


Article

Does the Use of Prehospital Emergency Care Units in Inter-Hospital Transfers Affect Regional Prehospital Emergency Care Readiness?—A Finnish Pilot Study

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Abstract: Inter-hospital transfers remain a significant part of emergency care service missions, even though efforts have been made to change this. We examined the use of prehospital emergency care units in inter-hospital patient transfers in one wellbeing services county in Finland. We evaluated the potential strain they place on regional prehospital emergency care readiness, and examined how these transfers arise between different regions, populations, and healthcare centers. This was a register-based pilot study using prehospital emergency care inter-hospital transfer mission statistics within the wellbeing services county of Pirkanmaa, Finland during 2020 and 2021. The data were extracted from the emergency care service's field management program. A descriptive analysis of the data was performed, in which interdependencies between several variables were examined. During the two years, there were 5812 prehospital emergency care inter-hospital transfer missions dispatched to prehospital emergency care units. The number of prehospital emergency care inter-hospital transfer missions was especially notable in rural regions, where there were also fewer units available. Based on the results, the criteria for prehospital emergency care use in inter-hospital transfers require clarification, since there is an observable strain caused by these transfers on regional emergency care readiness. The results of this pilot study encourage further studies on the use of prehospital emergency care units in inter-hospital patient transfers.

Keywords: paramedic; emergency medical service; EMS; prehospital emergency care; emergency care; inter-hospital; inter-hospital transfer; patient transfer



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1. Introduction

The use of prehospital emergency care in Finland and internationally has been steadily increasing for years and continues to do so [1–3]. The use of prehospital emergency care services among the populus for issues that can be resolved in local healthcare facilities or at the scene has increased [1,4,5], and there is a propensity on the part of the emergency dispatch center to over-triage patients [5,6]. Similar trends can also be seen in prehospital emergency care inter-hospital transfers, as the number of patients whose conditions threaten to deteriorate while waiting is extremely low and patients are often transferred on unnecessarily minor grounds [7], or even when the necessary patient care is available at the referring hospital [8].

However, patients who need emergency intervention benefit from direct transport to a sufficiently capable facility, and the potential delay in receiving treatment may have negative outcomes in terms of treatment and length of hospital stay [9–11]. Despite this, there is some evidence that prehospital emergency care inter-hospital transfers are generally safe and beneficial for patients who are severely injured [12].

The urgency of a health problem and the appropriate use of prehospital emergency care units are complex issues, since the appropriateness of use varies between prospective and retrospective determinations [1]. It is worth noting that there is a need for guidelines to improve decision making in non-transport situations, which are complex and multi-factorial [13]. Specific non-transport guidelines can help guide decision making in these scenarios [14].

No studies have been conducted previously which specifically focus on the use of prehospital emergency care units in inter-hospital transfers from the perspective of finite resources, but the need to analyze transfer efficiency has previously been raised [15]. Although practical, it may not be expedient to use prehospital emergency care units for inter-hospital transfers. Therefore, the aim of this pilot study was to examine to what extent and where these missions are conducted and whether they place a strain on regional prehospital emergency care readiness. The following research questions were addressed in this pilot study: How many and what type of prehospital emergency care inter-hospital transfers are performed by the prehospital emergency care service units in the wellbeing services county of Pirkanmaa? What kind of effect does the use of prehospital emergency care units in inter-hospital transfers have regarding the readiness of the regional prehospital emergency care service? How do prehospital emergency care inter-hospital transfers materialize in the different regions of the wellbeing services county of Pirkanmaa, Finland?

2. Materials and Methods

The study was a descriptive, retrospective, register-based pilot study using destination-, time stamp-, and code-based information from 5812 prehospital emergency care inter-hospital transfer missions in the wellbeing services county of Pirkanmaa, Finland, during 2020 and 2021.

There is only one emergency number in Finland for all emergency situations, including prehospital emergency care inter-hospital transfers. The Ministry of Social Affairs and Health and the wellbeing services counties responsible for organizing prehospital emergency care have given the Emergency Dispatch Center instructions for handling emergency calls regarding emergency care, including prehospital emergency care inter-hospital transfers. The operation of emergency centers is regulated by the Finnish Law on Emergency Center Operations, which is currently being revised [16]. In the wellbeing services county of Pirkanmaa, the Inland Finland collaborative area's Centre for Prehospital Emergency Care has created criteria for the emergency care dispatch center that aim to clarify what type of patients need prehospital emergency care inter-hospital transfers and what kind of patients can be transferred via other means of transportation.

In Finland, inter-hospital patient transfers are not directly the responsibility of the prehospital emergency care service, unless the transfer is related to the follow-up of a suddenly ill or injured patient, and they require demanding and continuous care or monitoring during the transfer. According to Finland's Health Care Law, it is the responsibility of the relevant wellbeing services county to arrange for the transportation of patients to receive treatment at another facility. It is also primarily the responsibility of the referring physician to give care instructions for the transfer, regardless of the form of transport [7,17].

Currently, there are 37 prehospital emergency care units in the wellbeing services county of Pirkanmaa, and nearly 80,000 prehospital emergency care missions are performed in the region annually. Of these, prehospital emergency care inter-hospital transfers represent the tenth most frequently used mission code [18]. In this study, the population of the different municipalities was taken into consideration to find a stable reference point when assessing the numbers and frequency of prehospital emergency care inter-hospital transfer missions in the different regions within the wellbeing services county of Pirkanmaa. The municipalities included: Ruovesi with a population of 4114, Parkano with a population of 6240, Virrat with a population of 6395, Ikaalinen with a population of 6804, Orivesi with a population of 8935, Mänttä-Vilppula with a population of 9360, Hämeenkyrö with a population of 10,257, Akaa with a population of 16,473, Jämsä with a population of 19,347,

Pirkkala with a population of 20,405, Valkeakoski with a population of 20,703, Sastamala with a population of 23,734, Lempäälä with a population of 24,580, Kangasala with a population of 32,959, Ylöjärvi with a population of 33,607, and Nokia with a population of 35,346 (Figure 1) [19]. Jämsä, the next municipality east of Orivesi, is part of the wellbeing services county of Central Finland as of January 2023.

