Research

Assessing the usefulness of instant feedback and the Hawthorne effect: an audit of time indexes of EMS missions in Tehran

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Abstract

Introduction

It has been well established that if a person is aware that they are being monitored their commitment and effort will be maximised (the Hawthorne effect), which then leads to efficiency increase and optimal workflow.

Objective

Our aim was to evaluate the efficacy of instant feedback and the Hawthorne effect of this intervention on pre-hospital time indexes during emergency medical service (EMS) missions.

Methods

This is a cross-sectional auditing study on the missions of the Tehran EMS Center (performed over a 12-month period) in three phases: pre-intervention, instant feedback, and monitoring without feedback. The measured time indexes were the different parts of mission times. To collect data, a pre-prepared checklist was set up. For the first phase, data were extracted from the database of the Tehran EMS Center. In the second and third phases, the data were entered into the relevant forms for each mission by the researcher and executive colleagues.

Results

The data of 229,847 missions were analysed. In the instant feedback phase, compared to the pre-intervention phase, the mean activation time, response time, scene time, transfer time and hospital delay time were decreased. When we compared the mean time indexes in the monitoring phase compared to the instant feedback phase, we saw that the average activation time, response time and transfer time were increased but they were still less than that in the pre-intervention phase. However, the scene time and hospital delay time were not changed compared to the instant feedback phase but were lower than that in the pre-intervention phase.

Conclusion

Auditing was effective in reducing the total time of missions and this effect was largely maintained in the monitoring phase under the Hawthorne effect.

Keywords:

effect modifier; epidemiologic; emergency medical services; feedback; Hawthorne effect; management audit

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Introduction

Pre-hospital care is an important factor in influencing patient outcomes (1). Providing effective and fast medical services in the pre-hospital setting could be critical (2,3), therefore emergency medical services (EMS) play a very important role in this regard (4-7). The main goal of EMS is to provide fast, immediate and appropriate care for critical patients and rapid transfer of patients to emergency departments (EDs) (3). It is clear that a shorter duration in the pre-hospital stage leads to better outcomes in some time-sensitive situations (8,9). Reduction of pre-hospital time in certain populations, including stroke, myocardial infarction and severe trauma, has been beneficial (10-12). Cohort studies show that providing feedback to caregivers reduces delays in dealing with patients with myocardial infarction and stroke (13-15). Also, giving feedback has improved the management of cardiac arrest and its complications. Undoubtedly, providing information to emergency medical technicians (EMTs) in these targeted scenarios leads to a significant improvement in outcome (16). Psychologically, it has been well established that a person's awareness of being monitored can maximise his commitment and effort. This phenomenon, known as the Hawthorne effect, increases efficiency and leads to optimal workflow (16-18). Audit interventions have been increasingly considered as a strategy to reduce diversity and improve quality of care and have been shown to improve clinical performance (19,20). There are currently no specific audit and feedback features that can improve pre-hospital emergency care in Iran. Our goal in this study was to evaluate and monitor various mission time intervals (ie. from calling the emergency 115 number until delivering the patient by ambulance to the hospital and leaving the hospital) and provide instant feedback for cases outside of the defined standards to reduce pre-hospital delays and provide appropriate patient management.

Methods

Study design and setting

This is a cross-sectional auditing study on the missions of the Tehran EMS Center performed over a 12-month period from March 2019 to February 2020. To conduct the study, permits were obtained from the Tehran EMS Center and the ethics committee of Tehran University of Medical Sciences (IR.TUMS.VCR.REC.1398.716). We adhered to principles of ethics and information confidentiality in collecting and analysing information and presenting the results and reports. The checklists were anonymous and the information remained confidential.

Intervention and data gathering

Data sampling was conducted via census sampling and all non-repetitive missions conducted from 6 to 12pm in all phases of the study in mentioned period were included. Repetitive and cancelled missions and also those with incomplete recorded data were considered as exclusion criteria. To collect data, required checklists were set up based on the research objectives and variables (details of mission time).

The study consists of three phases: pre-intervention, instant feedback, and monitoring without feedback.

For the pre-intervention phase of the study we reviewed the missions of the Tehran EMS Center 5 months retrospectively (March to July 2019). The required data were extracted from the database of the Tehran EMS center, retrospectively. In the audit and instant feedback phase, which was performed for three consecutive months from August until November 2019, EMTs who were directly involved in the missions were given instant feedback. An audit committee consisting of EMS station chiefs and inspectors was formed. In this committee, the times that were outside of the expected mean time were determined and we analysed our findings based on these times (as considered the national standard). In international standards, just for critical patients, the time standard for response time (RT) and scene time (ST) is defined as less than 8 minutes and less than 10 minutes, but these times cannot be generalised to all missions.

All EMTs were informed about auditing at the beginning of the second phase. Four representatives from each district and a quality control inspector (five in total) settled at the central headquarters from 18:00 to 24:00, which is the peak time of the missions of the Tehran EMS Center. The data of missions is registered electronically in the databank system of the Tehran EMS Center. The times of a mission are recorded both through the GPS and operational form that EMTs fill out. The reports of times were generated online by a pre-defined reporting system and seen by inspectors at the headquarters. If a time exceeded the determined time, instant feedback was given; the inspectors called the considered EMT and investigated the cause of delay. If the cause was related to issues such as city traffic, or due to the lack of an empty hospital bed, the delivery of the patient from the ambulance to the hospital was delayed and the ambulance was discharged from the hospital with delay, the necessary coordination was done, and if it was related to the EMT's error, feedback was given.

