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A retrospective analysis of the need for on-site emergency physician presence and mission characteristics of a rural ground-based emergency medical service

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Abstract

Background This study aimed to address the challenges faced by rural emergency medical services in Europe, due to an increasing number of missions and limited human resources. The primary objective was to determine the necessity of having an on-site emergency physician (EP), while the secondary objectives included analyzing the characteristics of rural EP missions.

Methods A retrospective study was conducted, examining rural EP missions carried out between January 1st, 2017, and December 2nd, 2021 in Burgenland, Austria. The need for physical presence of an EP was classified based on the National Advisory Committee for Aeronautics (NACA) score into three categories; category A: no need for an EP (NACA 1–3); category B: need for an EP (NACA 1–3 along with additional medical interventions beyond the capabilities of emergency medical technicians); and category C: definite need for an EP (NACA 4–7). Descriptive statistics were used for analysis.

Results Out of 16,971 recorded missions, 15,591 were included in the study. Approximately 32.3% of missions fell into category A, indicating that an EP's physical presence was unnecessary. The diagnoses made by telecommunicators matched those of the EPs in only 52.8% of cases.

Conclusion The study suggests that about a third of EP missions carried out in rural areas might not have a solid medical rationale. This underscores the importance of developing an alternative care approach for these missions. Failing to address this could put additional pressure on already stretched EMS systems, risking their collapse.

Keywords Emergency medical services, Emergency medicine, Telemedicine, Anesthesiology, Rural medicine

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Background

The ever-increasing number of rescue missions has put a strain on the emergency medical services (EMS) in Austria [1] and many other countries [2–4]. In particular, the increasing number of emergency physician (EP) missions is due to a growing shortage of general practitioners and general problems with outpatient care, and the uneven sociodemographic development of the population [5]. However, the medical indication for these EP missions is only sometimes adequate.

In Austria, prehospital emergency medicine is based on an ambulance service staffed by emergency medical technicians (EMTs) and a separate ground- or air-based emergency service staffed by EPs. The lowest level of EMT training is similar to the EMT-Basic with 100 h of theory and 160 h of practical training. Extended first aid and basic non-invasive diagnostics are included in their scope of practice. They are not allowed to administer medication other than oxygen. The advanced training levels for EMTs encompass EMT-Intermediate and EMT-Advanced. At this stage, EMTs are authorized to administer additional medications based on predefined lists and are skilled in performing additional medical procedures, such as the insertion of intravenous lines (see Supplementary Table 1) [6, 7]. Noteworthy, in rural areas of Austria, the distribution of EMTs reveals a notable imbalance. Only 17.3% of EMTs hold an EMT-Intermediate designation, and a mere 0.3% are classified as EMTs-Advanced. The majority, constituting 82.4%, are categorized as EMTs-Basic. In addition, unlike in most other countries [8], most Austrian EMTs are volunteers, especially in rural areas. Because of this special circumstance and the long-distance requirements, the role and availability of EPs for medically indicated missions are particularly important in rural areas of EP-based EMS systems.

We hypothesized that a considerable number of EP missions might be unnecessary and could therefore show a proportion of missions that could be handled through alternative care strategies, like a telemedicine-enabled approach for on-site EMTs.

Furthermore, the specifics of rural prehospital EMS, including the frequency and duration of rescue missions as well as the range of diagnoses, remain unexplored. Therefore, the primary objective of this study was to investigate the need for the physical presence of ground-based EPs in rural areas using the example of Burgenland. The secondary objectives were to examine the characteristics of rural EP rescue missions.

Methods

Study design

This retrospective study evaluated all records of ground-based EP rescue missions between January 1st, 2017, and December 2nd, 2021, in Burgenland. Data were extracted from the mandatory documentation system (NACA-X, Version 4.0, EDV-Trimmel, Gleißenfeld/Austria) in which all EP missions were documented. All records were categorized as primary missions or additional EP requests. Primary missions were defined as the direct and simultaneous dispatch of the EP emergency vehicle and an ambulance to the scene. In the cases of additional EP requests, EMTs arrived at the scene without a physician and decided that a physician's presence was still necessary. Transfers, canceled missions, and records with missing mission category data were excluded.

Ethical approval was obtained from the Ethics Committee of the Medical University of Vienna (Number: 1903/2021). The STROBE checklist was used in the reporting of this study.

