Retrospective Comparative Analysis of Two Medical Evacuation Systems for Ukrainian Patients Affected by War

SUPPLEMENTAL MATERIAL

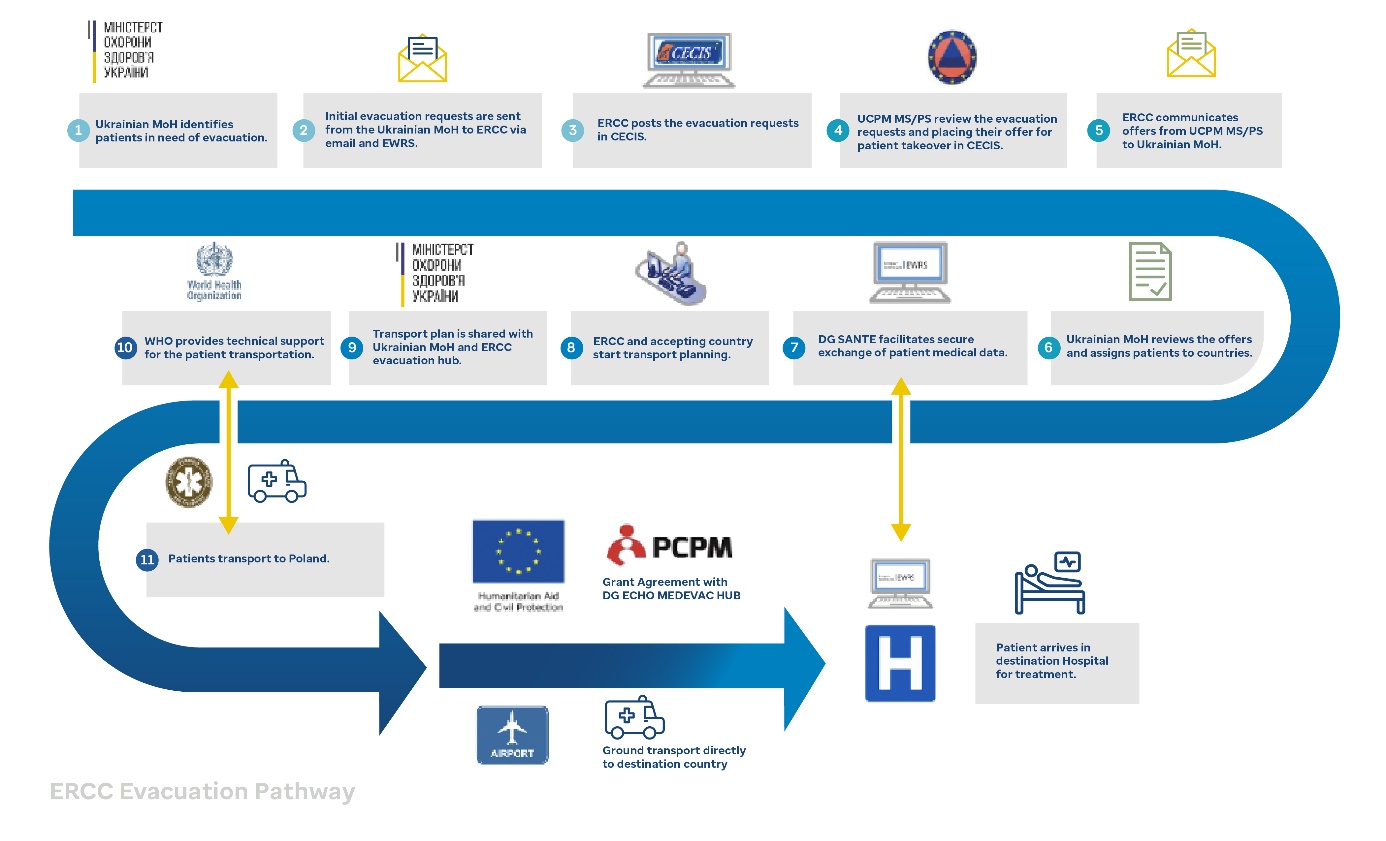
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| Marcin | Sławomir | Wasiak | Norbert Barlicki Memorial Teaching Hospital No. 1 of the Medical University of Lodz | Anaesthesiology and intensive care therapy | Lodz | Poland |
| Lance | Allan | Wiedower | St. Jude Children's Research Hospital | Global Pediatric Medicine | Memphis | USA |
| Natalia |  | Wobst | American Lebanese Syrian Associated Charities (ALSAC) | ALSAC Global Alliances | Memphis | USA |
| Lena | Isolde | Wuenschel | Gesellschaft für Pädiatrische Onkologie und Hämatologie |  | Berlin | Germany |
| Mariusz | Stanislaw | Wysocki | Collegium Medicum, Nicolaus Copernicus University Torun | Pediatric Hematology and Oncology | Bydgoszcz | Poland |
| Marina |  | Yurieva | The Jackson Laboratory for Genomic Medicine | Computational Sciences | Farmington | USA |
| Anastasiia |  | Zagurska | SAFER Ukraine |  | Warsaw | Poland |
| Stanislav | S | Zakharenko | St. Jude Children's Research Hospital | Neural Circuits and Behavior, Developmental Neurobiology | Memphis | USA |
| Aelita | V | Zakharenko | SAFER Ukraine |  | Collierville | USA |
| Khrystyna |  | Zapotochna | Western Ukrainian Specialized Children`s Medical Center | Pediatric Oncology and Bone Marrow Transplant | Lviv | Ukraine |
| Joanna | Emilia | Zawitkowska | Medical University of Lublin | Pediatric Hematology, Oncology and Transplantology | Lublin | Poland |
| Marco |  | Zecca | Fondazione IRCCS Policlinico San Matteo | Pediatric Hematology/Oncology | Pavia | Italy |

