



Paramedics' Perceptions of Training and Competence in Structured Documentation in the Finnish KEJO Electronic Patient Care Record

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Abstract: Structured electronic patient care records can support consistent documentation, information transfer and secondary data use, but implementation depends on users' competence and system compatibility with clinical work. Evidence concerning education and competence development for structured documentation in prehospital emergency care remains limited. This secondary analysis examined paramedics' education and development needs and whether assessments of KEJO training adequacy, timing and documentation competence differed by age, educational background or the electronic patient care record previously used. Data originated from an anonymous cross-sectional web survey conducted in one Finnish wellbeing services county in February-March 2024. Responses from 137 professionals (response rate 30.4%) were examined using descriptive statistics and non-parametric group comparisons, contextualised by previously reported findings and an expanded inductive analysis of free-text responses. Overall, 46.7% considered theoretical instruction sufficient, and the same proportion considered face-to-face training sufficient. Most respondents (83.9%) considered the training-to-implementation interval too long, while 54.7% assessed their documentation competence positively. After Holm adjustment for multiple comparisons, no statistically significant differences were detected across the background groups. Qualitative findings emphasised hands-on practice, authentic cases, simulation, refresher training, concise update materials and timely support. Respondents distinguished educational needs from problems requiring system development. The comparisons provided no evidence of systematic differences between the groups examined. Training should be coordinated with implementation and user-centred system development as a continuous process rather than a single pre-launch event.

Keywords: emergency medical services, professional education, competence development, structured documentation, system implementation, user-centred development.

INTRODUCTION

Prehospital emergency care is delivered in dynamic and unpredictable environments in which paramedics are required to make time-critical decisions, communicate effectively, and manage several simultaneous responsibilities. An integrative systematic review identified decision-making, communication, collaboration, and both technical and non-technical competencies as central elements of paramedics' role in promoting patient safety. The review also highlighted training, clear guidelines, documentation, feedback

mechanisms, and supportive organisational conditions as important factors supporting safe prehospital practice [1]. Together, these findings emphasise the importance of continuous education and competence development, including documentation competence, in emergency medical services.

Finnish prehospital EMS personnel work at two principal operational qualification levels: basic and advanced. These are broadly comparable with Basic Life Support (BLS) and Advanced Life Support (ALS), respectively, although the equivalence is approximate because educational pathways and scopes of practice vary internationally [2]. Under Finnish legislation, an advanced-level EMS unit must include at least one clinician holding either a Bachelor of Health Care degree in emergency care or a registered nursing qualification supplemented with at least 30 ECTS credits in advanced-level prehospital emergency care studies [3]. This distinction is relevant when examining whether education and competence-development needs differ according to professional background.

Advanced-level competence builds on basic-level competence in patient assessment, monitoring, communication, documentation and safe transportation, while encompassing broader clinical decision-making and operational responsibilities. In a national Delphi study, Finnish EMS managers identified patient-safety-oriented documentation and reporting among the most important advanced-level competences, alongside systematic patient assessment and the interpretation of vital parameters [4]. Documentation is therefore an important professional competence in prehospital emergency care, and competence in using electronic documentation systems can be regarded as an integral component of safe professional practice. This highlights the importance of providing paramedics with sufficient education and opportunities to maintain and continuously develop their documentation competence.

Accurate and reliable documentation supports patient safety and the quality and continuity of care [5, 6]. Documentation practices are influenced by clinical workflows, the amount of information to be recorded, and the information systems used, highlighting the importance of involving frontline professionals in the development of documentation practices [6]. Structured and standardised documentation has been associated with improved documentation quality by supporting clear and consistent recording of patient information and facilitating the secondary use of structured health data [7]. More broadly, a systematic review of hospital-based studies found predominantly positive effects of electronic patient record implementation on documentation, particularly in relation to completeness and adherence to documentation requirements, although the reported effects varied across studies and outcomes [8]. Documentation competence also requires an understanding of the significance of the information being recorded, as inadequate or non-compliant documentation practices may affect not only the quality of documentation and care but also subsequent reporting and statistical use of the data [6].

Despite these benefits, structured electronic documentation may increase workload when systems are technically unreliable, difficult to use, or poorly aligned with prehospital workflows. Administrative workload in prehospital EMS may include extensive documentation alongside other coordination and communication tasks, and high administrative workload has been associated with adverse professional well-being outcomes [9]. Previous studies of electronic patient care records in prehospital settings have identified increased documentation time, workflow interruptions, technical difficulties, and the

development of workarounds associated with system implementation and use [10-12]. However, the effects of electronic documentation and information sharing are not uniformly negative. Barrett et al. [13] found that ambulance clinicians generally perceived electronic capture and sharing of patient information as beneficial and efficient, although some electronic communication tasks were perceived to increase time spent on scene. In prehospital care, usability extends beyond the technical ease of using a system to how effectively its documentation structure supports patient assessment, clinical decision-making, consultation, handover, and continuity of care. When information is distributed across several views, documentation pathways are unclear, or essential functions operate slowly, users may experience the system as burdensome even when structured documentation is intended to improve data quality and standardisation [11, 12]. These findings suggest that the effects of structured electronic documentation on workload depend substantially on system usability, technical reliability, and compatibility with prehospital workflows.

Evidence from broader healthcare settings similarly indicates that successful electronic health record implementation depends on more than the technical deployment of a system. In a scoping review of 142 studies, Tsai et al. [14] identified insufficient training, inadequate technical and educational support, and limited technological literacy and skills as recurrent barriers to EHR adoption and use. More recently, Finnegan and Mountford [15], in a scoping review of 90 studies on EHR implementation processes, identified training and support as central components of competence building and emphasised that training should be ongoing, embedded in workflows, and timed close to operational implementation. Together, these findings position user competence development as an integral part of EHR implementation rather than as a single pre-launch training event.

Evidence from prehospital settings further indicates that training needs to be closely aligned with system implementation and supported in practice. In the ERA multiple-methods study, a delay between training and operational roll-out made the electronic record unfamiliar to some ambulance clinicians by the time they were expected to use it in practice [12]. Participants also described trainer-guided education involving direct use of the system and the completion of patient cases, as well as implementation support through on-site assistance, telephone support and local clinical mentors. Similarly, Baird and Boak [16] found that informal learning from colleagues was perceived as helpful during electronic record implementation, while participants considered that additional formal training could have supported earlier adoption. Although these observational findings do not establish the comparative effectiveness of particular educational methods, they suggest that initial training should be closely connected to operational implementation and reinforced by accessible workplace support.