Ground-based EMS in the federal state of Burgenland

Burgenland, with a population of approximately 292,000 inhabitants (as of 2017) [9], represents a typical rural area in Austria. The EMS relies on five ground-based EP emergency vehicles spread across an area of about 3,965 square kilometers. These ground-based EP units operate continuously, complemented by an additional helicopter during the day. Each medical team consists of an EP alongside either an EMT-Intermediate or Advanced.

Moreover, there are 13 ambulances stationed across twelve strategic locations, ensuring comprehensive coverage around the clock. During daytime hours, an additional 31 ambulances reinforce the fleet, enhancing emergency response capabilities. In addition, around 300 off-duty EMTs can be mobilized as first responders, equipped with basic medical equipment to support the ambulance team promptly and effectively at the scene, or even provide first aid before the ambulance team arrives.

Endpoints

Based on the National Advisory Committee for Aeronautics (NACA) score, we defined the need for physical presence of an on-site EP as either category A: no need for an EP (NACA 1–3), category B: need for an EP (NACA 1–3 plus additional medical interventions that extend EMTs competencies as listed in Supplementary Table 1), or category C: definite need for an EP (NACA $\geq$4). NACA classification stems from the EP on scene after completing the respective mission. This definition differs from the conventional NACA score, which typically considers only a score of $\geq$4 as indicative of the need for an EP due to life-threatening conditions. However, as many EMTs do not have the professional authorization to administer medications or perform other necessary interventions, there is often a need for an EP even if the NACA score is $<$4. This necessitated modification of the NACA score for analysis in this study. Although this score, which is recorded for each mission in the standardized database of the EMS system studied, is non-specific, it was the only objective variable available to assess the need for physical EP resources at the scene. Therefore, it was used as the outcome variable for the analysis of the primary endpoint. We utilized variables from the provided database, including mission category (categorized as either primary mission or additional EP request), mission figures over time, distribution throughout the day (dayshifts from 8:00 to 19:59 and nightshifts from 20:00 to 7:59), and week (weekdays from Monday to Friday and weekends on Saturday to Sunday). Additional variables encompassed patient demographics, such as sex (male or female) and age categories (infants: <1 year; children: 1 to 13 years; adults: 14 to 64 years; seniors: ≥65 years). Moreover, we considered the NACA score, and the medical interventions performed (e.g., drug administration, airway management, mechanical ventilation). We also took into account the presumptive diagnoses made by both the EMS telecommunicators using a standardized questioning scheme for emergency calls and by the EPs at the scene using their professional judgement, and the concordance of these respective presumptive diagnoses. An evaluation of the presumptive diagnoses and the corresponding NACA scoring from the perspective of the EMTs could not be performed due to the lack of relevant data in the database. Further variables included EP vehicle arrival times from dispatch to scene arrival and mission duration from dispatch to the conclusion of the operation.

Statistical analysis

To ensure data integrity, two independent members of the study team evaluated the plausibility and consistency of the data. Continuous data, due to their skewed distribution, are presented as median and interquartile range (IQR). The normal distribution was assessed using the Shapiro-Wilk test. Categorical data are expressed as counts and percentages. Differences between expected and observed frequencies, as all group sizes exceeded 5, were analyzed using the Chi-squared test. This was employed to compare the need for physical EP presence (category A vs. category B+C) during dayshifts and nightshifts, as well as between weekdays and weekends. For non-normally distributed continuous data, such as differences in mission duration for non-necessary (category A) and necessary (category B+C) missions, the Mann-Whitney test was utilized. Additionally, the percentage of matching diagnoses between EPs and telecommunicators was calculated to further elucidate the findings.

Missing data were excluded from calculations concerning the respective variable. A two-sided p-value of <0.05 was considered statistically significant. Correction for multiple testing was not used due to the single primary outcome and exploratory nature of this study.

Data processing for statistical analysis were performed using IBM SPSS Statistics 29 (IBM Corporation, Armonk, NY, USA) and Python 3.7.11 using the Pandas framework [10].