**Appendix Figure 1: Overview of the implemented Emergency Response Coordination Centre** (**ERCC) evacuation pathway.** 1. The Ukrainian Ministry of Health (MoH) identifies patients in need of evacuation. 2. The initial evacuation requests are sent from the Ukrainian (UA) MoH to the ERCC and Early Warning and Response System (EWRS) via email. 3. The ERCC team posts the evacuation requests in the Common Emergency Communication and Information System (CECIS) and facilitates communication between UA MoH, the Union Civil Protection Mechanism (UCPM) member states (MS)/participating states (PS) and the ERCC evacuation hub. 4. UCPM MS/PS reviews the evacuation requests and identifies and suggests accepting medical center in CECIS. 5. The ERCC team communicates offers from UCPM MS/PS to the UA MoH. 6. The UA MoH reviews and accepts offers. 7. European Commission's Directorate-General for Health and Food Safety (DG SANTE) facilitates secure exchange of patient medical information between the Ukrainian MoH and the accepting country. 8. The ERCC team together with the accepting country start planning patient transport. 9. The transport plan is shared with the UA MoH and the ERCC evacuation hub. 10. The World Health Organization provides technical support for patient transportation. 11. From Ukraine, patients are transported to the ERCC evacuation hub in Poland prior to further travel to reach their final destinations.