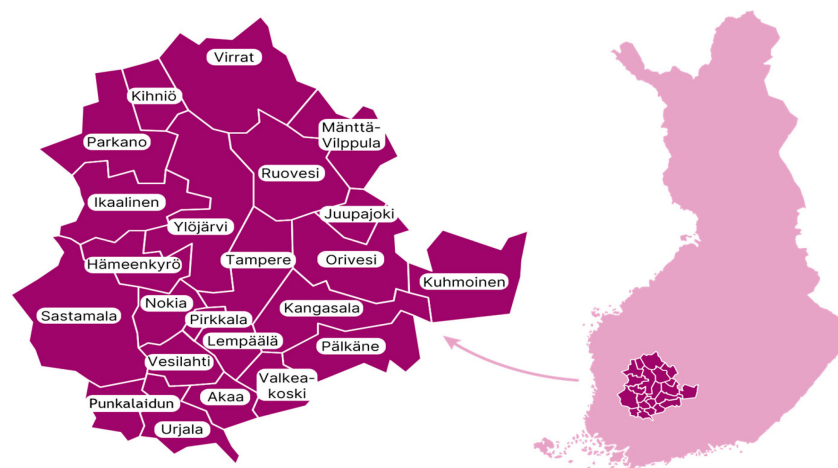


Figure 1. Wellbeing services county of Pirkanmaa, Finland.

Tampere, with a population of 249,009 (1225 missions), is the main city of the wellbeing services county of Pirkanmaa and was excluded from this study. There are several local neighborhood health care centers in the city, with minimal mission numbers, and one main health care center, Hatanpää, which is also an extension of the Tays University Hospital. The Tays University Hospital, which is the destination for most prehospital emergency care inter-hospital transfers in the wellbeing services county of Pirkanmaa, is located in Tampere and is the most widely available medical treatment center in Pirkanmaa. For these reasons, the Hatanpää health care center and the city of Tampere were excluded, because the information on missions was neither reliable nor comparable. The following municipalities were also excluded in this study because the number of missions was too low or the population too small, their health care centers had no emergency care at all and the missions were from bed wards, or if they had emergency care, their opening hours were limited and variable, making comparisons unreliable: Juupajoki, population 1768 (8 missions), Kihniö, population 1771 (5 missions), Kuhmoinen, population 2119 (34 missions), Punkalaidun, population 2675 (1 mission), Pälkäne, population 6347 (6 missions), Urjala, population 4569 (12 missions), and Vesilahti, population 4501 (19 missions) (Figure 1) [19].

The emergency care service's prehospital emergency care inter-hospital mission statistics were determined for two consecutive years, from 1 January 2020 to 31 December 2021. The data were collected by the Inland Finland collaborative area's Centre for Prehospital Emergency Care using the Codea field management program, and all statistics regarding prehospital emergency care units conducting prehospital emergency care inter-hospital transfers were extracted from it.

The descriptive analysis was performed using the IBM SPSS Statistics Program version 28. The data consisted purely of the destination, mission urgency code (Urgency A = severe disturbance of vital functions or imminent threat thereof, B = disturbance of vital functions cannot be excluded, C = minor disturbance of vital functions or other reason why the patient's condition needs to be evaluated, D = non-urgent prehospital emergency care mission), and time-stamp-based information that was automatically stored in the Codea field management program used by all emergency care units in the region. The data were extracted as two single Excel files divided by year, containing all stamps reported by the emergency dispatch center or prehospital emergency care units on all prehospital emergency care inter-hospital missions.

The characteristics taken into consideration in this study were unit ID, alarm time and date, mission urgency code, mission destination (=local health care center offering public health care, with doctor appointments and emergency care) and municipality, mission start time, transfer mission urgency code, transfer time, and end of mission time.

The number of missions carried out by each unit was determined and sorted by unit ID. The number of missions at different health care centers was determined by sorting mission destinations by municipality and address. The mission urgency codes designated by the emergency dispatch center and the transfer urgency codes reported by the units for each mission were determined separately. Mission durations were calculated from the time of each unit's alerting by the dispatch center to the end of mission-time stamp reported by the units and are presented as mean + standard deviation (std) and median + interquartile range (IQR). The occurrences of missions at each health care center were determined for the six most incidence-prone health care centers by sorting the alarm times hourly according to the start time of the mission and dividing these into two-hour windows for each weekday for the whole year, and dividing both years into seven total days with two-hour windows for each day.

Sound scientific practice was followed in the conduct of this study [20]. The research permit was granted in the fall of 2023 by the Inland Finland collaborative area's Centre for Prehospital Emergency Care. The data used in this study did not contain any patient information and were strictly time stamp-, location-, and mission code-based, so individual incidents or patients could not be distinguished. Because this study was based purely on registry material where distinguishable patient information was not extractable, preliminary ethical evaluation was not required [21].

3. Results

3.1. Number and Type of Prehospital Emergency Care Inter-Hospital Transfers

Within a two-year period, from 1 January 2020 to 31 December 2021, there were 5812 (100%) prehospital emergency care inter-hospital missions performed by prehospital emergency care units in the wellbeing services county of Pirkanmaa. Most missions were from a health care center to the regional university hospital in Tampere. The most used units for prehospital emergency care inter-hospital transfers and their stations were in Valkeakoski, unit EPI423 = 424 (7.3%), Jämsä, unit EPI325 = 400 (6.9%), Jämsä, unit EPI324 = 349 (6.0%), Sastamala, unit EPI522 = 348 (6.0%), and Parkano, unit EPI625 = 270 (4.6%). The other wellbeing service county's prehospital emergency care inter-hospital transfers were handled by other prehospital emergency care units with a mission variance from 5 (0.1%) to 222 (3.8%) (Appendix A Figure A1).

The mission urgency of all prehospital emergency care inter-hospital transfers was categorized by the emergency dispatch center as follows: A = 6 (0.1%), B = 2678 (46.1%), C = 2873 (49.4%), D = 254 (4.4%). After receiving the mission, the mission urgency code or X-code (non-transport) was categorized by the prehospital emergency care unit as follows: A = 168 (2.9%), B = 1850 (31.8%), C = 2536 (43.6%), D = 478 (8.2%), X-code = 610 (10.4%). The remaining 169 missions were missing their urgency or X-code information from the unit side, and one transfer was missing the mission urgency code from the dispatch center side (Figure 2).