Competence development also needs to continue beyond the initial implementation phase. Kjær et al. [17] found that ambulance professionals perceived their training in completing an electronic prehospital patient record as insufficient and reported uncertainty about the meaning and correct use of some structured fields. Functions used only in exceptional situations were particularly susceptible to being forgotten. Participants also described a lack of systematic audit and feedback on completed records, which contributed to individual documentation practices that could subsequently be passed on to students and new employees. These findings highlight the importance of continuing training, clear

documentation guidance, and feedback based on actual documentation practices in maintaining consistent competence after system implementation.

Educational needs should, however, be distinguished from limitations in system design and usability. Altuwaijri et al. [18] identified insufficient training for required information entry alongside time-consuming data entry, complex navigation, connectivity problems and other technical difficulties in an electronic prehospital patient record. Similarly, Al Haliq and Al Jumaan [19] found no statistically significant association between the type of ePCR training received and perceived system usability, while users also identified system features that required further development. Although these findings do not demonstrate that training is unrelated to usability, they indicate that education alone cannot compensate for technical limitations or a system that is poorly aligned with prehospital workflows. Competence development and user-centred system development should therefore be regarded as complementary components of successful electronic documentation implementation.

Taken together, the available literature provides useful evidence on the implementation, usability and support needs associated with electronic patient care records in prehospital emergency care, but evidence focusing specifically on education and competence development remains limited. Existing studies have predominantly examined implementation experiences, usability, barriers to adoption and user perceptions rather than systematically evaluating how competence in structured electronic documentation should be developed and maintained. In particular, limited evidence is available on how paramedics assess the adequacy and timing of ePCR training, how education and competence-development needs may vary across users with different professional backgrounds or previous experience with electronic documentation systems, and what forms of continuing education and system development are needed to support sustained structured documentation in prehospital practice.

In Finland, the KEJO electronic patient care record is being introduced through a phased national implementation to provide a nationally standardised electronic documentation model for prehospital emergency care. The electronic patient care record forms part of the KEJO field command system and uses nationally defined structured data to support the recording and subsequent use of prehospital patient information [20, 21]. This large-scale implementation provides an important context for examining paramedics' experiences of education, competence development and system-development needs related to structured electronic documentation. Within the study organisation, the operational implementation of KEJO was also staggered across a geographically large service area, resulting in variation in the interval between training and actual system use.

The survey data used in this study were originally collected for a master's thesis completed in Finland and written in Finnish, which reported descriptive findings and qualitative analyses, including findings concerning training and support needs [22]. The same dataset also formed the basis of an earlier article examining paramedics' experiences of structured documentation in the KEJO electronic patient care record [23]. The present article extends these earlier reports through additional statistical comparisons of perceived training adequacy, training timing and documentation competence across background groups, with adjustment for multiple comparisons. Previously reported descriptive and qualitative findings are used to contextualise these comparisons and inform their

interpretation. This focus addresses the limited evidence concerning education and competence development for structured documentation in prehospital emergency care.

Aim and Research Questions

The primary aim of this secondary analysis was to examine whether assessments of KEJO training adequacy, training timing and perceived competence in structured documentation differed according to age, educational background or the electronic patient care record previously used. Descriptive findings and qualitative accounts of training and system-development needs were used to contextualise these comparisons. An expanded analysis of free-text responses concerning new KEJO features provided additional perspectives on training preferences and development-related views. The research questions were:

1. How do paramedics assess the adequacy and timing of KEJO training and their competence in structured documentation?
2. Do assessments of training adequacy and timing, and competence in structured documentation, differ according to age, educational background or the electronic patient care record previously used?
3. What training, competence-development and system-development needs do paramedics describe in relation to KEJO, and how do they prefer training on new KEJO features to be delivered?

METHODS

Study Design

This study presents a secondary analysis of data from a cross-sectional mixed-methods survey originally conducted for a Finnish master's thesis [22]. Descriptive and qualitative findings from the dataset have previously been reported in Finnish in the thesis, and the dataset has also been used in an earlier qualitative article [23]. The additional quantitative analyses presented here examine differences in assessments of KEJO training adequacy, training timing and perceived competence in structured documentation according to age, educational background and the electronic patient care record previously used. Previously reported descriptive and qualitative findings provide context for these comparisons and their integrated interpretation.

Quantitative and qualitative data were collected concurrently through the same electronic questionnaire. The quantitative component assessed respondents' perceptions of the adequacy and timing of KEJO training and their competence in structured documentation, and examined differences in these assessments according to selected background variables. The qualitative component explored paramedics' training, competence-development and system-development needs, as well as their preferences for training on new KEJO features. The quantitative and qualitative data were analysed separately and integrated during interpretation [24, 25].

Integration involved comparing the quantitative findings with the categories derived from the open-ended responses in relation to the research questions. This enabled

identification of findings that converged across the two components, provided complementary perspectives, or differed between the quantitative and qualitative data.

Setting and Participants

The study was conducted in Oulu University Hospital Emergency Medical Services, operating within the Wellbeing Services County of North Ostrobothnia (Pohde), Finland. In the Finnish healthcare system, prehospital emergency medical services are organised regionally by wellbeing services counties and provided as part of the public healthcare system.

Operational implementation of KEJO did not begin simultaneously at all locations within the study organisation. The new mobile devices and electronic patient care record were introduced gradually across the geographically large service area. For most personnel, approximately 3-6 months elapsed between training and operational use of the system, although the interval varied according to the area in which the employee worked and their employment situation.

Eligible participants were permanent employees and fixed-term employees with employment contracts of at least three months who worked in operational prehospital field duties and had started using the KEJO electronic patient care record during 2023. A total of 450 eligible emergency medical services professionals were invited to participate.