Results

Out of the 16,971 recorded ground-based EP missions, 15,591 were eligible for inclusion in this study. Among the excluded cases, 729 were transfers, 145 were canceled missions, and 506 were excluded due to missing data. Among the included cases, 5.5% were categorized as additional EP requests. The median age of patients [143 missing data points] was 67 years (IQR 48 to 80), and 47.5% [417 missing data points] were female. A proportion of 53.8% were aged 65 years or older (Table 1). Regarding NACA scores, about 47.4% of all patients presented a potential vital risk (NACA 4–6). Additionally, approximately 44.7% had a NACA score between 1 and 3, indicative of non-urgent missions (Table 1).

Approximately 60.2% of all missions were recorded during dayshifts [88 missing data points] falling between 8:00 and 19:59. There was no statistically significant difference in the relative frequency of missions necessitating physical EP presence (category A vs. B+C) between day shifts (67.9%) and night shifts (67.7%, $p=0.75$).

Over weekends, there was an increased average daily mission rate in comparison to weekdays (9.4 vs. 8.4). Additionally, the average number of missions requiring the presence of an EP (categories B+C) was higher on weekends as opposed to weekdays (6.3 vs. 5.7). Despite these observed variations, a comparative analysis of the relative frequency of missions necessitating physical EP

Table 1 Distribution of NACA scores and age groups

NACA score							
1	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
277 (1.8)	1694 (10.9)	5004 (32.1)	5767 (37.0)	1404 (9.0)	221 (1.4)	1223 (7.8)	15,590

Age group				
< 1 year	**1–13 years**	**14–64 years**	**≥ 65 years**	**Total**
118 (0.8)	688 (4.5)	6338 (41.0)	8304 (53.8)	15,448

This table shows the number and relative frequency of the distribution of NACA scores [1 missing data point] and patients per age group [143 missing data points]. NACA = National Advisory Committee for Aeronautics

Table 2 Total annual and average daily numbers of rescue missions

	Primary missions	Additional EP requests	Total	Annual average de-/increase (%)
2017	2975 (8.2)	206 (0.6)	3181 (8.7)	
2018	2287 (6.3)	179 (0.5)	2466 (6.8)	−21.8
2019	3041 (8.3)	164 (0.4)	3205 (8.8)	+29.4
2020*	3306 (9.0)	144 (0.4)	3450 (9.4)	+6.8
2021**	3127 (9.3)	162 (0.5)	3289 (9.8)	+4.3

This table shows the total annual and average daily number of missions over time. * 366 days, ** 336 days

presence (categories B+C) indicated no statistically significant difference between weekday missions (68.1%) and weekend missions (66.9%, $p=0.16$).

Additionally, the study period revealed an upward trend in mission figures over time, as presented in Table 2.

The need for physical EP presence

Approximately 67.7% of all missions required the physical presence of an on-site EP (categories B and C). 55.3% of the missions fell into category C (NACA scores 4–7), indicating a clear medical need for on-site medical support (Fig. 1). An additional 12.4%, categorized as category B, involved NACA scores of 1–3 but required medical interventions beyond the EMTs' competencies. The remaining 32.3% of missions did not require an on-site EP and fell within NACA scores 1–3 (category A).

Per our modified NACA score-based classification, roughly one-third of all EP missions were deemed medically inadequate. The cases of cardiac arrest displayed the highest medical indication rate, reaching 99.9%, while gynecological and urological emergencies exhibited the lowest at 50.0% (Table 3). In terms of age groups, the lowest rate of EP presence necessity was identified in infant emergencies at 45.8%. Conversely, the highest rate was observed among patients aged over 65 years, with a rate of 71.3% (Table 3).

Presumptive diagnoses

The majority of missions (60.0%) were dispatched due to medical issues, encompassing conditions such as respiratory distress, allergic reactions, reduced state of consciousness, non-traumatic bleeding, hypo-/hyperglycemia, intoxication, as well as circulatory and cardiological problems. Predominantly, cardiac problems and decreased level of consciousness were the most frequent reasons prompting EP missions. Trauma constituted