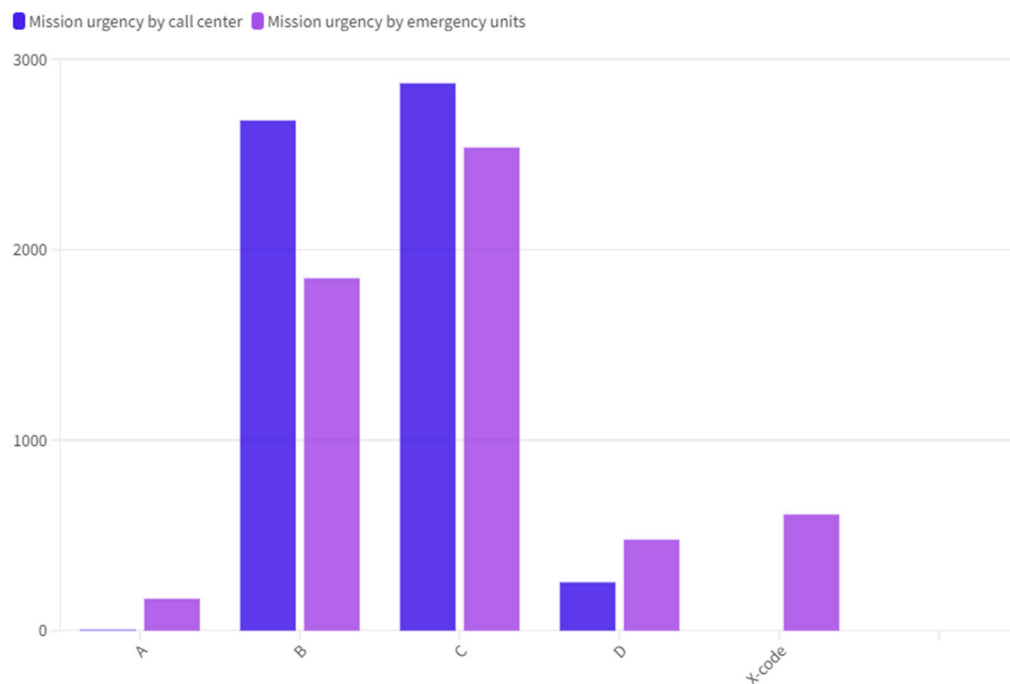


Figure 2. Mission urgency codes by dispatch center and by emergency care units. A = Urgency A, severe disturbance of vital functions or imminent threat thereof. B = Urgency B, disturbance of vital functions cannot be excluded. C = Urgency C, minor disturbance of vital functions or other reason why the patient's condition needs to be evaluated. D = Urgency D, non-urgent prehospital emergency care mission. X-code = Non-transport.

3.2. The Concentrated Strain on the Readiness of Prehospital Emergency Care Services in Certain Regions and Health Care Centers by Mission Number, Duration, and Time of Day

Prehospital emergency care inter-hospital transfer mission incidence within health care centers followed the same geographical trend as that of prehospital emergency care unit mission strain. The highest mission incidence was at rural health care centers on the outskirts of Pirkanmaa, apart from the Hatanpää hospital campus, which is in the center of Tampere and acts as the central health care center for its population. The Hatanpää hospital campus had 725 (12.5%) missions, and they were unevenly distributed among 10+ units, without significantly straining certain single units. Mission durations at the Hatanpää hospital campus were as follows: mean = 62 min (std 26 min), median = 64 min (IQR: 54 min, 74 min).

Jämsä health care center had 785 missions (13.5%), managed by the region's on-call units EPI324 (343 missions), EPI325 (395 missions), and other units (47 missions) (Figure 3). Most missions occurred on Mondays between 8 a.m.–12 p.m., on Wednesdays between 10 a.m.–6 p.m., on Thursdays between 2 p.m.–6 p.m., on Fridays between 10 a.m.–4 p.m. and on Sundays between 10 a.m.–2 p.m. Mission durations were as follows: mean = 159 min (std 55 min), median = 172 min (IQR: 150 min, 188 min).

The Valkeakoski hospital campus had 545 missions (9.4%), managed by the region's on-call unit EPI423 (401 missions), the neighboring region's unit EPI424 (62 missions) and other units (82 missions) (Figure 4). Most missions occurred on Mondays between 4 p.m.–6 p.m., on Tuesdays between 2 p.m.–4 p.m. and 6 p.m.–8 p.m., on Saturdays between 10 a.m.–12 p.m. and 6 p.m.–8 p.m., and on Sundays between 4 p.m.–6 p.m. and 8 p.m.–10 p.m. Mission durations were as follows: mean = 92 min (std 36 min), median = 97 min (IQR: 83 min, 111 min).

The Sastamala health care center had 483 (8.3%) missions, managed by the region's units EPI522 (317 missions), EPI523 (133 missions), and other units (33 missions) (Appendix B Figure A4). Most missions occurred on Tuesdays between 2 p.m.–4 p.m., on Wednesdays between 2 p.m.–4 p.m., on Thursdays between 12 p.m.–2 p.m., and on Saturdays between 12 p.m.–

2 p.m. Mission durations were as follows: mean = 119 min (std 43 min), median = 128 min (IQR: 112 min, 144 min).

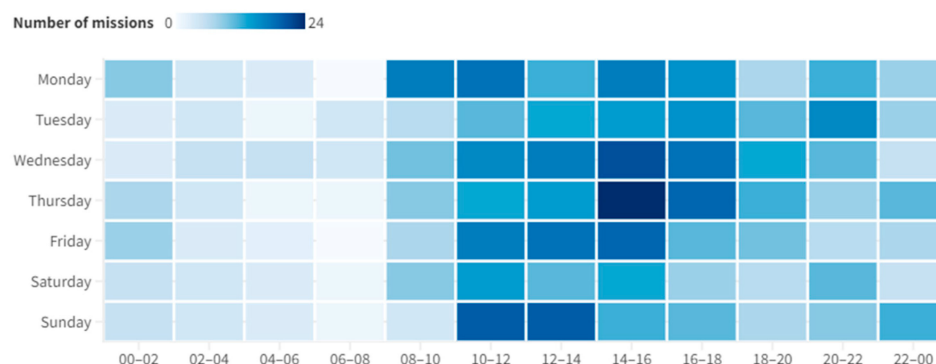


Figure 3. Jämsä health care center mission incidence by 2-h mission start time windows.

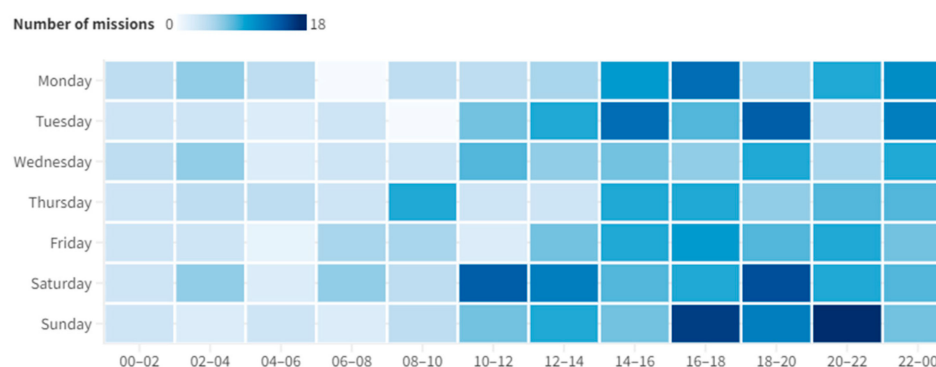


Figure 4. Valkeakoski health care center mission incidence by 2-h mission start time windows.