Questionnaire Development

The questionnaire was developed on the basis of previous international research on electronic prehospital documentation, the Finnish national documentation guide for emergency medical services, previous national work on the content and structure of the electronic patient care record, and expert consultation [11, 12, 17, 20, 26]. Free-text response opportunities were included to allow respondents to describe experiences and development needs that might not have been captured by predefined response options [27].

Expert consultation involved an emergency medical services working group comprising a development coordinator, a supervisor, a health information system specialist and a key user of the system. The consultation addressed system usability, fragmented documentation views, structured documentation in complex clinical situations, documentation burden during urgent missions, and the content and timing of training.

The questionnaire was pilot tested with eight paramedics before data collection. Based on the pilot testing, minor revisions were made to the wording of questions and the character limits of the open-ended items.

Data Collection

Data were collected between 23 February and 8 March 2024 using an anonymous electronic questionnaire administered through Webropol. The questionnaire link and an invitation letter were distributed to eligible participants by email. Two reminders were sent during the data-collection period: one halfway through the survey period and another two days before the survey closed. The administration and reporting of the web-based survey were guided by the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) [28].

The analyses reported in this article used three background variables: age, educational background and the electronic patient care record previously used. The questionnaire also included structured training-related items and free-text response opportunities. For the qualitative analyses, data were drawn from one open-ended question asking respondents what additional training they would have needed to use KEJO and from the free-text responses provided by respondents who selected the 'Other' option in a structured item concerning preferred training methods for new KEJO features. The structured item offered three response options: organisation-provided face-to-face training, self-study material in the Koulumaali learning environment, and 'Other', with a free-text field.

A total of 137 emergency medical services professionals responded to the questionnaire, corresponding to a response rate of 30.4%. Of these respondents, 97 provided an interpretable response relevant to the open-ended question concerning additional training needs. In addition, 28 respondents provided free-text responses after selecting 'Other' in the structured training-method item.

Data Analysis

Quantitative data were analysed using IBM SPSS Statistics for Windows, version 29.0.1.0. Respondent characteristics and responses to the four items assessing the adequacy and timing of KEJO training and perceived competence in structured documentation were summarised using frequencies (n) and percentages (%). Each item was measured on a five-point Likert scale ranging from strongly agree (1) to strongly disagree (5). All 137 respondents provided responses to these four items. For Research Question 2, group sizes (n) and mean scores are presented descriptively to facilitate interpretation. Educational background was regrouped for the group comparisons to reflect Finnish competence requirements for advanced-level emergency medical services. Because the four response items were ordinal, between-group differences were examined using non-parametric tests: two-tailed Mann-Whitney U tests for the two educational groups and for respondents who had previously used Codea or Merlot Medi, and two-tailed Kruskal-Wallis H tests for the three age groups (≤ 35 , 36-45 and ≥ 46 years). The respondent who reported previous use of both Codea and Merlot Medi was excluded from comparisons based on the previously used electronic patient care record, resulting in $n = 136$ for these analyses. Statistical significance was set at $p < 0.05$. To control the family-wise error rate across the 12 comparisons addressing Research Question 2, p-values were adjusted using the Holm method.

The qualitative data consisted of 97 interpretable responses to the open-ended question concerning additional training needs and 28 free-text responses provided under the 'Other' option in the structured item concerning preferred training methods for new KEJO features. Forty submissions to the open-ended training-needs item were excluded because they were blank, uninterpretable or did not contain content relevant to the question.

The qualitative data were reanalysed for the present article, including all 97 interpretable responses concerning additional training needs and all 28 free-text responses concerning training on new KEJO features. Although training-related findings from these data had previously been reported in the master's thesis [22], the original responses were analysed again in relation to the research questions of the present study. For the item

concerning new KEJO features, the analysis was expanded from the 17 responses categorised in the thesis to all 28 free-text responses, including those addressing system development, user involvement or resistance to new features. The resulting findings therefore overlap with previously reported findings and are not presented as entirely new.

The reanalysis followed an inductive content analysis approach. Responses were read repeatedly, and meaning units relevant to the research questions were identified and condensed while preserving their original meaning. Similar condensed expressions were coded and grouped into subcategories, which were subsequently organised into generic categories and main categories.

Initial coding was conducted by one researcher and subsequently reviewed by a second researcher. The second researcher reviewed the coding structure, category formation and interpretation of the data. Differences in interpretation were discussed until consensus was reached. Microsoft Word was used to organise the meaning units, condensed expressions, codes and categories. The final category structures are presented in Tables 4 and 5.

After the quantitative and qualitative analyses had been completed, the findings were compared in relation to the study aims and research questions. Convergent findings, complementary findings and possible discrepancies were identified and considered in the interpretation of the results [25].

Ethical Considerations

Research permission was obtained from the Wellbeing Services County of North Ostrobothnia before data collection. Ethical review was not required under the Finnish national guidelines for research involving human participants, as the study did not include research design elements requiring prior ethical review. Participation was voluntary and based on informed consent, the study did not intervene in participants' physical integrity, and participation did not expose respondents to exceptional stimuli, risks exceeding those encountered in normal daily life, or threats to their safety [29]. Data were collected through an anonymous online questionnaire, and no directly identifying personal data were collected. The invitation letter informed potential participants about the purpose of the study, voluntary participation, anonymity and the use of the data for research. The invitation letter stated that opening the questionnaire link was considered to indicate informed consent to participate. The study was conducted in accordance with the Finnish national ethical principles for research involving human participants and the principles of research integrity [29, 30].

RESULTS

Respondent Characteristics

A total of 137 emergency medical services professionals participated in the study, corresponding to a response rate of 30.4%. The respondents' characteristics are presented in Table 1. Of the respondents, 50% were men, 48% were women, and 2% reported another gender. Of the respondents, 48% were 35 years of age or younger, 37% were aged 36-45 years, and 15% were 46 years of age or older.

The majority of respondents (80%) were qualified to work at the Advanced Life Support (ALS) level, either as paramedics or as registered nurses who had completed an additional 30-ECTS-credit qualification in emergency medical care. Respondents with other educational backgrounds, including Basic Life Support (BLS) personnel, such as practical nurses, ambulance attendants and rescue personnel, as well as registered nurses without the additional qualification in emergency medical care, accounted for 20% of the sample.