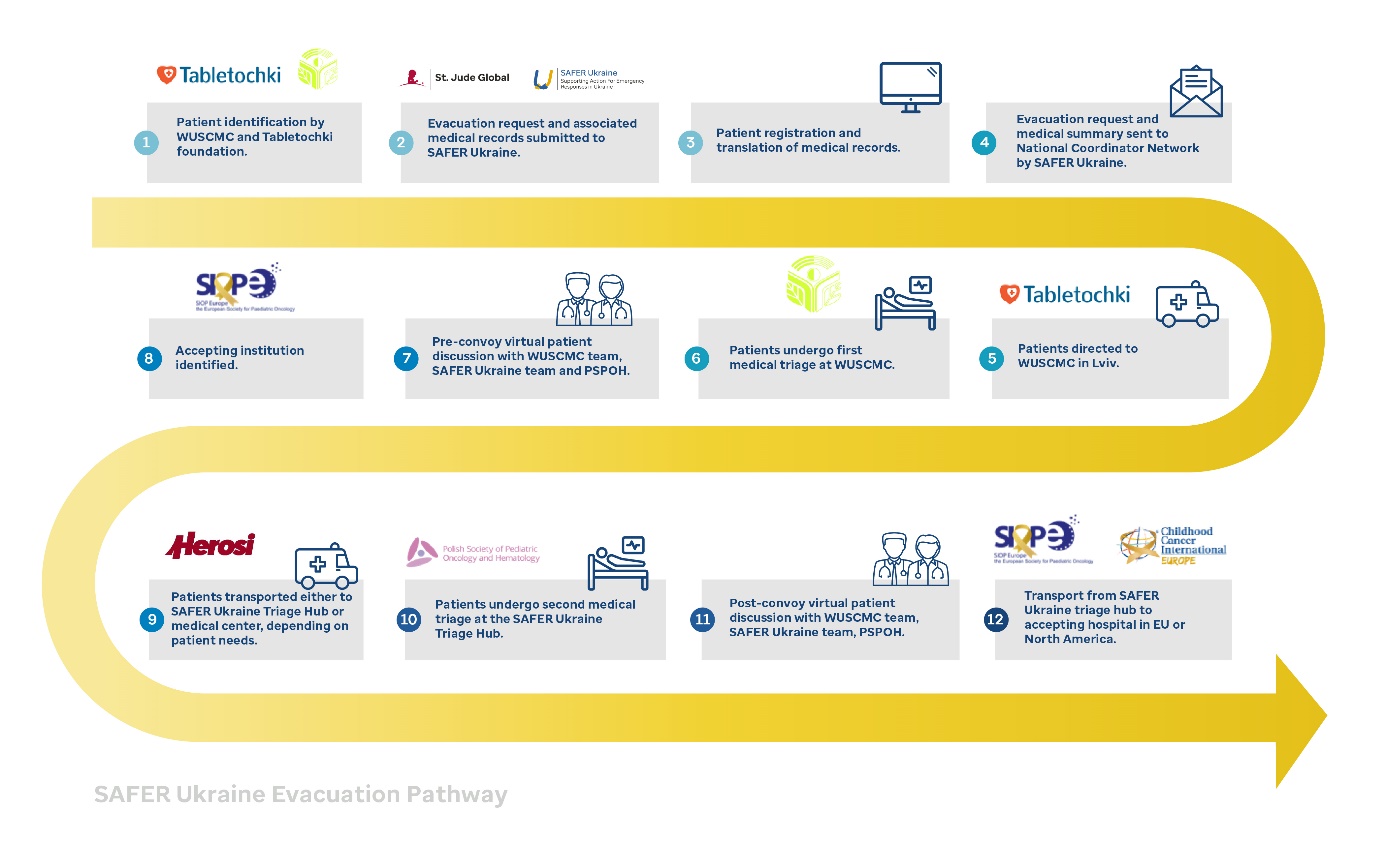


ERCC Evacuation Pathway

The ERCC is the operational arm of the EU Civil Protection Mechanism and coordinates delivery of assistance to countries affected by natural and man-made disasters.The ERCC facilitates evacuations via the Early Warning and Response System (EWRS) and Common Emergency Communication and Information System (CECIS) (eTable 2 Supplement). The ERCC's international referral network includes all EU Members States (27 countries) and Union Civil Protection Mechanism Participating States (ten countries). Ukrainian patients eligible for evacuation are identified and registered in CECIS by the Ukrainian Ministry of Health (MoH). ERCC facilitates international patient referral either with direct transfer to the accepting country or with an intermediate stop at the EU evacuation hub (MedEvac hub Jasionka) in Rzeszow, Poland. Medical services offered at the EU evacuation hub are provided by the Polish Center for International Aid (PCPM) designated by the Polish MoH to the Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO) of the European Commission. The European Commission’s Directorate-General for Health and Food Safety (DG SANTE) facilitates the confidential exchange of medical information between the Ukrainian MoH and accepting countries. In addition, the WHO provides technical support and co-financing. Ambulances transfer patients from Lviv to Poland prior to final allocation, either directly or via the EU Evacuation Hub.

Liaising directly with the national civil protection authorities, ERCC ensures tailored assistance by leveraging the reserve of pre-committed EU member states and Union Civil Protection Mechanism (UCPM) participating states. This mechanism allows for coordinated support and co-financing of operational and transportation costs by the EU, ultimately decreasing the financial burden in crisis areas, including Ukraine.