The Ylöjärvi healthcare center had 356 (6.1%) missions, managed by the region's unit EPI621 (166 missions), and neighboring units EPI126 (61 missions), EPI129 (55 missions), EPI 525 (23 missions), EPI 521 (22 missions), and other units (30 missions) (Appendix B Figure A5). Most missions occurred on Mondays between 2 p.m.–4 p.m., on Tuesdays between 10 a.m.–2 p.m. and 4 p.m.–6 p.m., on Thursdays between 6 p.m.–8 p.m., on Fridays between 12 p.m.–2 p.m., on Saturdays between 4 p.m.–6 p.m., and on Sundays between 2 p.m.–4 p.m. Mission durations were as follows: mean = 65 min (std 24 min), median = 67 min (IQR: 58 min, 77 min).

The Mänttä-Vilppula health care center had 355 (6.1%) missions, managed by the region's unit EPI222 (215 missions), its neighboring unit EPI224 (105 missions), and other units (35 missions) (Appendix B Figure A6). Most missions occurred on Wednesdays between 4 p.m.–6 p.m., on Thursdays between 10 a.m.–12 p.m., on Fridays between 10 a.m.–12 p.m. and 2 p.m.–4 p.m., and on Sundays between 12 p.m.–2 p.m. Mission durations were as follows: mean = 155 min (std 65 min), median = 176 min (IQR: 147 min, 195 min).

The Parkano health care center had 307 (5.3%) missions, managed by the region's unit EPI625 (265 missions), its neighboring unit EPI626 (28 missions), and other units (14 missions) (Appendix B Figure A7). Most missions occurred on Mondays between 4 p.m.–6 p.m., on Tuesdays between 10 a.m.–12 p.m., on Wednesdays between 12 p.m.–2 p.m., on Fridays between 10 a.m.–12 p.m. and 2 p.m.–4 p.m., and on Saturdays between 4 p.m.–6 p.m. Mission durations were as follows: mean = 166 min (std 55 min), median = 181 min (IQR: 160 min, 195 min).

The mean time for all prehospital emergency care inter-hospital missions was 104 min (std 60 min) and the median was 92 min (IQR: 63 min, 150 min).

Besides being the most used units in prehospital emergency care inter-hospital transfers, EPI423, EPI325, EPI324 and EPI625 were also the only units in their respective on-call

region, with EPI522 being one of two units in its region. They were all also among the units that had the longest mission durations used for prehospital emergency care inter-hospital transfers, except for EPI423.

3.3. Occurrence of Prehospital Emergency Care Inter-Hospital Transfer Missions and Their Incidence with Reference to the Population of Different Municipalities in the Wellbeing Services County of Pirkanmaa

The number of prehospital emergency care inter-hospital transfer missions from local health care centers was highest in Jämsä (785), Valkeakoski (545) and Sastamala (483). The lowest number of emergency care inter-hospital transfers were from Ruovesi (55), Akaa (77) and Orivesi (86) (Figure A2).

Emergency care inter-hospital transfer mission occurrence compared to the population was highest in Parkano (4.9%), Jämsä (4.1%) and Mänttä-Vilppula (3.8%), which are among the most rural regions of Pirkanmaa. The rate of occurrence was lowest in Akaa (0.5%), Nokia (0.7%) and Lempäälä (0.7%) (Figure A3).

The population and number of missions varied substantially, as can be seen when we compare the health care centers in Virrat (136 missions, with a population of 6395) and Parkano (307 missions, with a population of 6240); or Lempäälä (176 missions, with a population of 24,580) and Sastamala (483 missions, with a population of 23,734); or Hämeenkyrö (107 missions, with a population of 10,257) and Mänttä-Vilppula (355 missions, with a population of 9360). The disconnect between population and number of missions appears clearly when we compare, for example, Nokia (population 35,346), which had 265 prehospital emergency care inter-hospital transfer missions, and Parkano (population 6240), with 307 missions (Figure A2).

4. Discussion

The amount of strain placed on prehospital emergency care services by different missions is highly significant in many aspects of their operation and, therefore, the use of these resources must be appropriately assessed. In inter-hospital patient transfers, the use of prehospital emergency care units should be scrutinized in even greater depth. This is because healthcare professionals identify the need for these transfers, and their decisions are based on medical knowledge and reasoning. Notable post-transfer discharge rates that possibly lead to unnecessary excess costs have been recognized previously [15].

In this pilot study, the strain placed in terms of the readiness of prehospital emergency care services and individual units by inter-hospital transfers was greatest in rural regions, where there were also fewer on-call units available. Mission duration was also significant for units operating in these regions, with them being tied up in transfers for hours at a time. Higher rates of inter-hospital transfers of rural patients have also been reported internationally [22].

In this study, rural health care centers performed more prehospital emergency care inter-hospital transfer missions, both in terms of total number and compared to the population of the different regions, which is in line with previous findings [22]. This was not categorically true, however, since some rural health care centers had similarly small numbers of prehospital emergency care inter-hospital transfer missions in terms of total number and also compared to their respective populations, e.g., some bigger towns and municipalities with a lower or greater proximity to Tampere, the main city of the wellbeing services county. Moreover, geographical location, population size, and opening hours were not necessarily associated with the mission rate of prehospital emergency care inter-hospital transfers in this study. As found previously, the capabilities of the referring physician and the resources available at the referring health care center might lower the threshold for inter-hospital transfers, particularly affecting rural health care centers [15,23].

Another finding of our study was that mission incidence was highest in some of the rural towns of the Pirkanmaa wellbeing services county and it was not directly associated with population. Some highly populated regions with long opening hours and on-call weekends had a low number of total prehospital emergency care inter-hospital transfers,

while other health care centers with a small population had high mission numbers, some with long opening hours and others with short on-call hours. Previous findings also suggest that treatment options may be regionalized, and this may affect the tendency for inter-hospital transfers among different patient groups [15]. Previous findings also suggest that managing patients without inter-hospital transfers needs to be encouraged, since certain conditions have higher inter-hospital transfer rates, while others have higher discharge rates after second evaluation [15]. This suggests that further research on the matter is needed.

Missions mostly occurred during afternoon hours on weekdays and weekends, regardless of the opening hours of the health care centers, which varied between 24/7 and 8–16. The accumulation of transfers during normal working hours is consistent internationally [23]. Therefore, greater mission incidence cannot be explained by longer opening hours, even if some health care centers also provided an on-call emergency function during evening and night hours for neighboring cities and towns.

In addition, the mission urgency codes for prehospital emergency care inter-hospital transfers, assigned by the emergency dispatch center, exhibited a clear over-triage variance with respect to the urgency assigned by the prehospital emergency care unit. Over-triage by emergency dispatch center has also been found in previous research [5,6]. International research has found that most inter-hospital transfers were stable and had low early warning scores and triages [23]. In our study too, it was found that most prehospital emergency care inter-hospital transfers were non-urgent.