All respondents had previous experience with an electronic patient care record system before the implementation of KEJO. Of the respondents, 55% had previously used Codea, 45% had used Merlot Medi, and one respondent (1%) reported having used both systems.

Table 1: Demographic and professional characteristics of the study participants (n = 137) Percentages may not total 100% because of rounding

Variable	Category	n	%
Gender	Male	69	50
	Female	66	48
	Other	2	2
Age	≤35 years	66	48
	36-45 years	50	37
	≥46 years	21	15
Educational background	Paramedic or registered nurse with an additional 30-credit advanced-level EMS qualification	109	80
	Other educational background*	28	20
Previously used electronic patient record system	Codea	75	55
	Merlot Medi	61	45
	Codea and Merlot	1	1

*Other educational background included BLS personnel (practical nurses, ambulance attendants and rescue personnel) and registered nurses without the additional 30-ECTS-credit qualification in emergency medical care.

Assessments of KEJO Training and Competence in Structured Documentation

All 137 respondents completed the four items assessing the adequacy and timing of KEJO training and perceived competence in structured documentation (Table 2). Overall, 46.7% of respondents agreed or strongly agreed that the theoretical training was sufficient; 34.3% disagreed or strongly disagreed and 19.0% selected the neutral response option. The same proportion (46.7%) agreed or strongly agreed that the face-to-face training had provided sufficient preparedness for using the electronic patient care record, while 36.5% disagreed or strongly disagreed and 16.8% selected the neutral response option. The timing of training was assessed more critically: 83.9% agreed or strongly agreed that the interval between training and operational implementation had been too long, compared with 5.1% who disagreed and 10.9% who selected the neutral response option. Regarding perceived competence, 54.7% assessed their competence in structured documentation positively, while 22.6% selected the neutral response option and 22.6% assessed it negatively.

Table 2: Respondents' assessments of KEJO training and competence in structured documentation (n = 137)

Statement	Response category	n	%
Theoretical training was sufficient	Strongly agree	19	13.9
	Somewhat agree	45	32.8
	Neither agree nor disagree	26	19.0
	Somewhat disagree	36	26.3
	Strongly disagree	11	8.0
Face-to-face training provided sufficient preparedness	Strongly agree	14	10.2
	Somewhat agree	50	36.5
	Neither agree nor disagree	23	16.8
	Somewhat disagree	30	21.9
	Strongly disagree	20	14.6
Interval between training and operational implementation was too long	Strongly agree	92	67.2
	Somewhat agree	23	16.8
	Neither agree nor disagree	15	10.9
	Somewhat disagree	7	5.1
	Strongly disagree	0	0.0
Perceived competence in structured documentation was positive	Strongly agree	15	10.9
	Somewhat agree	60	43.8
	Neither agree nor disagree	31	22.6
	Somewhat disagree	22	16.1
	Strongly disagree	9	6.6

Percentages are calculated within each statement.

Association Between Educational Background and Training-Related Assessments

Training-related assessments were examined according to educational background by comparing respondents qualified to work at the Advanced Life Support (ALS) level with respondents from other educational backgrounds. The ALS-qualified group comprised paramedics and registered nurses who had completed the additional 30-ECTS-credit qualification in advanced-level emergency medical care. One unadjusted comparison indicated a difference between the educational groups in their assessment of face-to-face training ($p = 0.039$). ALS-qualified respondents had a lower mean score (2.83) than respondents with other educational backgrounds (3.39), indicating a more favourable assessment because lower scores represented stronger agreement. However, this difference did not remain statistically significant after Holm adjustment for multiple comparisons (Holm-adjusted $p = 0.464$). None of the other education-based comparisons was statistically significant after adjustment (Table 3).

Association Between Age and Training-Related Assessments

The respondents were divided into three age groups: 35 years or younger, 36–45 years, and 46 years or older. No unadjusted comparison reached the conventional significance threshold, and no statistically significant differences were detected between the age groups after Holm adjustment (Table 3).

The findings therefore provided no evidence of an association between age and these training-related assessments. Across all age groups, the interval between training and the implementation of KEJO was commonly considered too long.

Association Between the Previously Used Electronic Patient Care Record System and Training-Related Assessments

Training-related assessments were compared between respondents who had previously used Codea and those who had previously used Merlot Medi. None of the four comparisons was statistically significant before or after Holm adjustment (Table 3).

Table 3: Mean scores for training-related assessments by educational background, age and previously used electronic patient care record

Background group	n	Theoretical training	Face-to-face training	Training-implementation interval too long	Perceived documentation competence
Educational background					
ALS-qualified: paramedic or RN with an additional 30-credit advanced-level EMS qualification	109	2.75	2.83	1.54	2.57
Other educational background: BLS personnel and RNs without the additional advanced-level EMS qualification	28	3.07	3.39	1.54	2.89
Unadjusted p		0.180	0.039	0.969	0.209
Holm-adjusted p		1.000	0.464	1.000	1.000
Age					
≤35 years	66	2.74	2.73	1.62	2.41
36-45 years	50	2.80	3.14	1.52	2.86
≥46 years	21	3.10	3.14	1.33	2.81
Unadjusted p		0.432	0.140	0.276	0.150
Holm-adjusted p		1.000	1.000	1.000	1.000
Previously used electronic patient care record (ePCR)					
Codea	75	2.75	2.89	1.64	2.53
Merlot Medi	61	2.89	3.00	1.39	2.77
Unadjusted p		0.471	0.662	0.075	0.204
Holm-adjusted p		1.000	1.000	0.826	1.000

Respondents who had previously used Merlot Medi had a lower mean score for the statement that the interval between training and system implementation had been too long than those who had previously used Codea (1.39 vs 1.64), indicating stronger agreement. Respondents who had previously used Codea had a slightly lower mean score for perceived competence in structured documentation than those who had previously used Merlot Medi

(2.53 vs 2.77), indicating a somewhat more positive self-assessment. These descriptive differences did not provide evidence of statistically significant associations with the previously used electronic patient care record.

Mean scores are based on a five-point Likert scale (1 = strongly agree, 5 = strongly disagree); lower mean scores indicate stronger agreement with the statement. Unadjusted p-values are shown alongside Holm-adjusted p-values; the Holm adjustment controls the family-wise error rate across the 12 comparisons addressing Research Question 2. The respondent who reported previous use of both Codea and Merlot Medi was excluded from the comparisons based on the previously used electronic patient care record.

