

# Ergonomics at work in the ambulance – the opinion of paramedics

(Ergonomia pracy w karetce pogotowia ratunkowego –  
opinie ratowników medycznych)

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**Abstract** – Introduction. Workplace ergonomics has been a topic of increasing interest for many years. The ever-greater importance of this issue has encouraged the authors to pursue their own research.

**Aim of the study.** The purpose of the study is to present the opinion of paramedics related to the ergonomics of work aboard an ambulance.

**Materials and methods.** A group of 50 paramedics (48 men and 2 women) aged from 25 to 65 were suspected to a prospective study. The survey was conducted directly in the period from 1 January 2015 to 30 May 2015. It was based on the checklist by K. F. H. Murrell comprising 11 problem questions.

**Results and conclusions.** The study conducted made it possible to conclude that 74% of the respondents believed that during work in an ambulance they could make optimum use of their skills. 48% of the people surveyed indicated that the equipment in the ambulance was adapted to the tasks carried out by the paramedics. 90% of the paramedics surveyed believed that the ambulance's interior has been designed with future users in mind. The auditory channel is the most important communication channel for paramedics working on the ambulance. The same numbers of respondents were of the opinion that the best communication system inside the ambulance was intercom – such was the conviction of 37% of respondents, and voice communication – this method was preferred by 37% of those surveyed. 80% of the paramedics questioned emphasized that verbal communication especially should be used in the ambulance. 72% of the surveyed complained that verbal communication in the ambulance may be disturbed by noise. All the paramedics surveyed pointed out that both the physical or mental demands arising during work in the ambulance may lead to the paramedic becoming overburdened. Among the suggestions put forward by the surveyed, which could improve work in the ambulance, the following two were predominant: modern equipment and an optimum number of team members.

**Key words** - ergonomics, paramedic, ambulance interior, survey research.

**Streszczenie** – Wprowadzenie. Ergonomia miejsca pracy jest tematyka budzącą już od wielu tak rosnące zainteresowanie. Dużą aktualność tematyki skłoniła mnie do podjęcia badań własnych. Cel badań. Celem pracy jest przedstawienie opinii ratowników medycznych w zakresie ergonomicznych warunków pracy wewnątrz karetki pogotowia ratunkowego.

**Materiał i metody.** Badaniom prospektywnym poddana grupa 50 (48 mężczyzn oraz 2 kobiety) w wieku od 25 do 65 lat ratowników medycznych.

**Badania ankietowe,** bezpośrednie przeprowadzono w okresie od 1 stycznia 2015 do 30 maja 2015. Ankietę oparto na liście kontrolnej K. F. H. Murrella zawierającej 11 pytań-problemów.

**Wyniki i wnioski.** Przeprowadzone badania pozwoliły stwierdzić, że 74% respondentów uważało, że podczas pracy wewnątrz karetki pogotowia ratunkowego mogą w sposób optymalny wykorzystywać posiadane umiejętności. 48% badanych wskazało, że urządzenia, jakie znajdują się w karetce są dostosowane do czynności, jakie wykonuje ratownik. 90% badanych ratowników medycznych jest zdania, że wnętrze karetki zostało zaprojektowane z myślą o przyszłych użytkownikach. Dla ratowników pracujących wewnątrz karetki najważniejszym kanałem komunikacji jest kanał słuchowy. Jednakowa liczba respondentów jest zdania, że najlepszym systemem łączności wewnątrz karetki jest: intercom – takiego zdania było 37% badanych i łączność głosowa – ten sposób komunikacji preferowało 37% badanych. 80% ankietowanych ratowników podkreśla, że łączność w karetce pogotowia powinna być przede wszystkim słowna. 72% badanych skarżyła się, że łączność słowna w karetce może być zakłócana przez hałas. Wszyscy badani ratownicy medyczni wskazują, że wymagania fizyczne bądź umysłowe, jakie powstają podczas wykonywania pracy w karetce pogotowia mogą prowadzić do nadmiernego przeciążenia ratownika.

Wśród wielu postulatów zgłaszanych przez ankietowanych, mogących poprawić pracę wewnątrz karetki pogotowia ratunkowego dominowały dwa podstawowe: nowoczesny sprzęt i zapewnienie optymalnej liczby członków w zespole.