5. Limitations

The properties of the data used in this study, which only included unit ID, alarm time and date, mission urgency code, mission destination and municipality, mission start time, transfer mission urgency code, transfer time, and end of mission time, and which only pertained to prehospital emergency care inter-hospital transfer missions, limited the depth of the descriptive analysis.

Another limitation concerning the discussion of the results is due to the fact that only data regarding prehospital emergency care inter-hospital transfer missions were used in its descriptive analysis, and data regarding other prehospital emergency care missions, population age, geographic dispersion, etc., were not available.

The data used in this study were collected during the COVID-19 pandemic, which may or may not influence the results. Prehospital emergency care inter-hospital transfer missions follow an increasing trajectory similar to that of total prehospital emergency care missions. They have been steadily increasing for years and this trend was not altered by the COVID-19 pandemic.

Even though this study had a large dataset, it lacked properties that would allow for a more in-depth statistical analysis. Moreover, the timestamp-based data restricted the possibilities for analysis. Due to these limitations, a pilot study design was implemented so as to preliminarily explore the relevance and suitability of the research topic. The findings of this pilot study were interesting with regard to both research and practical development, encouraging further, more extensive research.

6. Conclusions

This pilot study suggests that the number of prehospital emergency care inter-hospital transfer missions was significant, especially in the more rural regions of Pirkanmaa, where there were also fewer prehospital emergency care units on call. Mission durations were also significant in these regions, possibly negatively affecting the readiness of the region's prehospital emergency care services. The inconsistency between the dispatch mission urgency code and the urgency assessed by the prehospital emergency care units raises questions, as the request for prehospital emergency care inter-hospital transfers is made by health care professionals. This in turn leads to questions about the legitimacy of the strain caused by these transfers. In this pilot study, the variance in the use of prehospital emergency

care inter-hospital transfers in different regions and health care centers is not explicitly explainable by distance, accessibility due to opening hours, or differences in population size. The study invites further research on the criteria that determine the necessity and urgency of prehospital emergency care inter-hospital transfers and encourages studies that provide clarity as to the appropriate use of prehospital emergency care.

Author Contributions: Conceptualization, S.L., H.N. and A.A.; methodology, S.L., J.L. and H.N.; formal analysis, S.L.; writing—original draft preparation, S.L.; writing—review and editing, J.L., A.A. and H.N.; visualization, J.L.; supervision, H.N.; project administration, H.N. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: Following the ethical principles of research with human participants and the ethical review of human sciences in Finland by the Finnish National Board on Research Integrity TENK, the Institutional Review Board Statement was waived for this study.

Informed Consent Statement: Patient consent was waived because the data used in this study did not contain any patient information and were strictly based on time stamps, locations, and mission codes.

Data Availability Statement: The datasets presented in this article are not readily available because of the nature of official information that must be accessed by the appropriate authorities or by application only. Requests to access the datasets should be directed to the Inland Finland collaborative area's Centre for Prehospital Emergency Care, Head of Emergency Services, Anssi Aunola.

Conflicts of Interest: J.L. and H.N. declare that they have no conflicts of interest. S.L. declares that he is employed as a paramedic by Ikaalisten Ambulanssipalvelu Oy, a private prehospital emergency care service provider operating in Pirkanmaa, contracted by the wellbeing services county of Pirkanmaa and supervised by the Centre for Prehospital Emergency Care, Emergency Medical Services, wellbeing services county of Pirkanmaa. A.A. declares that he is in charge of the operational activities of the Emergency Medical Services operational activities in the wellbeing services county of Pirkanmaa as the executive EMS officer in the county's Centre for Prehospital Emergency Care. S.L. and A.A. declare that their employers had no role in the design of the study, in the collection, analyses, or interpretation of the data, in the writing of the manuscript, or in the decision to publish the results.

Appendix A

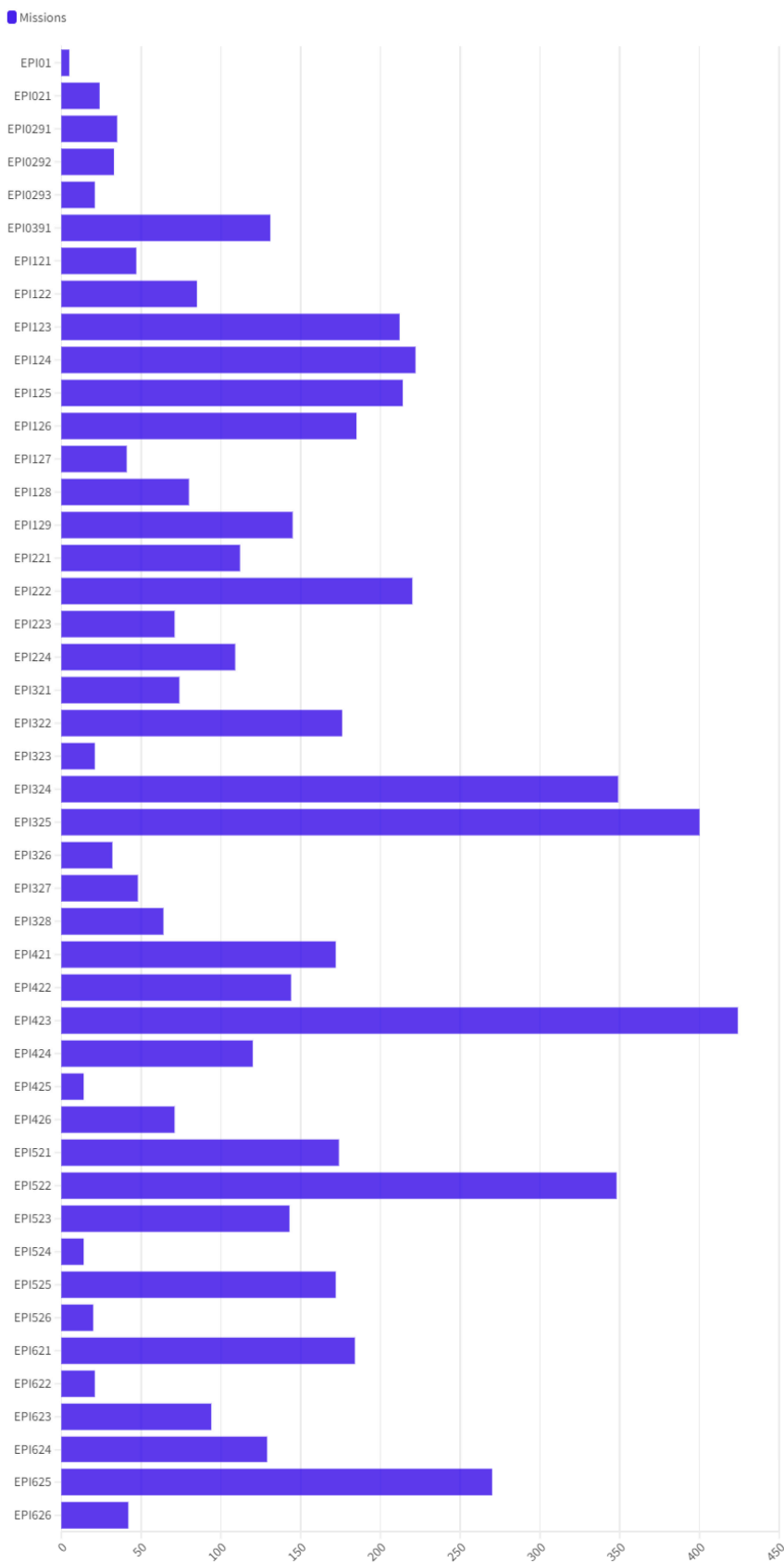


Figure A1. Missions by different units.