Overview of the Qualitative Findings

The qualitative analyses resulted in two category structures. The first was based on the open-ended question on additional training needs (Table 4), and the second on the 28 free-text responses provided under the 'Other' option in the structured item concerning training on new KEJO features (Table 5).

Table 4: Categories describing paramedics' training and development needs related to the KEJO electronic patient care record

Sub-categories	Generic category	Main category
Practical training	Practice-oriented learning	Paramedics’ experiences of training and development needs related to the KEJO electronic patient care record
Simulation- and case-based training		
Timing of training	Development of the training process	
Refresher training		
Training in structured documentation	Strengthening documentation competence	
Incomplete system development	Need for system development	

Table 5: Categories derived from the 28 free-text responses concerning training on new KEJO features and related development views

Sub-categories	Generic category	Main category
Practical training	Practice-oriented training	Training preferences and development-related views concerning new KEJO features
Self-study materials	Multimodal training	
Online training		
Face-to-face training		
Blended training		
Opportunities for self-study		
Concise training materials	Concise communication	
Communication about changes		
User-centred development	Prerequisites for development	
Resistance to new features		
Rejection of the system		

What Training, Competence-Development and System-Development Needs Did Paramedics Identify in Relation to KEJO?

The main category, Paramedics' experiences of training and development needs related to the KEJO electronic patient care record, was formed from responses to an open-ended question in which paramedics were asked to describe what additional training they would have needed to use the KEJO electronic patient care record. Of the 137 responses submitted to this item, 97 addressed the question and were included in the qualitative analysis. Based on the inductive content analysis, four generic categories were identified: practice-oriented learning, development of the training process, strengthening documentation competence, and the need for system development.

Practice-Oriented Learning:

The generic category *practice-oriented learning* consisted of two subcategories: practical training and simulation- and case-based training. Respondents particularly described a need for opportunities to practise using the KEJO system before its operational implementation. Theoretical instruction alone was not considered sufficient; instead, practical training was regarded as supporting the adoption of structured documentation and effective use of the system. The following quotations illustrate the subcategory of practical training:

"More practical training in completing the electronic patient care record."
(Respondent 1)

"More opportunities to actually practise." (Respondent 12)

"Supervised training through practice missions or during training days immediately before the implementation of KEJO." (Respondent 37)

Respondents also wanted opportunities to practise using the system through simulations and patient cases resembling actual prehospital emergency care situations. Case-based training was considered helpful in facilitating the adoption of structured documentation and improving preparedness to use the system in different patient situations. The following quotations illustrate the subcategory of simulation- and case-based training:

"More opportunities to practise outside the formal training as well. More training days, including opportunities to practise using KEJO during simulated emergency missions." (Respondent 59)

"Training closer to the implementation date, using the latest version rather than an older one. A few simulation exercises involving the documentation of ordinary emergency medical care missions." (Respondent 112)

Development of the Training Process:

The generic category *development of the training process* consisted of two subcategories: timing of training and refresher training. Respondents considered the timing of training to be an important factor affecting its usefulness. In particular, a long interval between training and system implementation made it difficult to retain the knowledge and skills acquired. The following quotations illustrate the subcategory of timing of training:

“The training was four months before implementation. Before implementation, we had to complete another training session in the training environment. That only made things more confusing.” (Respondent 24)

“The training days should have been scheduled closer to the implementation of KEJO.” (Respondent 131)

“Face-to-face training closer to implementation. When the interval is more than six months, there is enough time to forget things.” (Respondent 83)

Training was also viewed as a continuing process that should be supplemented with refresher training after implementation and additional training related to system updates. The following quotations illustrate the subcategory of refresher training:

“Refresher training and more guidance on resolving problems, as there seemed to be more than enough problems in the beginning.” (Respondent 8)

“Training on documentation and related matters a few weeks after KEJO has been implemented.” (Respondent 26)

“Additional training on updates whenever KEJO is updated.” (Respondent 120)

Strengthening Documentation Competence:

The generic category *strengthening documentation competence* consisted of the subcategory of training in structured documentation. Respondents described a need for more practice-oriented instruction on structured documentation and guidance on how the structured fields of the system should be used in different prehospital emergency care situations. The following quotations illustrate this subcategory:

“I feel that everyone has to find their own way of completing the electronic patient care record through self-study ... perhaps there could have been more emphasis on which structured information is particularly important ...” (Respondent 43)

“Some form of training on a logical order for completing the record.” (Respondent 38)

Respondents also described a need for concrete examples, model documentation entries, and guidance on how structured documentation could be completed consistently across different emergency medical care missions.

Need for System Development:

The generic category *need for system development* consisted of the subcategory of incomplete system development. Some respondents considered that increasing the amount of training alone would not be sufficient to resolve the challenges associated with using the KEJO system. Their responses highlighted technical functionality, usability problems, and the incomplete state of the system as factors affecting system use and training. The following quotations illustrate the subcategory of incomplete system development:

“The final training and implementation should take place once KEJO is ready; at present, there is a great deal of unnecessary work.” (Respondent 9)

“First, KEJO should be made to function properly; it is a completely unfinished system ...” (Respondent 13)

“The training itself was good, but KEJO is simply not a finished or smoothly functioning system.” (Respondent 78)

The responses therefore distinguished needs related to training and documentation competence from challenges perceived to require further development of the system.

How Would Paramedics Prefer Training on New KEJO Features to Be Delivered?

In the structured item concerning preferred training methods for new KEJO features, 62 respondents (45.3%) selected organisation-provided face-to-face training, 47 (34.3%) selected self-study material provided through the Koulumaali learning environment, and 28 (20.4%) selected 'Other'. The free-text responses provided by these 28 respondents were subsequently analysed inductively to explore preferences and development-related views in greater detail.

The main category, Training preferences and development-related views concerning new KEJO features, was formed from the 28 free-text responses provided under the 'Other' option. These responses included both suggestions concerning training delivery and broader views concerning system development and the introduction of new features. Based on the inductive content analysis, four generic categories were identified: practice-oriented training, multimodal training, concise communication, and prerequisites for development.