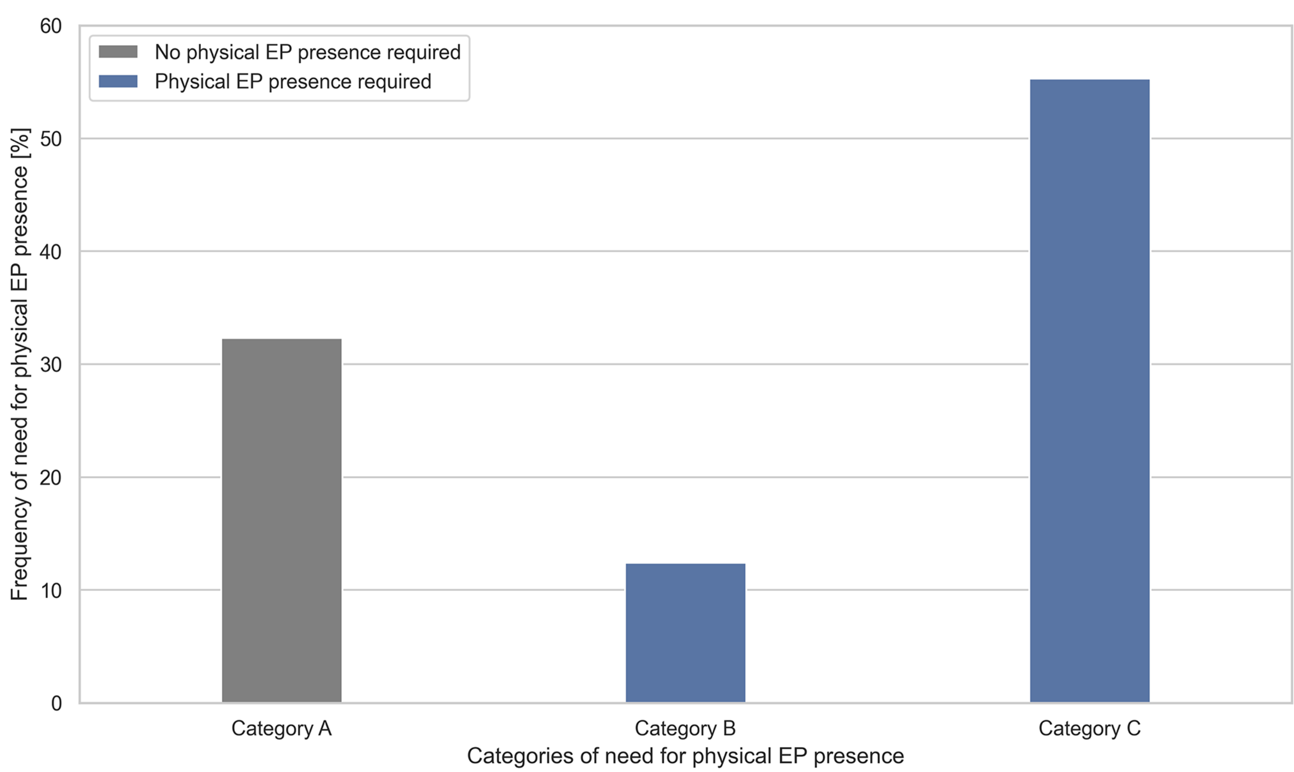

Fig. 1 The frequency of need for EP presence
The frequency of need for EP presence [1 missing data point]. Category A: no need for an EP (NACA 1–3), category B: need for an EP (NACA 1–3 plus additional medical interventions that extend EMTs' competencies), category C: definite need for an EP (NACA ≥ 4). *EMT = emergency medical technician, EP = emergency physician, NACA = National Advisory Committee for Aeronautics*