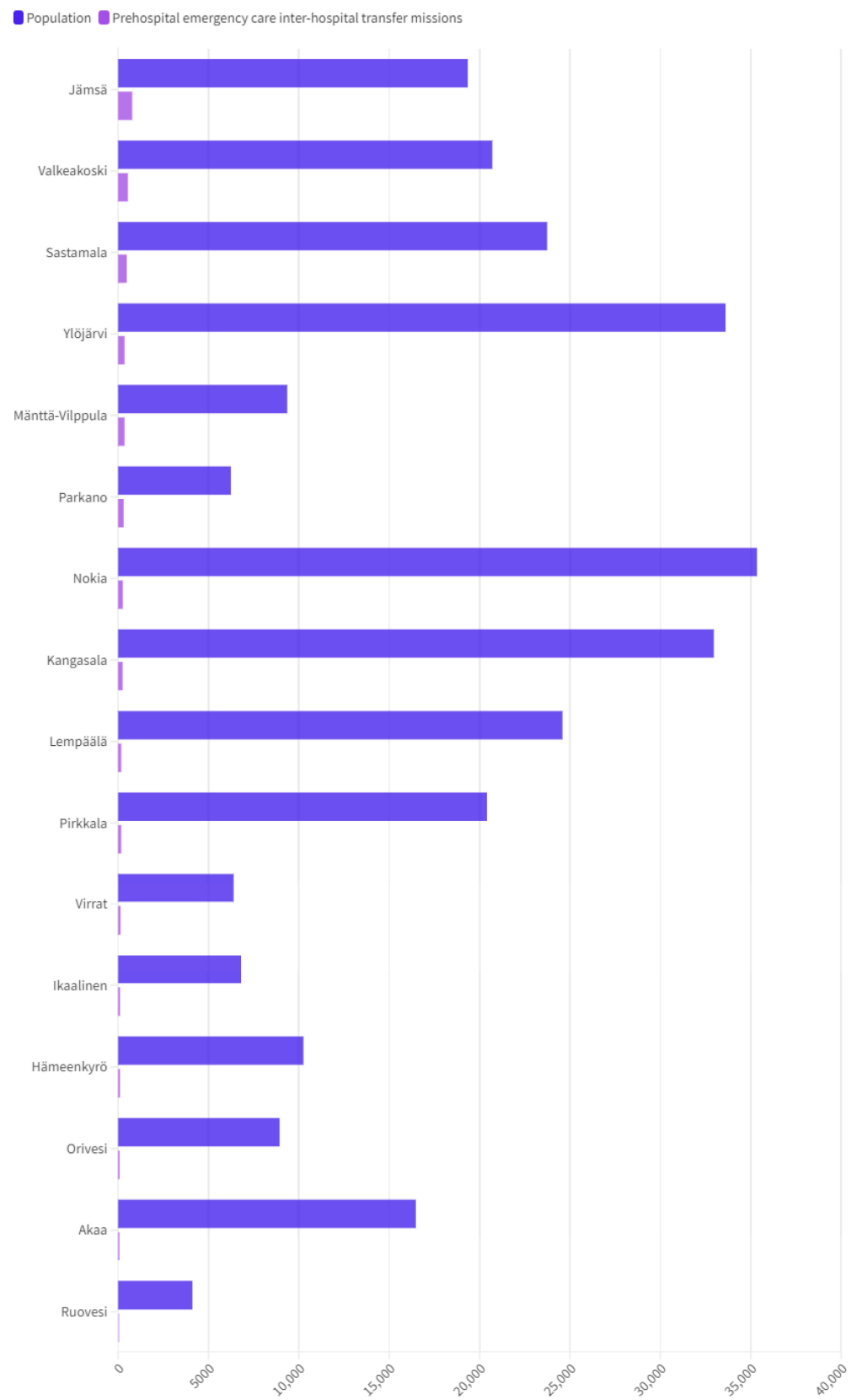


Figure A2. Mission incidence and county population.

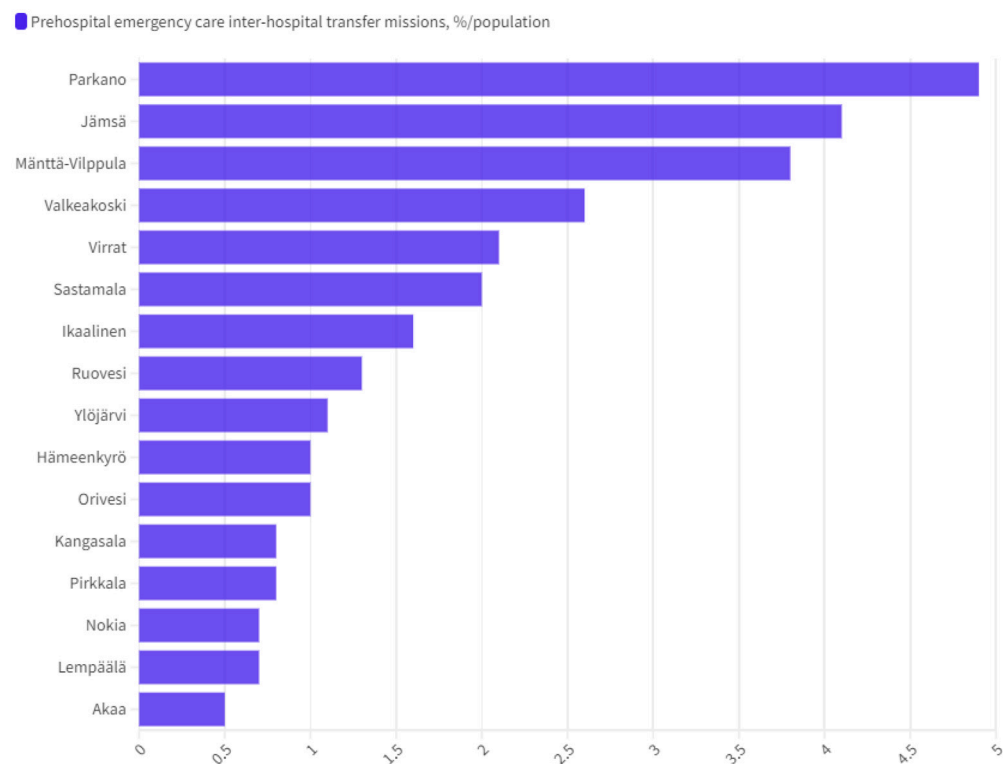


Figure A3. Mission incidence/population, percentage.