Practice-Oriented Training:

The generic category *practice-oriented training* consisted of the subcategory of practical training. Respondents considered it important that the implementation of new features include opportunities to practise using the system before the features were introduced into operational use. They also described a need for practice opportunities in an environment where new functions could be tested without the pressure associated with actual emergency medical care missions. The following quotation illustrates this subcategory:

“One computer at the station that could be used to practise documentation and other functions.” (Respondent 21)

The responses highlighted the importance of providing opportunities to practise new functions before their operational implementation.

Multimodal Training:

The generic category *multimodal training* consisted of the subcategories of self-study materials, online training, face-to-face training, blended training, and opportunities for self-study. Respondents described a preference for flexible training methods that would allow employees to familiarise themselves with new features in different ways and at a suitable time.

Video recordings, short online materials, and self-study were considered appropriate, particularly in connection with minor system updates. The following quotations illustrate these subcategories:

“A Teams session or another video immediately after the change is introduced.” (Respondent 66)

“A video lecture.” (Respondent 84)

Some respondents preferred training to combine different delivery methods:

“Both. Self-study and face-to-face instruction, naturally depending on the features concerned.” (Respondent 98)

Respondents also emphasised that sufficient time should be allocated for independent learning:

“Self-study, but with working time allocated to it.” (Respondent 135)

Overall, the responses reflected a preference for flexible training that could combine different delivery methods depending on the nature of the new feature.

Concise Communication:

The generic category *concise communication* consisted of two subcategories: concise training materials and communication about changes. Respondents described a preference for brief, easily understandable materials and information about system updates.

The subcategory *concise training materials* reflected a preference for short presentations introducing changed features. The following quotation illustrates this subcategory:

“Presenting the changed features, for example through short PowerPoint presentations delivered by key users.” (Respondent 112)

The subcategory *communication about changes* emphasised brief summaries of updated or newly added features. The following quotations illustrate this subcategory:

“A brief summary of the features that have been changed or added.” (Respondent 77)

“Simple information about the changes is sufficient.” (Respondent 79)

Together, these responses highlighted a preference for concise materials and clear communication to help users familiarise themselves with changes to the KEJO system.

Prerequisites for Development:

The generic category *prerequisites for development* consisted of the subcategories of user-centred development, resistance to new features, and rejection of the system. Some respondents did not directly describe how training should be delivered but instead emphasised that the development of new features should take account of user experiences and the practical needs associated with using the system. The following quotations illustrate the subcategory of user-centred development:

“I would like employees working in the field to be listened to when new features are developed.” (Respondent 25)

“I would like KEJO to be developed based on users’ experiences.” (Respondent 70)

Some respondents were critical of adding new features and considered that the existing system should be improved before further functions were introduced. The following quotation illustrates the subcategory of resistance to new features:

“Do not add anything else ...” (Respondent 7)

The following quotations illustrate the subcategory of rejection of the system:

“Remove it from use.” (Respondent 40)

“Replace the entire system.” (Respondent 110)

These responses indicate that, for some paramedics, preferences regarding training on new features were closely connected with perceptions of system usability and user-centred development.

The free-text analysis identified preferences for practical, flexible, and readily accessible training on new KEJO features. Short videos, concise instructions, combinations of different training methods, and opportunities for independent practice were identified as suitable approaches. At the same time, some responses focused on system development rather than training, highlighting the close relationship between competence development and the further development of KEJO.

DISCUSSION

Main Findings

This study examined paramedics’ assessments of the adequacy and timing of KEJO training and their competence in structured documentation, differences in these assessments according to selected background variables, and their training, competence-development and system-development needs related to the use of the KEJO electronic patient care record.

The unadjusted analyses identified one difference in the assessment of face-to-face training according to educational background, but this difference did not remain statistically significant after Holm adjustment for multiple comparisons. After adjustment, no statistically significant differences in assessments of training adequacy and timing or perceived competence in structured documentation were detected according to educational background, age or the electronic patient care record previously used. Overall, the adjusted analyses provided no evidence that these assessments differed systematically between the background groups examined.

In the structured item concerning training on new KEJO features, 45.3% selected organisation-provided face-to-face training, 34.3% selected self-study material, and 20.4% selected 'Other'. The qualitative findings provided a more detailed understanding of the content of these needs. Respondents emphasised opportunities for hands-on practice, simulation- and case-based learning, appropriate timing of training, refresher training, and

more concrete guidance on structured documentation. The analysis of the 28 free-text responses identified practical training, flexible combinations of training methods, concise materials and clear communication about system changes. At the same time, some respondents described usability and technical problems that they considered to require further system development rather than additional training alone.

The quantitative and qualitative findings therefore provided complementary perspectives on the implementation of structured electronic documentation. While the adjusted quantitative analyses provided no evidence of systematic differences between the background groups examined, the qualitative findings clarified the nature and context of the training and competence-development needs reported by respondents. The findings also highlighted the importance of distinguishing needs that may be addressed through training and competence development from challenges related to system usability and technical development.

Findings in Relation to Previous Research

The findings are consistent with previous evidence indicating that the perceived adequacy of training during electronic health record implementation is influenced not only by the training provided but also by its timing and connection to operational implementation. In the present study, 46.7% of respondents considered the theoretical instruction sufficient, and the same proportion considered the face-to-face training sufficient, whereas 83.9% considered the interval between training and the operational implementation of KEJO too long.

The finding regarding the interval between training and operational implementation should also be considered in relation to the local implementation process. KEJO was introduced gradually across the study organisation, and for most personnel approximately 3-6 months elapsed between training and operational use of the system. The interval varied according to working area and employment situation. The high proportion of respondents who considered the interval too long may therefore reflect not only perceptions of the training itself but also the practical sequencing of training and system implementation.

This finding is consistent with the ERA multiple-methods study, in which a delay between training and system roll-out left the electronic record unfamiliar to some ambulance clinicians by the time it was introduced into practice [12]. More broadly, insufficient training and support have been identified as recurrent barriers to electronic health record implementation [14], while recent evidence emphasises that training should be ongoing, embedded in clinical workflows and timed close to operational implementation [15]. Taken together, the present findings and previous research highlight the importance of aligning training with the implementation process and providing opportunities to apply newly acquired knowledge and skills in practice soon after training.