**Słowa kluczowe** - ergonomia, ratownik medyczny, wnętrze karetki pogotowia ratunkowego, badania ankietowe.

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- A. The idea and the planning of the study
- B. Gathering and listing data

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## I. THE IMPORTANCE OF ERGONOMICS IN AMBULANCES

Ambulance workers are exposed to a wide range of risks and dangers resulting from the very nature of their profession. The hazards mainly relate to: [1]

- a large number of traffic accidents,
- contact with persons suffering from infectious diseases,
- injuries caused by e.g. carrying and transporting patients,
- time pressure resulting from e.g. shift work,
- contact with patients experiencing difficult life circumstances, which may affect the mental health and well-being of ambulance workers,
- the application of various cleaning agents and disinfectants,
- injuries when using sharp tools.

The present considerable importance of the issue of ergonomics in the ambulance has encouraged the authors to initiate their own research whose purpose was to present the opinion of paramedics in the scope of ergonomic workplace conditions inside the ambulance.

## II. MATERIALS AND METHODS

### Material

A group of 50 paramedics (48 men and 2 women) aged from 25 to 65 were subjected to a prospective study. They were all employees of the Voivodeship Ambulance and Sanitary Transport Station of the Independent Public Healthcare Centre in Plock, department in Sierpc.

### Methods

The direct survey was conducted in the period from 1 January 2015 to 30 May 2015. The survey was based on

the checklist by K. F. H. Murrell [2] consisting of 11 problem questions.

## III. RESULTS

The results of the survey study considering the distribution of answers between the particular problem questions have been presented below.

*Does the paramedic make optimum use of his or her skills during work in the ambulance?*

74% of the respondents believed that they could make optimum use of their skills in the ambulance; however, as many as 26% found that it was not possible.

*Is the paramedic forced to take actions which they cannot carry out correctly?*

26% of the respondents declared that they were forced to take actions which they could not perform correctly, whereas 74% had not been in such a situation.

*May these functions be performed by equipment?*

66% of the surveyed believed that those functions may not be performed by equipment while 34% of persons surveyed believed that it was possible.

*Is the ambulance equipment adapted to the tasks performed by the paramedic?*

48% of the respondents indicated that the ambulance equipment was adjusted to the tasks performed by the paramedic. However, 52% believed that it was the case only to some degree.

*Does the design of ambulance equipment result from tradition or was it designed with the prospective user in mind?*

The design of ambulance equipment results from tradition according to 10% of the respondents, whereas 90% believed that it has been designed with the prospective user in mind.

*Can the paramedic sit when performing most of the tasks or must he or she stand?*

The paramedic must stand during most of the tasks according to 80% of the respondents, whereas 20% believe that he or she may sit.

*Is the paramedic's posture satisfactory in all of these work situations?*

28% of the surveyed believed that his or her posture was satisfactory; 54% admitted that it was not fully satisfactory, and 18%, stated that it was unsatisfactory.

*Does the ambulance's interior design allow the equipment to be partially or exclusively used by women?*

All the respondents found that the ambulance equipment may be partially used by women. Nobody pointed to the operation of equipment exclusively by women.

*If the answer is yes, what qualities should women possess to work in the ambulance?*

Most respondents (60%) were not able to specify the qualities of women working in the ambulance. The following qualities were mentioned markedly more seldom and with similar frequency: physical fitness, dexterity, and resilience. It is worth noting that 14% of the respondents believed that women should not work in the ambulance.

*In what form should the paramedic receive information when working in the ambulance and how should it be conveyed? By the visual, auditory or tactile channel?*

For the respondents, the most important communication channel (86% of responses) inside the ambulance was the auditory channel. The visual channel was pointed by 14% of the respondents. Nobody prefers conveying information by touch.

*Which of these manners of conveying information reaches the paramedic the fastest and in the most unambiguous manner?*

80% of the respondents indicated information conveyed via the auditory channel and the remaining 20% pointed to the visual channel.

*Which of the devices in the ambulance are the most crucial for the paramedic to work effectively?*

From opinions collected, it results that the most useful device rendering the paramedic's work easier is the defibrillator (25% of all answers) and ventilator (19% of all answers). Other devices were mentioned by the respondents much less frequently.

*Which devices may be considered secondary?*

The people surveyed also indicated devices being of secondary importance in the paramedic's effective work. In their opinion, the most useful secondary piece of equipment was the protective helmet (33%), but also the scoop stretcher (16%) and the vacuum stretcher (16%).

*What kinds of control devices are necessary and what control system should be used to coordinate the paramedic's work inside the ambulance?*

The respondents indicated control devices and control systems to be used in order to coordinate the paramedic's work aboard the ambulance. They believed that the most necessary system was automatic stretcher lifting. Moreover, the arrangement of ambulance equipment must be standardised.