Appendix B

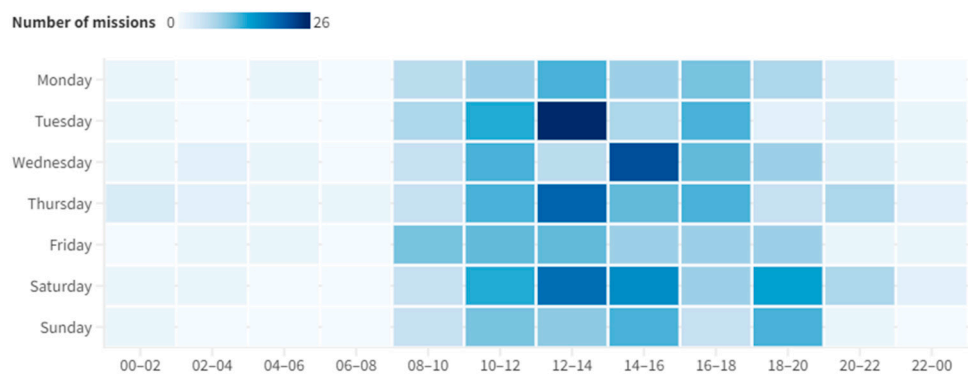


Figure A4. Sastamala health care center mission incidence by 2-h mission start time windows.

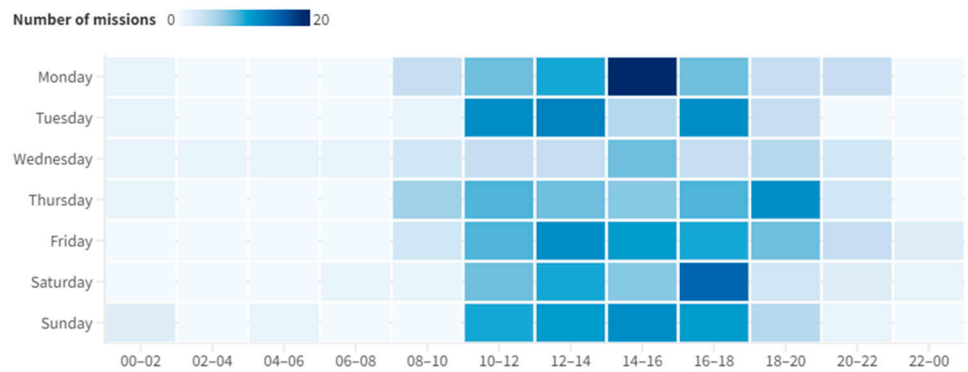


Figure A5. Ylöjärvi health care center mission incidence by 2-h mission start time windows.

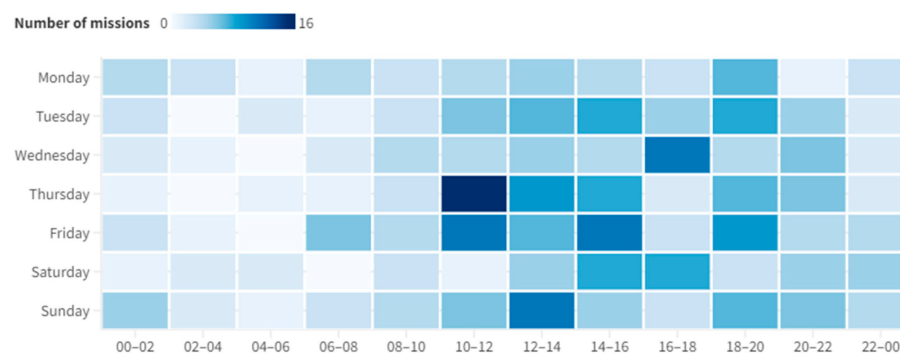


Figure A6. Mänttä-Vilppula health care center mission incidence by 2-h mission start time 15 windows.

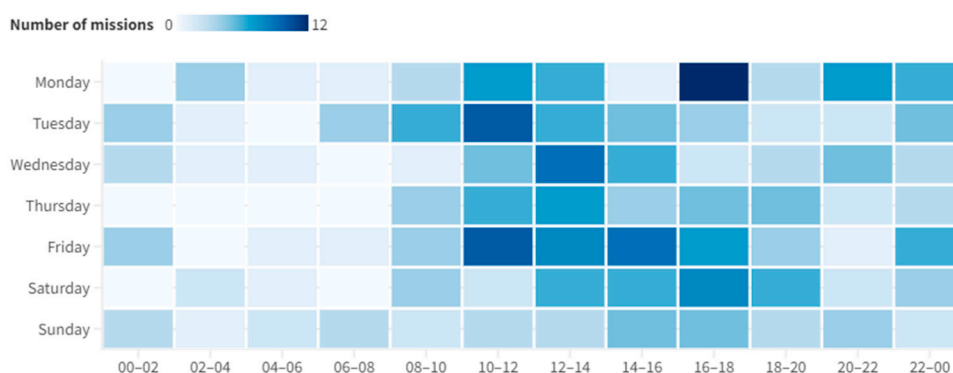


Figure A7. Parkano health care center mission incidence by 2-h mission start time windows.