Preferences for training on new KEJO features were distributed across the available response options: 45.3% selected organisation-provided face-to-face training, 34.3% selected self-study material, and 20.4% selected 'Other'. Together with the free-text findings, this suggests that a single delivery format may not address all training needs and that training methods may need to vary according to the nature and complexity of the system change. These findings describe user preferences rather than the comparative

effectiveness of the training methods. Participants particularly emphasised hands-on training, case-based learning and simulation. The closest support in previous prehospital ePCR research comes from the ERA multiple-methods study, in which ambulance clinicians described previous trainer-guided sessions involving direct use of the documentation system and working through a series of patient cases. They contrasted this approach with a later roll-out in which training was provided through brief online videos [12]. Although these findings do not demonstrate the superior effectiveness of supervised or case-based training, they indicate the perceived value of opportunities to practise system use with guidance and immediate support.

The present findings extend this perspective by identifying simulation as an additional approach that paramedics considered useful for practising structured documentation in realistic prehospital situations. Baird and Boak [16] provide complementary evidence regarding workplace support: in their case study, peer-to-peer dialogue and assistance from colleagues developed where formal training was limited, and participants indicated that additional formal training might have supported earlier acceptance of the electronic record. Taken together, these findings suggest that ePCR competence development may benefit from combining formal, practice-oriented training with accessible workplace support, while the effectiveness of specific educational methods, including simulation, requires direct evaluation.

The findings suggest that competence-development needs may continue beyond initial system implementation. Although 54.7% of respondents assessed their competence in structured documentation positively, the open-ended responses concerning additional training needs highlighted refresher training, clearer guidance and opportunities to practise structured documentation. These findings provide complementary perspectives at the sample level, as individual respondents' competence assessments were not linked to their descriptions of training needs.

This finding is consistent with Kjær et al. [17], who reported that ambulance professionals experienced uncertainty about the meaning and correct use of some structured fields despite previous exposure to the electronic patient record. Functions used infrequently were particularly susceptible to being forgotten. Participants also described a lack of systematic audit and feedback on completed records, which contributed to individual documentation practices that could subsequently be passed on to students and new employees. Kjær et al. [17] therefore highlighted continuous training and review of documentation practices as potential means of supporting more systematic use of the electronic record. In the present study, the reported need for refresher training and clearer guidance similarly suggests that competence development should not be limited to initial system training. Regular opportunities to revisit documentation practices and receive guidance may help maintain structured documentation competence as users gain experience and the system evolves.

A further important finding was that respondents distinguished needs that could potentially be addressed through training and competence development from problems they perceived as requiring further system development. This distinction is consistent with Altuwaijri et al. [18], who identified a lack of training for required information entry alongside barriers related to system architecture, user-interface design, navigation and data-entry demands. These findings suggest that training deficits and usability constraints

may coexist rather than represent alternative explanations for difficulties in using an electronic patient care record.

Similar concerns regarding the interaction between user competence and system usability have been reported by Al Haliq and Al Jumaan [19]. Although they found no statistically significant association between the type of ePCR training received and perceived system usability, this finding does not establish that training and usability are unrelated. Their study also identified system features requiring further development and emphasised the need for standardised training. Taken together with the present findings, this suggests that training and system development should be coordinated but not treated as interchangeable solutions. Training can support users' technical and documentation competence, whereas limitations arising from system design, functionality or workflow compatibility require corresponding system-level development.

The present findings further suggest a reciprocal relationship between training and system development. System updates and new features may create new competence-development needs, while users' experiences of documentation challenges and system usability can provide information for further system development. Training and system development should therefore be coordinated as related but distinct processes, so that the content and timing of training remain aligned with changes in the system and with the practical requirements of prehospital workflows.

Implications for Practice

At the individual level, paramedics should have access to sufficient time, clear guidance and opportunities to practise structured documentation in clinically realistic situations. Training should address not only the technical use of the electronic patient care record but also the principles of structured documentation, including which information is relevant and how it can be documented consistently across different patient situations. Refresher opportunities may be particularly important as users gain experience and encounter less frequently used documentation functions.

At the workplace level, competence development can be supported through case-based learning, simulation, peer support and opportunities to discuss documentation-related challenges. Local key users or super-users may provide accessible practical support, facilitate refresher training and help identify recurring training and usability issues. The findings also suggest that opportunities for independent practice should be integrated into working arrangements rather than relying solely on employees' own time.

At the organisational level, training should be planned as a continuing process aligned with system implementation and subsequent updates. The structured preference data and free-text findings together support flexibility in training delivery rather than reliance on a single format. Minor changes may be supported through concise instructions, short videos or other readily accessible materials, whereas more substantial changes may warrant supervised hands-on training and opportunities to practise before operational implementation. The content and intensity of training should therefore be proportionate to the significance and complexity of the system change.

Frontline paramedics should also be involved in both training development and system development. Their experiences can help identify whether emerging difficulties

primarily reflect a need for additional competence development, clearer guidance or changes in system functionality and usability. Establishing systematic channels for this feedback may help organisations coordinate training and system development more effectively and maintain alignment with prehospital workflows.

These measures may support more consistent structured documentation practices. Although patient safety was not directly assessed in the present study, this implication is consistent with previous evidence identifying documentation, continuing education, clear guidance and feedback mechanisms as important components of safe prehospital practice [1].

Strengths and Limitations

A strength of this study was the mixed-methods design, which enabled the phenomenon to be examined from complementary quantitative and qualitative perspectives. The quantitative component provided information on respondents' assessments of training adequacy and timing, perceived competence in structured documentation, and differences according to selected background variables. The qualitative component provided a more detailed understanding of the content and context of the training, competence-development and system-development needs described by respondents. Integrating the two components during interpretation allowed the quantitative findings to be considered alongside respondents' descriptions of their experiences and development needs.

The questionnaire used in the survey was developed on the basis of previous research, national documentation guidance, expert consultation and pilot testing, but it was not a previously validated instrument. Its measurement properties were not formally evaluated, which should be considered when interpreting the quantitative findings. In addition, competence in structured documentation was assessed through respondents' self-reports rather than through objective measures of documentation performance. Consequently, the findings reflect perceived competence and training adequacy and cannot be interpreted as direct evidence of actual documentation quality, accuracy or proficiency.