Table 3 The need for physical EP presence at the scene

	Physical EP presence needed		
	Primary missions	**Additional EP requests**	**Total missions**
Age group			
< 1 year	52/115 (45.2)	2/3 (66.7)	54/118 (45.8)
1–13 years	322/667 (48.3)	10/21 (47.6)	332/688 (48.3)
14–64 years	3889/5978 (65.1)	267/360 (74.2)	4156/6338 (65.6)
≥ 65 years	5577/7838 (71.2)	342/466 (73.4)	5919/8304 (71.3)
EP Diagnosis			
Cardiological emergency	1907/2626 (72.6)	110/141 (78.0)	2017/2767 (72.9)
Circulatory problem	1060/2056 (51.6)	49/80 (61.3)	1109/2136 (51.9)
Trauma	1126/1685 (66.8)	124/173 (71.7)	1250/1858 (67.3)
Respiratory distress	1035/1512 (68.5)	63/77 (81.8)	1098/1589 (69.1)
Cardiac arrest	1327/1327 (100.0)	32/33 (97.0)	1359/1360 (99.9)
Other	624/1196 (52.2)	47/88 (53.4)	671/1284 (52.3)
Seizure	598/1014 (59.0)	25/32 (78.1)	623/1046 (59.6)
Stroke	401/483 (83.0)	34/42 (81.0)	435/525 (82.9)
Psychiatric emergency	236/469 (50.3)	17/26 (65.4)	253/495 (51.1)
Allergic reaction	337/439 (76.8)	15/18 (83.3)	352/457 (77.0)
Acute Abdomen	233/395 (59.0)	22/34 (64.7)	255/429 (59.4)
Intoxication	257/393 (65.4)	17/22 (77.3)	274/415 (66.0)
Other neurological emergency	262/325 (80.6)	19/20 (95.0)	281/345 (81.4)
Hypo-/Hyperglycemia	151/258 (58.5)	5/11 (45.5)	156/269 (58.0)
Reduced state of consciousness	126/179 (70.4)	6/10 (60.0)	132/189 (69.8)
Non-traumatic bleeding	122/171 (71.3)	12/16 (75.0)	134/187 (71.7)
Pain therapy	73/99 (73.7)	18/21 (85.7)	91/120 (75.8)
Birth assistance	36/64 (56.3)	6/8 (75.0)	42/72 (58.3)
Gynecological or urological emergency	23/45 (51.1)	1/3 (33.3)	24/48 (50.0)
Total	**9934/14,736 (67.4)**	**622/855 (72.7)**	**10,556/15,591 (67.7)**

The number and relative frequency of cases requiring the physical presence of an EP (category B + C) on-site according to age group [143 missing data points] and EPs' diagnosis. Category A: no need for an EP (NACA 1–3), category B: need for an EP (NACA 1–3 plus additional medical interventions that extend EMTs' competencies), category C: definite need for an EP (NACA ≥ 4). EMT = emergency medical technician, EP = emergency physician, NACA = National Advisory Committee for Aeronautics

9.5% of dispatched missions, while out-of-hospital cardiac arrest accounted for 6.4% (Fig. 2).

There was a concordance of only 52.8% between telecommunicator diagnoses and the EPs' working diagnosis on-scene. Particularly notable was the high level of agreement in cases related to cardiological problems, where 65.7% of dispatched missions demonstrated alignment between telecommunicator and physician diagnoses. Conversely, a minimal 4.8% of dispatched cases involving a reduced state of consciousness were validated by the physician at the scene (Fig. 2).

Arrival times and mission duration

The overall median response time, spanning from dispatch to on-scene arrival, exhibited 12 min (IQR 9 to 16) [547 missing data points]. In missions necessitating the presence of physicians (categories B + C), the median mission duration [2,427 missing data points] amounted to 59 min (IQR 44 to 76). For non-urgent missions falling under category A, the median mission duration was significantly reduced at 38 min (IQR 30 to 49; $p < 0.001$).

Discussion

This retrospective study investigated rural EP operations using Burgenland as an example. We evaluated the characteristics of these missions to determine the proportion of missions where an EP's scarce expertise might not be necessary. We found that about one-third of these missions met these criteria. This suggests there could be opportunities to use alternative and more efficient care strategies in EMS in the future for this proportion of missions. Our findings align with similar challenges faced by other European EMSs, which also deal with a significant number of "non-urgent" classified missions [2, 11–13]. The inefficiencies in the Austrian EMS may stem from similar issues observed in other countries, such as limitations in the dispatching system [14, 15]. Conversely, the considerable number of volunteer EMTs in Austria and potential gaps in their experience and training may be a key contributing factor to this situation. This is particularly notable in cases involving medically inadequate additional EP requests. Nevertheless, the existing configuration of the Austrian EMS system, which affords EMTs constrained authority in terms of the application