*Is it possible to use foot control when the paramedic is standing?*

The respondents expressed the following opinions concerning work in a standing position using foot control: 50% of respondents believed that it was possible to use foot control, 36% believed that it was partially possible, and 14% believed that it was impossible.

*What is the amount of effort to be used by the paramedic in coordinating his or her work?*

70% of the respondents believed that moderate effort was required to coordinate their work. 10% claimed that little effort was needed, but 20% stated that much effort was necessary.

*Are auxiliary devices (servomechanisms) necessary?*

The vast majority of paramedics (80% of the respondents) indicated that auxiliary devices (i.e. servomechanisms) were necessary for their work, whereas 20% were of the opinion that servomechanisms were useful in the paramedic's tasks only partially.

*What kind of communication system between the paramedics working in the ambulance is needed?*

Nearly the same number of respondents indicated the best, in their opinion, two communication systems in the ambulance: intercom and voice communication (37% each) whereas 25% of the respondents favoured the use of a mobile radio.

*Should there be verbal communication?*

The paramedics surveyed believed that there should primarily be verbal communication in the ambulance - 80%, and the remaining 20% stated that communication should be partially verbal.

*If the answer is yes, will not communication be disturbed by noise?*

72% of the respondents confirmed that verbal communication may be disturbed by noise, yet 28% were of the opinion that noise had no impact on communication inside the ambulance.

*If such disturbance to voice communication is expected, is it possible to ensure communication using other devices?*

In case of disturbance caused by noise, the paramedics believed that communication may be partially ensured by devices - 44% of all answers, it may well be ensured by devices - 28% of all answers, it cannot be attained using devices - 28% of all answers.

*What degree of physical work is carried out by the paramedic in coordinating his or her tasks in the ambulance?*

72% of the rescuers surveyed considered their physical work in the ambulance to be of medium intensity, yet 28% stated that it involved much effort. None of the respondents believed that their work required little physical effort.

*Does the work correspond to the paramedic's ability?*

80% of the paramedics believed that their work was consistent with their ability, 20% claimed that it was relevant partially. None of the surveyed believed that their work exceeded their ability.

*Is there need for auxiliary mechanical devices assisting the paramedic in his work?*

86% of the respondents confirmed the need for auxiliary mechanical devices supporting the paramedic, 14% of the persons requested mentioned a partial application of me-

chanical devices supporting the paramedic in his or her work.

*What workplace conditions characterise the work of a paramedic aboard the ambulance?*

80% of the respondents described the conditions as of a medium standard, the remaining 20% as difficult.

*Is there noise?*

34% found that noise during work was annoying, yet 66% considered that noise was a problem only to some extent.

*Is there too much heat?*

74% of the respondents found heat at work problematic to some extent, 17% considered that it was a serious problem, whereas 9% did not mind hot temperature.

*What lighting is necessary?*

All the paramedics surveyed agreed that good lighting was necessary in their work.

*Can the work-related physical or mental demands overburden the paramedic?*

All the paramedics subjected to the study believed that the physical or mental requirements resulting from their work in the ambulance may lead to excessive burden.

*If so, what steps should be taken in order to reduce that burden?*

From many suggestions of the respondents, the following basic two dominated: modern equipment – the necessity of possessing it was indicated by 26% of respondents, and the second one concerns ensuring an optimum number of team members, which was also emphasised by 26% of respondents.

*Have the devices inside the ambulance been designed in a manner enabling mistakes to be detected easily as well as in a manner allowing potential repairs to be conducted with the minimum loss of time?*

30% of the surveyed believed that the existing mistakes in the ambulance's interior design may be easily detected, 62% claimed that such mistakes may be detected to a limited degree, and finally 8% believed that such mistakes were impossible to detect.

*Is there good enough access to devices for periodic repairs to be conducted?*

20% of the respondents found that maintenance access to devices inside the ambulance was good, whereas 60% believed that it was partially limited.

#### IV. DISCUSSION

Kenneth Frank Hywel Murrell (1908-1984) – an employee of the Royal Navy started to investigate the interaction between man and his working environment in order to identify the potential causes of ineffectiveness and stress

among workers. One of the main innovations introduced by Murrell was the creation of work groups comprising representatives of various disciplines. At a conference in Oxford on 12 July for the British Admiralty, he used for the first time the term ergonomics determining a new field of study. His theory is based on the principle: "*Fitting the job to the worker*".

Despite considerable interest in workplace ergonomics, studies concerning ergonomics in the ambulance have been rarely conducted.

