
| Russia       | 1      | 1          | 29         | yes        | Paramedic  | Occasionally         |                          |
| Slovenia     | 30     |            |            | yes        | n.a.       | Yes                  |                          |
| Spain        | 2      | 2          | 31         | yes        | Flight Nurse| occasionally         | no                       |
|              |        |            | 32         | yes        | Flight Nurse| no                   |                          |
| Sweden       | 3      | 1          | 33         | yes        | Flight Nurse| Yes                  |                          |
| Switzerland  | 5      | 3          | 34         | yes        | Paramedic  | no                   |                          |
|              |        |            | 35         | yes        | Paramedic  | no                   |                          |
|              |        |            | 36         | yes        | Paramedic  | yes                  |                          |
| United Kingdom| 5     | 5          | 37         | yes        | Paramedic  | yes                  |                          |
|              |        |            | 38         | yes        | Paramedic  | no                   |                          |
|              |        |            | 39         | yes        | Paramedic  | yes                  |                          |
|              |        |            | 40         | yes        | Paramedic  | yes                  |                          |
|              |        |            | 41         | yes        | Paramedic  | yes                  |                          |

n.a. – no answer; *HEMS organizations are listed by numbers to keep the data anonymous, every number express a different HEMS organization
Table 2. Time since POCUS is provided or will be provided and frequents of use.

| Question                                                                 | Number | Median (range) | Mean (SD)   |
|--------------------------------------------------------------------------|--------|----------------|-------------|
| For how many years have your HEMS been providing POCUS?                  | 51     | 6 (0.5 – 20)   | 6.54 (4.4)  |
| In how many years does your HEMS organization plan to integrate POCUS in the patients care in the future? | 11     | 2 (1 – 4)      | 2.81 (1.1)  |
| How often has POCUS being used in the last 1000 patients of your HEMS organization? | 40     | 150 (8 – 375)  | 146 (100)   |
|                                                                         |        |                | 15% (0.8 – 37.5) | 14.6% (10) |

Table 3. Importance of POCUS in general, in different areas and different patient conditions
Table 4. Used POCUS protocols and mode of recording of the findings.
| POCUS protocol                                                                 | Number | %  |
|--------------------------------------------------------------------------------|--------|-----|
| If you use standard protocols – What protocols are used?                        |        |     |
| (p)FAST (pre-hospital focused assessment sonography for trauma)                 | 9      | 23  |
| (e)FAST (extended focused assessment sonography for trauma)                    | 30     | 77  |
| FATE (focus assessed transthoracic echo)                                       | 14     | 36  |
| RUSH (rapid ultrasound in shock)                                               | 10     | 26  |
| Others (see below)                                                             | 7      | 18  |
| Not specified                                                                  | 5      | 12.5|
| FEEL (focused echocardiography in emergency life support)                      | 1      | 2.5 |
| Lung-US for COVID-19                                                           | 1      | 2.5 |

| How are the POCUS findings recorded in your HEMS?                              |        |     |
| Mission protocol / Patient Record Form                                         | 33     | 57  |
| Video clip                                                                     | 8      | 14  |
| Electronic data base                                                           | 8      | 14  |
| Not recorded, if not relevant                                                  | 11     | 19  |
| Not recorded at all                                                            | 16     | 28  |

**Supplementary Files**

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix1.pdf