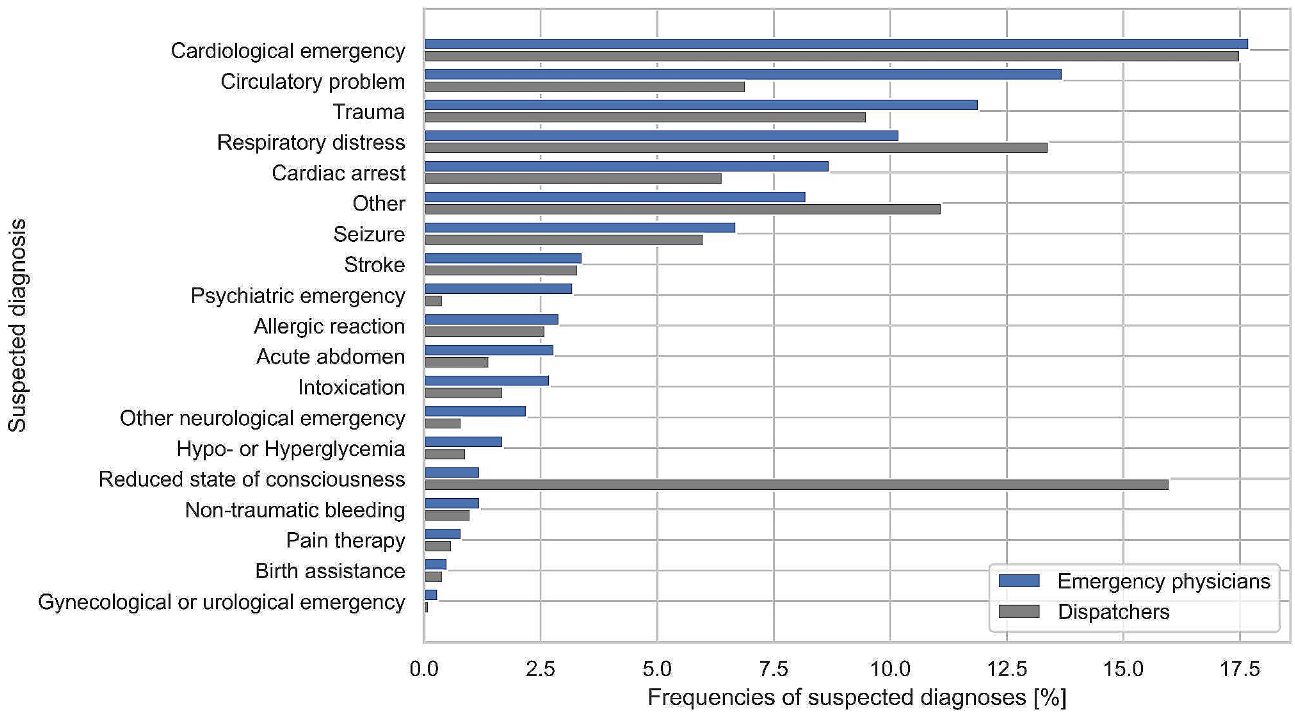

Fig. 2 The frequencies of suspected diagnoses between telecommunicator and emergency physicians

of medication and medical procedures, is likely a contributing factor to this issue. Despite undergoing a period of transformation, the system still ails to meet international standards due to the absence of delegation options from physicians to EMTs. In contrast, countries such as Switzerland, the United Kingdom, and parts of northern Germany have already implemented such delegation systems.

Diagnoses and EP resource efficiency

The present data reveal a considerable disparity between the anticipated diagnoses made by telecommunicators and those determined by on-site EPs, with the most notable differences observed in cases categorized as "reduced state of consciousness" and "psychiatric emergencies." Telecommunicators tend to overestimate the severity of emergencies when contrasted with the NACA scores evaluated at the scene. This trend aligns with observations documented in other EMS systems [14, 15].

As highlighted in a recent systematic review [15], there is a need to improve the accuracy of dispatching to make more efficient use of EPs. Our research also showed that the frequency of needing an EP's on-site medical support varied according to the suspected diagnoses at the scene.

In this context, further research could help to identify diagnoses that might benefit from alternative care approaches. For instance, a more diagnosis-specific alert system could differentiate between EP and EMT missions, with EMTs also having access to medical telesupport, similar to setups as in other EMS systems [12]. For example, 82.9% of suspected stroke cases and 81.4% of other neurological emergencies required a physical EP resource according to the NACA score (Table 3). Conversely, the presence of on-site EPs in such cases often adds little value because treatment often cannot be initiated without advanced in-hospital diagnostics, such as a computed tomography scan. A more efficient strategy for such predefined cases may be to prioritize transport by EMTs, even when an EP would be needed according to the NACA score, possibly with tele-EP support to optimize resource utilization. However, scientific evaluation is needed to confirm the potential resource-saving benefits of such new tele-EP-assisted systems. While data already suggest that telemedicine can improve patient outcomes through cost-effectiveness and timely access to medical care [16] further research is needed to validate these findings specifically for tele-EP-assisted EMS systems.