**Appendix Figure 2. Overview of the implemented Supporting Action for Emergency Response in Ukraine (SAFER Ukraine) evacuation pathway.** 1.The teams of the Western Ukraine Specialized Children’s Medical Center (WUSCMC) and the Tabletochki foundation identify patients in need of evacuation. 2. The evacuation request and associated medical records are submitted to SAFER Ukraine. 3. The patient is registered in the SAFER Ukraine evacuation registry and medical records are translated. 4. The evacuation requests with short medical summaries are sent to the representatives (pediatric hematology/oncology experts) of participating countries by SAFER Ukraine. 5. The patients are directed to WUSCMC in Lviv with the support of the Tabletochki foundation. 6. The patients undergo the first medical triage at WUSCMC. 7. The pre-convoy virtual patient discussion meeting is held with the attendance of WUSCMC team, SAFER Ukraine team and delegates from the Polish Society of Pediatric Hematology and Oncology. 8. Identification of an accepting institution with expertise and capacity by country representatives and with support of the European Society of Paediatric Oncology (SIOP-E) and Childhood Cancer International Europe (CCI-E). 9. Stable patients are transported to the SAFER Ukraine triage hub or if unstable, directly to a medical center, depending on patient needs. 10. The post-convoy virtual patient discussion meeting is held with the attendance of WUSCMC team, SAFER Ukraine team, and delegates from the Polish Society of Pediatric Hematology and Oncology. 12. The patients are transported from the SAFER Ukraine triage hub to the accepting institution in Europe or North America.



SAFER Ukraine evacuation pathway

Pre-existing regional relationships led to the development of the SAFER Ukraine collaborative in response to the escalation of war in Ukraine.This initiative included an international referral network to refer children diagnosed with cancer and blood disorders to specialized medical centers in the EU or North America to continue required medical care. This referral network included pediatric hematology-oncology (PHO) experts who served as country representatives in all accepting countries. These experts were responsible for local capacity assessment and identifying receiving centers to match the medical needs of Ukrainian patients. Patients requesting evacuation support were registered in a patient registry and transferred to the Western Ukrainian Specialized Children's Medical Center (WUSCMC) in Lviv for initial medical assessment.A triage hub was established in Boheniec, Poland to accept referred patients and perform a second evaluation prior to international referral. The triage hub was staffed by multidisciplinary PHO staff designated by the Polish Society of Pediatric Oncology and Hematology to perform patient triage and basic medical assistance.

While healthcare for Ukrainian citizens in the EU is financed through a temporary protection mechanism, the costs of evacuation logistics, including transportation, triage hub maintenance, and staffing were supported by multiple non-governmental organizations. Accepting medical centers assumed costs related to medical care, housing, and psychosocial needs, in addition to financial support provided by local governments.

**Appendix Table 2: Tools and organizational entities within the Emergency Response Coordination Centre (ERCC) evacuation pathway.**

|  |  |  |
| --- | --- | --- |
| **Name** | **Abbreviation** | **Function** |
| Emergency Response Coordination Centre | ERCC | The Emergency Response Coordination Centre is the heart of the European Union (EU) Civil Protection Mechanism. It is responsible for coordinating the delivery of assistance to disaster-stricken countries, such as relief items, expertise, civil protection teams, and specialized equipment. The center ensures the prompt provision of emergency assistance and serves as a central point of contact for all EU Member States, the eight additional participating states, the affected country, and experts in civil protection and humanitarian assistance. |
| Early Warning and Response System | EWRS | The Early Warning and Response System in the EU is a web-based communication system created European Commission to ensure a rapid and effective response by the EU to public health threats. |
| Common Emergency Communication and Information System | CECIS | The Common Emergency Communication and Information System is a web-based communication system used by the ERCC for alerting and notification and enables real-time information exchange. |
| Polish Center For International Aid | PCPM | The Polish Center For International Aid is a non-governmental organization delivering humanitarian assistance around the world. |
| European Commission's Directorate-General for Civil Protection and Humanitarian Aid Operations | DG ECHO | The Directorate-General for European Civil Protection and Humanitarian Aid Operations is a EU commission department and entrusted with safeguarding individuals and communities afflicted by natural hazards and man-made disasters. |
| European Commission's Directorate-General for Health and Food Safety | DG SANTE | The European Commission's Directorate-General for Health and Food Safety is a EU commission department and responsible for EU policy on food safety and health and for monitoring the implementation of related laws. |