References

- Booker, M.J.; Shaw, A.R.G.; Purdy, S. Why do patients with ‘primary care sensitive’ problems access ambulance services? A systematic mapping review of the literature. *BMJ Open* **2015**, *5*, e007726. [CrossRef] [PubMed]
- Vuilleumier, S.; Fiorentino, A.; Dénéréaz, S.; Spichiger, T. Identification of new demands regarding prehospital care based on 35,188 missions in 2018. *BMC Emerg. Med.* **2021**, *21*, 63. [CrossRef] [PubMed]
- Ilkka, L. Emergency Medical Services (EMS) in Finland: National Data Management as a Path to Better Prehospital Care. Ph.D. Thesis, University of Eastern Finland, Kuopio, Finland, 20 May 2022. Available online: <https://urn.fi/URN:ISBN:978-952-61-4543-3> (accessed on 20 May 2024).
- Paulin, J.; Kurola, J.; Koivisto, M.; Iirola, T. EMS non-conveyance: A safe practice to decrease ED crowding or a threat to patient safety? *BMC Emerg. Med.* **2021**, *21*, 115. [CrossRef] [PubMed]
- Hoikka, M. Prehospital Risk Assessment and Patient Outcome—A Population Based Study in Northern Finland. Ph.D. Thesis, University of Oulu, Oulu, Finland, 7 December 2018. Available online: <https://urn.fi/URN:ISBN:9789526221366> (accessed on 15 May 2024).
- Magnusson, C.; Herlitz, J.; Axelsson, C. Patient characteristics, triage utilisation, level of care, and outcomes in an unselected adult patient population seen by the emergency medical services: A prospective observational study. *BMC Emerg. Med.* **2020**, *20*, 7. [CrossRef] [PubMed]
- Kirves, H. Ennakoimattomat kiireelliset siirtokuljetukset—Hyvin suunniteltu on puoliksi tehty. *Finnanest* **2018**, *4*, 280–285. Available online: https://say.fi/files/kirves_ennakoimattomat.pdf (accessed on 15 May 2024).
- Nair, D.; Vaughan, F.; Bennett, K. A Chart Review of Acute Care Inter-Hospital Transfers from Rural WV Hospitals. *Marshall J. Med.* **2017**, *3*, 49. Available online: <https://mds.marshall.edu/cgi/viewcontent.cgi?article=1100&context=mjmm> (accessed on 20 May 2024). [CrossRef]
- Limmer, A.M.; Edye, M.B. Interhospital transfer delays emergency abdominal surgery and prolongs stay. *ANZ J. Surg.* **2017**, *87*, 867–872. [CrossRef] [PubMed]
- Rathod, K.S.; Jain, A.K.; Firoozi, S.; Lim, P.; Boyle, R.; Nevett, J.; Dalby, M.C.; Kalra, S.; Malik, I.S.; Sirker, A.; et al. Outcome of inter-hospital transfer versus direct admission for primary percutaneous coronary intervention: An observational study of 25,315 patients with ST-elevation myocardial infarction from the London Heart Attack Group. *Eur. Heart J. Acute Cardiovasc. Care* **2020**, *9*, 948–957. [CrossRef] [PubMed]
- MacKenzie, I.E.R.; Arusoo, T.; Sigounas, D. Impact of Direct Admission Versus Interfacility Transfer on Endovascular Treatment Outcomes for Acute Ischemic Stroke: Systematic Review and Meta-Analysis. *World Neurosurg.* **2021**, *152*, e387–e397. [CrossRef] [PubMed]

12. Waalwijk, J.F.; Lokerman, R.D.; van der Sluijs, R.; Fiddelers, A.A.A.; den Hartog, D.; Leenen, L.P.H.; Poeze, M.; van Heijl, M. Pre-hospital Trauma Triage Research Collaborative (PTTRC). The influence of inter-hospital transfers on mortality in severely injured patients. *Eur. J. Trauma Emerg. Surg.* **2023**, *49*, 441–449. [[CrossRef](#)] [[PubMed](#)]
13. Ebben, R.H.A.; Vloet, L.C.M.; Speijers, R.F.; Tönjes, N.W.; Loef, J.; Pelgrim, T.; Hoogeveen, M.; Berben, S.A.A. A patient-safety and professional perspective on non-conveyance in ambulance care: A systematic review. *Scand J. Trauma Resusc. Emerg. Med.* **2017**, *17*, 71. [[CrossRef](#)] [[PubMed](#)]
14. Gray, J.T.; Wardrope, J. Introduction of non-transport guidelines into an ambulance service: A retrospective review. *Emerg. Med. J.* **2007**, *24*, 727–729. [[CrossRef](#)] [[PubMed](#)]
15. Kindermann, D.R.; Mutter, R.L.; Houchens, R.L.; Barrett, M.L.; Pines, J.M. Emergency Department Transfers and Transfer Relationships in United States Hospitals. *Acad. Emerg. Med.* **2015**, *22*, 157–165. [[CrossRef](#)] [[PubMed](#)]
16. Ministry of Social Affairs and Health. Available online: <https://stm.fi/ensihito> (accessed on 15 May 2024).
17. Health Care Act 1326/2010. Available online: https://www.finlex.fi/en/laki/kaannokset/2010/en20101326_20131293.pdf (accessed on 14 May 2024).
18. Wellbeing Services County of Pirkanmaa. Available online: [https://pirha.cloudnc.fi/fi-FI/Toimielimet/Aluehallitus/Kokous_2442023/Ensihoitopalvelun_palvelutasopaatos_vuos\(6789\)](https://pirha.cloudnc.fi/fi-FI/Toimielimet/Aluehallitus/Kokous_2442023/Ensihoitopalvelun_palvelutasopaatos_vuos(6789)) (accessed on 14 May 2024).
19. Statistics Finland. Available online: <https://www.stat.fi/tup/alue/kuntienavainluvut.html#?active1=KU702&year=2023> (accessed on 15 May 2024).
20. Keiski, R.; Hämäläinen, K.; Karhunen, M.; Löfström, E.; Näreaho, S.; Varantola, K.; Spoof, S.K.; Tarkiainen, T.; Kaila, E.; Sairio, A.; et al. *The Finnish Code of Conduct for Research Integrity and Procedures for Handling Alleged Violations of Research Integrity in Finland*; Finnish National Board on Research Integrity TENK: Helsinki, Finland, 2023; Volume 4, Available online: https://tenk.fi/sites/default/files/2023-11/RI_Guidelines_2023.pdf (accessed on 20 May 2024).
21. Kohonen, I.; Kuula-Luumi, A.; Spoof, S.K. *The Ethical Principles of Research with Human Participants and Ethical Review in the Human Sciences in Finland*; Finnish National Board on Research Integrity TENK: Helsinki, Finland, 2019; Volume 3, Available online: https://tenk.fi/sites/default/files/2021-01/Ethical_review_in_human_sciences_2020.pdf (accessed on 15 May 2024).
22. Atmore, C.; Dovey, S.; Gauld, R.; Gray, A.R.; Stokes, T. Do people living in rural and urban locations experience differences in harm when admitted to hospital? A cross-sectional New Zealand general practice records review study. *BMJ Open* **2021**, *6*, e046207. [[CrossRef](#)] [[PubMed](#)]
23. Miller, R.; Rimmer, E.; Blattner, K.; Withington, S.; Ram, S.; Topping, M.; Kaka, H.; Bergin, A.; Pirini, J.; Smith, M.; et al. A retrospective observational study examining interhospital transfers from six New Zealand rural hospitals in 2019. *Aust. J. Rural. Health* **2023**, *31*, 921–931. [[CrossRef](#)] [[PubMed](#)]

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