The authors' own study has revealed that 74% of the respondents believe that they can make optimum use of their skills when working in the ambulance. One may think that paramedics cannot say anything to the contrary. However, working conditions and workplace arrangement may reduce the comfort of work and the paramedic's well-being as well as prevent high effectiveness at work. [2,3,4] In relation to a paramedic's work, these restrictions may generate incorrect actions in life-threatening situations.

A fact worth emphasising is that nearly half (48%) of the respondents believed that the ambulance's interior was adjusted to the tasks performed by paramedics. However, the opinion of the other half is worrying – in their opinion, ambulance equipment is only partially adjusted to the potential tasks carried out by paramedics. In spite of various deficiencies in ambulance equipment, 90% of the paramedics surveyed stated that the ambulance's interior had been designed with prospective users in mind.

The ambulance environment makes team work necessary. During such work, the manner of communication is crucial, especially its ease. The paramedics surveyed pointed to that fact. In their opinion, the main means of communication inside the ambulance was the spoken language (80% of respondents), instructions carried out verbally, i.e. the auditory channel. Nevertheless, 72% of the respondents emphasised the fact that verbal communication in the ambulance may be disturbed by noise.

The authors have also considered the issues related to devices being useful and helpful in the paramedic's work, which should be part of ambulance equipment. According to the respondents, the most important devices were the defibrillator (25% of all answers) and ventilator (19% of all answers).

Numerous studies point to the importance of control devices in certain professions. [2-5] Paramedics also consider such devices useful at work. In the respondents' opinion, the most useful control device in the ambulance is an automatic stretcher lifting device. They also pointed to the need to standardise the arrangement of ambulance equipment. The vast majority of rescuers (80%) declared that auxiliary

devices (i.e. servomechanisms) were necessary during work in the ambulance. This corresponds to the fact that 72% of the paramedics surveyed considered their physical effort in the ambulance to be of medium intensity.

Communication is a crucial element improving team functionality – not only does it relate to contact with the dispatcher or with the medical coordinator in case of mass incidents, but also to contact between members of the same team. In the respondents' opinion, the best communication systems in the ambulance are the intercom and voice communication – both these methods were preferred by 37% of the surveyed.

In the recent decades, one of the essential areas of interest in occupational psychology has been the effectiveness of human actions in his or her workplace. It is an increasingly recognised fact that effective work is such work which brings satisfaction with the results of your own activity. Therefore, not only the conditions for effective work are being scrutinised ever more but also the employees' feelings, occupational satisfaction and the price they pay for their professional involvement, i.e. occupational burn-out. [6-9] Also the authors' own research was devoted to those issues. The conclusion is that both physical and mental requirements arising from work in the ambulance may lead to overburdening the paramedic. From the many suggestions of the respondents, which may lead to improving work conditions in the ambulance, the following two were predominant: modern equipment and providing an optimum number of team members.

The study conducted focuses on the important issue of ergonomic conditions for paramedics working in the ambulance. The observations made based on the authors' own study may serve as a starting point for further research. However, a much larger study group must be involved, and the study must be of a multicentre character so it may become the basis of further inference and generalisation.

## V. CONCLUSIONS

- 74% of the respondents believed that they could make optimum use of their skills during work in the ambulance.
- 48% of the respondents pointed out that the ambulance equipment was adapted to the tasks performed by the paramedic.
- 90% of the paramedics surveyed expressed the opinion that the ambulance's interior has been designed with future users in mind.

- The most important communication channel for paramedics working aboard the ambulance is the auditory channel.
- The most useful tools for paramedics are the defibrillator (25% of all answers) and the ventilator (19% of all answers).
- According to the respondents, the most useful control devices in the ambulance are the automatic stretcher lifting device and the standardised arrangement of ambulance equipment.
- The vast majority of paramedics surveyed (80% of all) observed that auxiliary devices (servomechanisms) were necessary for their work.
- The same number of respondents were of the opinion that the best communication system in the ambulance was the intercom and voice communication – 37% each.
- 80% of the paramedics emphasised that there should especially be verbal communication in the ambulance.
- 72% of the respondents complained that verbal communication in the ambulance may be disturbed by noise.
- 72% of the rescuers surveyed considered their physical effort in the ambulance to be of medium intensity.
- 86% of the respondents confirmed the need for auxiliary mechanical devices supporting the paramedic.
- All the paramedics surveyed pointed out that the physical and mental demands of their work may lead to overburdening the paramedic.
- From many suggestions of the respondents which could improve work in the ambulance, the following two were predominant: modern equipment and ensuring an optimum number of team members.

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