**Appendix Table 3.** Union Civil Protection Mechanism **Member and Participating States.** All European Union (EU) countries are defined as Union Civil Protection Mechanism (UCPM) member states. In addition to the EU countries, eight countries agreed to contribute to the EU Civil Protection Mechanism as UCPM participating states.

|  |  |
| --- | --- |
| **UCPM Member States** | |
| Austria | Italy |
| Belgium | Latvia |
| Bulgaria | Lithuania |
| Croatia | Luxembourg |
| Cyprus | Malta |
| Czech Republic | Netherlands |
| Denmark | Poland |
| Estonia | Portugal |
| Finland | Romania |
| France | Slovakia |
| Germany | Slovenia |
| Greece | Spain |
| Hungary | Sweden |
| Ireland |  |
| **UCPM Participating States** | |
| Albania | North Macedonia |
| Bosnia and Herzegovina | Norway |
| Iceland | Serbia |
| Montenegro | Turkey |

**Appendix Table 4. Standardized Guidelines for the International Referral of Ukrainian Pediatric Hematology-Oncology Patients.** Standardized evacuation guidelines were developed in August 2022 in a collaborative effort by the Ukrainian Ministry of Health (MoH), the three largest PHO departments in Ukraine (Western Ukrainian Specialized Children’s Medical Center, Okhmadyt Children’s Hospital and National Cancer Institute), and the SAFER Ukraine Initiative. To ensure a successful international patient referral, the three major PHO centers in Kyiv (Okhmadyt Children’s Hospital, National Cancer Institute) and Lviv (Western Ukrainian Specialized Children’s Medical Center) were assigned as reference centers to coordinate the international referral process together with the SAFER Ukraine initiative. The Ukrainian MoH distributed the standardized evacuation guidelines to all Ukrainian PHO departments.

|  |
| --- |
| **Groups of pediatric hematology-oncology patients in need of evacuation** |
| 1. Patients requiring advanced forms of therapy not currently available in Ukrainian centers. These include certain types of immunotherapy, CAR-T cell therapy, targeted therapy, or proton therapy, among others. |
| 2. Patients whose treatment requires a high level of resources in close temporal succession. These include, for example, certain brain tumor patients whose treatment requires a rapid succession of surgery, chemotherapy, and radiation therapy. |
| 3. Patients with unclear underlying disease, whose diagnosis requires specific diagnostic tools not currently available in Ukraine. |
| 4. Patients whose families desire to leave Ukraine for safety reasons related to the war and need to continue treatment abroad (elective referrals). |