Moreover, the diagnostic category labeled as "other" constituted 8.2% of all missions, which is notably lower than the 13% reported for "other emergencies" in a comparable study conducted in Switzerland [11]. This observation implies that a considerable number of missions defy straightforward attribution to a specific diagnosis. Especially when EMTs arrive at the scene ahead of the EP or are dispatched independently, these ambiguous cases can pose challenging situations for EMTs, introducing an element of uncertainty. Such scenarios may contribute to the occurrence of additional and potentially redundant

EP requests, manifesting in an elevated proportion of cases that are challenging to classify, reaching 10.3% among the additional EP requests. It is also noteworthy that while the median mission time for EP resources is 38 min, which is significantly shorter than the 59-minute median for indicated missions, EPs are unavailable for other missions during this time. This results in a significant waste of this scarce resource. The causes of these relatively lengthy mission times in instances when physical presence is not required could include the presence of considerable travel distances in rural areas and the potential for EMTs to misjudge the condition of the patient. Furthermore, only 145 EP alerts were cancelled by EMTs. This may be attributed to a lack of experience in patient assessment or a structural deficiency in the EMS system. Despite the option to cancel EP resources, this is not a common practice. Further investigation is required to enable more efficient resource allocation.

Effects on the population

Unnecessary EP missions have the potential to compromise prehospital care for the entire population. When EPs are engaged in non-indicated missions, they become unavailable for other medically necessary missions in the immediate area. This situation necessitates coverage by more distant EP resources, leading to potential increases in patient wait times and delays in providing appropriate care.

Analysis of the present data reveal that the overall median EP vehicle arrival time is 12 min, occasionally extending even longer in individual cases, with 25% of recorded instances exceeding 16 min. However, ambulance teams or off-duty first responders often arrive earlier due to better coverage and can administer initial care. To address the gap in care during the interim period before the EP arrives on site, the integration of an additional tele-physician could prove beneficial. This tele-physician could offer on-site medical support and delegate medical interventions to the ambulance team or first responder, contributing to improved prehospital medical care. In this context, tele-EPs have already been shown to be just as effective as physical EPs in managing severe but not acute life-threatening emergencies that require manual skills like intubation or chest drainage [17]. This means that tele-EPs could help dispatchers make decisions more easily, allowing them to send an ambulance without a physical EP in cases that are unclear over the phone. Consequently, tele-EPs could serve as an equivalent resource for patient care in specific situations while conserving physical resources, making these resources more available to the entire population. However, further research is needed to confirm these assumptions and to evaluate the feasibility and effectiveness of this proposed solution, especially for rural EMS systems.

Moreover, missions involving patients aged 65 and above necessitated the involvement of an EP more frequently, accounting for 71.3% of cases, in contrast to missions involving patients in other age brackets, with an average occurrence of 53.2%. A similar pattern is evident in other nations, such as Switzerland and Finland [11, 18]. As per data from Statistics Austria, the demographic composition of the Austrian population is anticipated to undergo a significant transformation. In 2021, the population consisted of 8,951,520 individuals, with 19.4% being over the age of 64, and this is projected to evolve to approximately 10 million inhabitants by 2050, with around 26.8% being over 64 years old [19]. The observed trend, coupled with the documented increase in rescue missions both in the present study and in broader European data [1–4], suggests a persisting challenge for the Austrian rural EMS to devise novel approaches for prehospital patient care. This demographic shift also underscores the need for proactive strategies and innovative solutions within the EMS framework to address the evolving demands associated with an aging population and the heightened frequency of EMS missions.

Potentials for the EMS

The current inefficient use of EP resources as shown in this study, coupled with an increasing number of missions and a shortage of EPs [1], highlights the need for a change in the current rural EMS framework.