The free-text responses enabled respondents to describe training, competence-development and system-development needs in their own words, including issues that might not have been captured by predefined response options. The inductive analysis was conducted systematically, and the coding and category structure were reviewed by a second researcher. However, qualitative data collected through free-text survey responses may be more limited in depth than data obtained through methods that allow respondents to clarify or elaborate on their answers. The qualitative findings should therefore be understood as a structured representation of the issues raised by respondents rather than as an exhaustive account of their experiences or of all possible training and development needs.

The study was conducted in a single emergency medical services organisation within one Finnish wellbeing services county, which may limit the generalisability of the findings to other EMS organisations and implementation contexts. The response rate was 30.4%, introducing a risk of non-response and self-selection bias, as professionals with particularly positive or negative experiences of KEJO may have been more likely to participate. In addition, the sample size, particularly in the smaller educational-background and older-age groups, may have limited the statistical power to detect small differences. Multiple group

comparisons were performed, and Holm adjustment was applied to control the family-wise error rate; one association that reached the conventional significance threshold in the unadjusted analysis did not remain statistically significant after adjustment. Consequently, although no between-group differences remained statistically significant after adjustment, this should not be interpreted as evidence of equivalence between the groups.

The data were collected during a relatively early phase of KEJO implementation in the study organisation. The findings therefore reflect respondents' experiences within a specific stage of system adoption, when both familiarity with the electronic patient care record and local implementation practices were still developing. Subsequent system updates, changes in training and support arrangements, and accumulated user experience may have altered some of the training, competence-development and system-development needs identified in this study. Furthermore, the cross-sectional design provides a snapshot of respondents' perceptions at one point in time and does not allow conclusions about how competence or training needs change over time. Nor can the study establish the effectiveness of particular training approaches or causal relationships between training, competence and system usability. The interval between training and operational implementation varied between employees because of the staggered roll-out, but the exact interval was not measured at the individual respondent level. Consequently, the study cannot determine whether longer individual training-to-implementation intervals were directly associated with more critical assessments of training adequacy.

Future Research

Future research should move beyond identifying preferred training approaches and evaluate their effectiveness in supporting competence in structured electronic documentation. Comparative or intervention studies could examine practice-oriented methods identified in the present study, including case-based learning, simulation, supervised hands-on training, brief digital materials, peer support and refresher training. Outcomes should extend beyond participants' satisfaction or perceived competence to include objective measures of documentation performance, such as completeness, accuracy, consistency, adherence to structured documentation requirements and the time required to complete documentation. Where feasible, system usability and workflow-related outcomes could be examined concurrently to clarify how training, user competence and system characteristics interact in practice. Longitudinal designs would also be valuable for examining how documentation competence and training needs develop after initial system implementation and in response to subsequent system updates. Patient-safety-related outcomes may also be relevant, but such associations should be examined directly rather than inferred from documentation or training measures alone.

Research across multiple EMS organisations and different implementation contexts is also needed to assess the generalisability of the present findings beyond a single organisation. Comparative studies conducted at different stages of KEJO implementation could help determine whether training and competence-development needs vary according to local implementation practices, organisational support, accumulated user experience or the maturity of the electronic patient care record system. Such research could provide a stronger basis for developing training approaches that are adaptable across prehospital settings while remaining responsive to local workflows and implementation conditions.

CONCLUSIONS

Paramedics identified continuing needs for practical, appropriately timed and ongoing training in the use of the KEJO electronic patient care record and in structured documentation. After Holm adjustment for multiple comparisons, no statistically significant differences in assessments of training adequacy and timing or perceived competence in structured documentation were detected according to educational background, age or the electronic patient care record previously used. The findings therefore did not provide evidence of systematic differences in these assessments between the background groups examined.

The qualitative findings further emphasised the importance of aligning training with system implementation and subsequent updates. Respondents identified hands-on practice, realistic patient cases, refresher training and clear guidance on structured documentation as important elements of competence development. For minor system changes, concise digital materials and clear communication may be appropriate, whereas more substantial changes may warrant supervised practice and opportunities to become familiar with new functions before their operational implementation.

Training and system development should be regarded as coordinated but distinct components of electronic patient care record implementation. User experiences can help identify whether emerging challenges are best addressed through additional training, clearer documentation guidance or further development of system functionality and usability. Aligning competence development with system changes and prehospital workflows may support more consistent structured documentation and more sustainable adoption of the electronic patient care record in practice.

DECLARATIONS

Ethics and Consent

Research permission was obtained from the Wellbeing Services County of North Ostrobothnia before data collection. According to the Finnish national guidelines for research involving human participants, prior ethical review was not required because the study did not include research design elements requiring ethical review. Participation was voluntary, and the invitation letter stated that opening the questionnaire link indicated informed consent to participate. Data were collected anonymously, and no directly identifying personal data were collected.

Consent to Publish

Not applicable. No identifiable individual-level information is reported.

Data and Code Availability

The dataset analysed in this study is not publicly available because participants were not informed that their responses would be deposited in a public data repository. Requests concerning access to the data may be directed to the corresponding author and will be

considered in accordance with applicable ethical, legal and organisational requirements. No custom code was developed for this study.

Conflicts of Interest

The authors declare no conflicts of interest.

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Author Contributions

Jaakko Hihnala: Conceptualization; Methodology; Formal analysis, with primary responsibility for the qualitative analysis; Writing - original draft (lead); Writing - review & editing.

Niko Sivula: Conceptualization; Methodology; Formal analysis, with primary responsibility for the quantitative analysis; Writing - original draft; Writing - review & editing.

Petri Roivainen: Supervision; Writing - review & editing.

Mari Salminen-Tuomaala: Supervision; Writing - original draft; Writing - review & editing.

Generative AI Use

The ChatGPT 5 artificial intelligence application (OpenAI) was used to support the structuring of the manuscript, refinement of wording, language translation, and the formatting and refinement of references and the reference list. The authors critically reviewed, verified and approved all AI-assisted content and take full responsibility for the accuracy, integrity and final content of the manuscript.

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