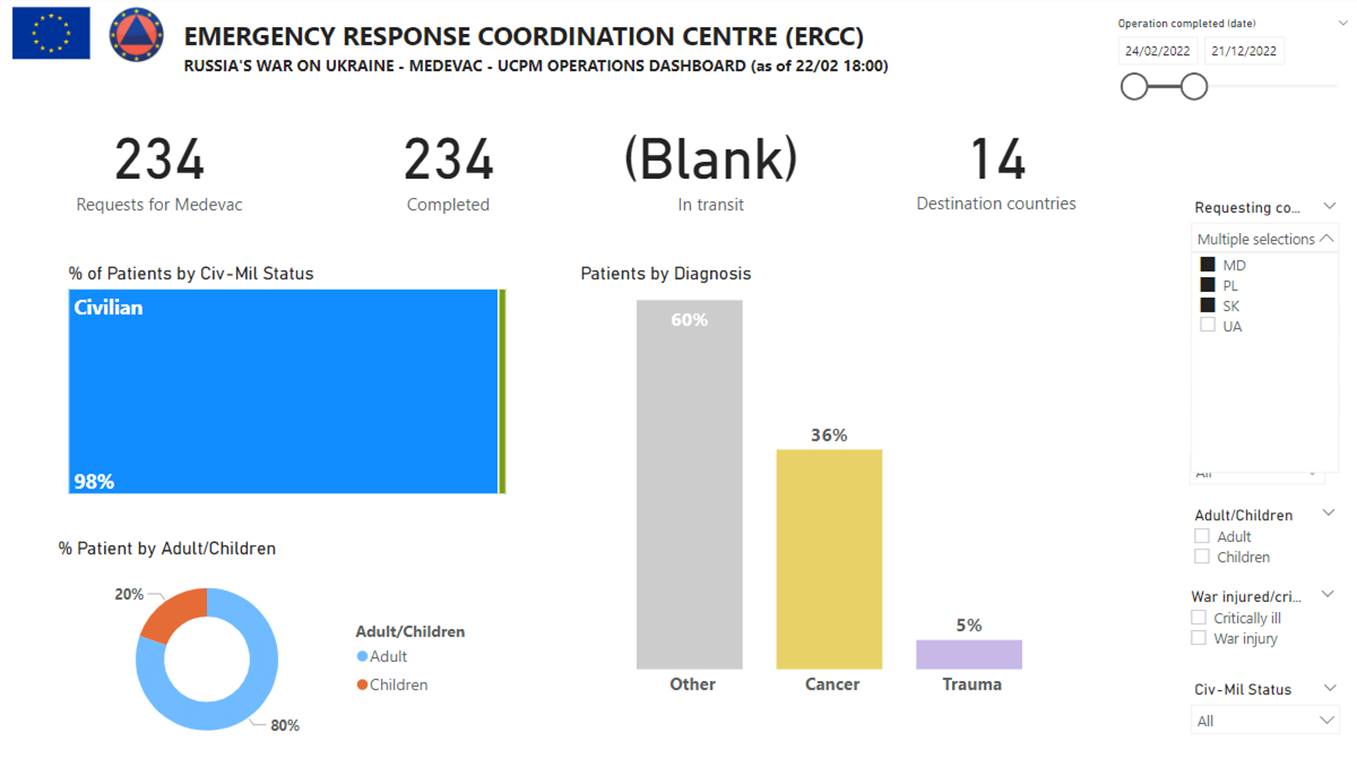
**Appendix Table 5: Allocation data of patients evacuated by the Emergency Response Coordination Centre (ERCC) within the first 10 months after the intensification of war in Ukraine (February 24, 2022 to December 21, 2022).** Data reported are for the entire ERCC patient cohort (civilian and military) and for each subgroup. The median evacuation time is defined as the time from receiving the evacuation request and the patient’s arrival at the accepting medical facility. IQR = Interquartile range.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | **Civilian Patients (%)** | **Military Patients (%)** | **All Patients (%)** |
| **Number of patients per patient subgroup and destination country** | | 490 (100) | 895 (100) | 1385 (100) |
|  | Austria | 17 (3.5) | 0 | 17 (1.2) |
| Belgium | 4 (0.8) | 25 (2.8) | 29 (2.1) |
| Czech Republic | 0 (0.0) | 2 (0.2) | 2 (0.1) |
| Denmark | 29 (5.9) | 25 (2.8) | 54 (3.9) |
| Finland | 8 (1.6) | 9 (1.0) | 17 (1.2) |
| France | 9 (1.8) | 32 (3.6) | 41 (3.0) |
| Germany | 208 (42.4) | 363 (40.6) | 571 (41.2) |
| Italy | 70 (14.3) | 14 (1.6) | 84 (6.1) |
| Ireland | 6 (1.2) | 12 (1.3) | 18 (1.3) |
| Lithuania | 1 (0.2) | 79 (8.8) | 80 (5.8) |
| Netherlands | 15 (3.1) | 56 (6.3) | 71 (5.1) |
| Norway | 70 (14.3) | 37 (4.1) | 107 (7.7) |
| Poland | 23 (4.7) | 143 (16.0) | 166 (12.0) |
| Romania | 2 (0.4) | 0 (0.0) | 2 (0.1) |
| Spain | 4 (0.8) | 71 (7.9) | 75 (5.4) |
| Sweden | 24 (4.9) | 27 (3.0) | 51 (3.7) |
| **Dates of completed evacuations (date/month/year)** | | | | |
|  | 200 completed evacuations | 30.05.2022 | 21.06.2022 | 19.05.2022 |
| 400 completed evacuations | 26.10.2022 | 28.07.2022 | 12.06.2022 |
| 600 completed evacuations | - | 07.09.2022 | 13.07.2022 |
| 800 completed evacuations | - | 24.11.2022 | 17.08.2022 |
| 1000 completed evacuations | - | - | 28.09.2022 |
| 1200 completed evacuations | - | - | 23.11.2022 |
| **Number of completed evacuations through ERCC evacuation hub** | | 57 (11.6) | 78 (8.7) | 135 (9.7) |
| **Number of completed evacuations independent from ERCC evacuation hub** | | 433 (88.4) | 817 (91.3) | 1250 (90.3) |
| **Median evacuation time in days (range)** | | 6  (IQR 25-75%: 4-11) | 7  (IQR 25-75%: 5-13) | 7  (IQR 25-75%: 5-13) |