In addition, future efforts will need to ensure that also EMT resources, graded by level of training, are dispatched as efficiently as possible. Currently, there is a lack of data on this, particularly in rural areas. The establishment of an alternative prehospital care system, such as one supplemented by tele-EPs, requires that EMTs have sufficient professional knowledge and practical experience. Ideally, this should be at least equivalent to that of an EMT-Intermediate, according to the current legal requirements for EMTs in Austria [6, 7]. This level of training is essential for EMTs to be able to follow the medical instructions of tele-EPs, such as administering medication or placing intravenous catheters. Unfortunately, this requirement is not consistently met at present. The vast majority (82.4%) operate at the EMT-Basic competence level. In Germany, recent amendments to the EMT law [20] already aim to enhance the competence of EMTs through expanded training. This legislative modification presumably grants a competitive advantage to the partially established telemedicine system in Germany, facilitating a more expedited implementation and realization compared to the current circumstances in Austria [12, 21]. On the other hand, other new prehospital care systems are being developed, such as the Acute Community Nurses (ACN) pilot project in Lower Austria [22]. This system complements the established EMS by employing nurses with additional training as EMT Intermediate or Advanced. These nurses can also be dispatched from the dispatch center, perform nursing activities independently without hospitalizing the patient, and possibly support the EPs during the prehospital phase. This approach aims to improve prehospital care and reduce unnecessary hospital admissions. Combining such a new system with other alternative care strategies, such as a tele-EP-assisted system, could further improve prehospital care and make it more efficient. However, further studies are needed to demonstrate the effectiveness of such systems and their integration with telemedicine, as well as their impact on EMS mission numbers.

Limitations

This retrospective data analysis is subject to limitations concerning the quality of both data and documentation. The analysis encompassed 19 potential presumptive diagnoses, incorporating an "other" category. Notably, the categorization of EP working diagnoses was conducted manually by physicians and assigned post-hoc to one of the predefined categories by the study team.

Additionally, our analysis solely examined data related to EP missions, distinguishing them as either medically indicated or not, without incorporating non-EP missions. As a result, essential insights into scenarios where an EP might have been required but was not dispatched or requested by the on-scene ambulance team are lacking. This information gap stems from the unavailability of relevant data for evaluation. It is imperative to acknowledge and rectify this limitation in future research efforts.

Furthermore, it is crucial to acknowledge that temporal fluctuations in mission figures may be confounded by the impact of the COVID-19 pandemic during the study period. Hence, it is recommended that future investigations focus on an extended time horizon, enabling a thorough exploration of the evolving patterns and potential enduring repercussions on mission metrics.

Additionally, it is important to highlight distinctions in the Austrian EMS compared to various other rescue systems. Dispatching centers within the Austrian EMS employ diverse questioning schemes and provide varied training for telecommunicators. Consequently, the generalizability of findings to international systems is constrained. Furthermore, the federal organization of the Austrian EMS may introduce minor variations between federal states, further emphasizing the need for caution when extrapolating study outcomes beyond the specific context of the Austrian EMS.

Conclusion

Given the evolving socio-demographic landscape and the growing scarcity of EP personnel, there exists a critical imperative to enhance the effectiveness of rural EMS. Our research underscores that about a third of EP missions carried out in rural areas might not have a solid medical rationale. This underscores the importance of developing an alternative care approach for these missions. Failing to address this could put additional pressure on already stretched EMS systems, risking their collapse.

Abbreviations

ACN	Acute Community Nurse
EMS	Emergency medical service
EMT	Emergency medical technician
EP	Emergency physician
IQR	Interquartile range
NACA	National Advisory Committee for Aeronautics

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12873-024-01062-2.

Supplementary Material 1

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Author contributions

JML, TG and CH were responsible for planning the study. JML performed statistical analyses and was responsible for drafting the manuscript, with substantial contributions from SU, TG, SB, DAK and CH. DL and LK processed the available data for statistical analysis. CF and RR contributed with insights and analyses of the structure of the prehospital rescue system in Burgenland. HW and CH supervised the authors throughout the whole project. All authors read and approved the final version of the manuscript.

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Data availability

The data that support the findings of this study are available from the Red Cross State Association of Burgenland but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Red Cross State Association of Burgenland.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained without any objections by the Ethics Committee of the Medical University of Vienna (Number: 1903/2021, Chairperson Jürgen Zezula). As this was a retrospective analysis, informed consent was not required and was waived by the Ethics Committee in their approval statement in the 'Ethics approval and consent to participate' section.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Authors' information

Thomas Glock worked on this study as a diploma student. Preliminary work was presented as a poster at AIC 2022, Bregenz, Austria.

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