**Appendix Table 6: Demographic data of pediatric patients evacuated by the Emergency Response Coordination Centre (ERCC) within the first 10 months after the intensification of war in Ukraine (February 24, 2022 to December 21, 2022).** The demographic data are reported for the subgroup of pediatric patients within the entire ERCC patient cohort. Pediatric patients were defined as children between the ages of 0 and 18 years of age. Disease categories were assigned based clinical information obtained from the ERCC evacuation registry. \*Other summarizes a broad spectrum of disease categories including cardiologic, endocrinologic, gynecologic, hematologic, hepatic, immunologic, neurologic, oncologic, otorhinolaryngologic, psychiatric and pulmonary illnesses.

|  |  |  |
| --- | --- | --- |
| **Characteristic** | | **n (%)** |
| **Total number of patients** | | 102 (100) |
| **Number of patients per disease category** | |  |
|  | Trauma injuries | 52 (51.0) |
| Oncologic | 12 (11.7) |
| Burn injuries | 1 (1.0) |
| Other | 37 (36.3) |

**Appendix Figure 3: Emergency Response Coordination Centre (ERCC) MEDEVAC evacuations of Ukrainian patients requested by Poland, Slovakia, and Moldova within the first 10 months after the intensification of war in Ukraine (February 24, 2022 to December 21, 2022).** Summary of allocation and demographic data of Ukrainian patients transferred from Poland, Slovakia, and Moldova through the ERCC evacuation pathway to another country in the European Union. Blank highlights no patient in transit at the time of data query.

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**Appendix Table 7: Allocation data of patients evacuated by the Supporting Action for Emergency Response in Ukraine (SAFER Ukraine) collaborative within the first 10 months after the intensification of war in Ukraine (February 24, 2022 to December 21, 2022).** The median evacuation time is defined as the time from receiving the evacuation request and the patient’s arrival at the accepting medical facility in Europe or North America. IQR = Interquartile range.

|  |  |  |
| --- | --- | --- |
|  | | **Patients (n, %)** |
| **Total number of patients** | | 550 (100) |
| **Number of patients per destination country** | |  |
|  | Austria | 8 (1.5) |
| Belgium | 8 (1.5) |
| Canada | 8 (1.5) |
| Czech Republic | 23 (4.2) |
| France | 43 (7.8) |
| Germany | 125 (2.7) |
| Italy | 51 (9.3) |
| Netherlands | 53 (9.6) |
| Poland | 81 (14.7) |
| Portugal | 6 (1.1) |
| Spain | 65 (1.8) |
| Switzerland | 37 (6.7) |
| United Kingdom | 22 (4.0) |
| United States of America | 9 (1.6) |
| Unknown | 11 (2.0) |
| **Dates of completed evacuations (date/month/year)** | | |
|  | 200 completed evacuations | 07.03.2022 |
| 400 completed evacuations | 08.04.2022 |
| **Number of evacuations through the SAFER Ukraine triage hub** | | 536 |
| **Evacuation independent from SAFER Ukraine triage hub** | | 14 |
| **Average time to final destination in days (range)** | | 6 (IQR 25-75%: 3-8) |