In the third phase of the study, direct supervision and instant feedback were discontinued, but the EMTs were informed that they were still under supervision (impact of the Hawthorne effect). The required data was gathered for another three consecutive months from December 2019 until February 2020 in this phase.

Statistical analysis

All study variables were descriptively analysed and the results were presented using statistics such as frequency (percentage), range and mean (standard deviation). We used the One-way ANOVA test for comparison of mean differences of different mission times in the three phases of the study. Pairwise comparisons between two phases and post-hoc comparison were conducted using the Bonferroni test. Data analysis was conducted using Stata v.14 (StataCorp, College Station, TX).

Results

The data of 229,847 missions were analysed. The mean of missions for each active ambulance was 335.6 (SD=46.5) in pre-intervention, 350.5 (SD=7.3) in audit and instant feedback,

and 372.0 (SD=4.4) in the monitoring without feedback period (Figure 1). This mean difference for the three study time periods was not statistically significant ($p=0.328$).

In general, the mean times after the intervention were reduced (Figure 2).

Figure 1. Mean of missions for each active ambulance for each month of the three study periods

Figure 2. Changes in the meantime of activation time (A), response time (B), scene time (C), transfer time (D), length of stay in the hospital (F) and mission's total time (G) in the pre-intervention, instant feedback and monitoring phases

Activation time

The mean activation time (AT) in the pre-intervention phase was 2.68 minutes (min=0.52 and max=4.98), although the mean time in the audit and feedback phase was increased slightly, it was decreased to 2.50 minutes in the monitoring phase without feedback. Two-to-two comparison of mean AT in three phases was statistically significant ($p<0.001$). In other words, the average increase of AT in the audit phase and instant feedback compared to the non-intervention phase and also the decrease of time in the monitoring phase without feedback compared to the previous two phases were significant ($p<0.05$).

Response time

The average RT in the pre-intervention phase was 13.57 minutes (min=3.00 and max=60) and this time was reduced in both phases after the intervention compared to the pre-intervention phase so that the average RT in the audit phase and feedback was 12.38 minutes and in the monitoring phase without feedback was 12.85 minutes. A two-to-two comparison of mean RT in the three phases was statistically significant ($p<0.001$).

Scene time

The ST was reduced in the instant feedback phase, from 24.22 minutes (min=3.00 and max=59.90) to 21.98 minutes. However, the average time in the monitoring phase without intervention was slightly decreased (21.95 minutes). A two-to-two comparison of mean ST in the three phases was significantly significant ($p<0.001$).

Transfer time

The mean transfer time (TT) in both phases after the intervention compared to the pre-intervention phase was reduced, so that the average TT in the pre-intervention phase was 20.28 minutes (min=3.00 and max=60) and in two phases of audit and instant feedback and monitoring without feedback it was 18.97 and 19.78 minutes, respectively. Two-to-two comparison of mean TT in the three phases was significant ($p<0.001$).

Length of stay in the hospital

The mean length of stay in the hospital (ie. from the time of arrival at the hospital to leaving the hospital) in the pre-intervention phase was 17.63 minutes (min=3.00 and max=60) and this time was reduced in both phases after the intervention compared to the pre-intervention phase, so that the average time in the audit phase and instant feedback was 14.10 minutes and in the monitoring without feedback phase 14.10 minutes. Two-to-two comparison of mean time in three phases was significantly significant ($p<0.001$).

Mission's total time

All five times in 16,919 missions were specified and the mission's total time was calculated and compared in three groups before and after the intervention. The intervention was generally effective. The mission's total time in the audit and feedback phase was about 8.5 minutes less than the

pre-intervention phase and the average time was reduced from 75.27 minutes to 66.88 minutes, which was statistically significant ($p<0.001$). Also, the average mission's total time in the monitoring phase without feedback was about 7.5 minutes less than the pre-intervention phase and the average time was reduced from 75.27 minutes to 67.78 minutes, which was statistically significant ($p<0.001$). There was no significant difference between the mission's total time in the audit phase and instant feedback with the monitoring without feedback phase ($p=0.068$). The mean of the mission's total time in the audit phase and instant feedback was about 1 minute less than the monitoring without feedback phase.

Discussion

Examining the results of the present study, it was found that auditing was effective in reducing the total time of missions and this effect was largely maintained in the monitoring phase. In this study, it was seen that in the feedback phase, compared to the pre-intervention phase, the mean AT, RT, ST and TT, as well as length of stay in the hospital, were decreased. When we compare the average times in the monitoring phase with the feedback phase we see that the average AT, RT and TT were increased but they were still lower than the pre-intervention phase. However, the ST and duration of the length of stay in the hospital were not changed in the monitoring phase compared to the instant feedback phase but they were lower than that of the pre-intervention phase.

Assessing the total number of missions for the three phases of the study, it was found that not only was the number of the EMS missions decreased, but also it was increased; while the number of EMTs and ambulances were almost the same. Albeit only AT and RT can be affected by the number of missions, both of them were decreased during and after the intervention indicating the indirect effect of shortening the total time on a faster return of the ambulance to the next operation cycle. On the other hand, some of the time intervals in the phase without intervention and feedback have an increasing trend, while others remain constant, which reinforces the hypothesis of the effect of the Hawthorne phenomenon in cases where it is more affected by human labor (eg. RT and TT, which are influenced by factors such as the proper routing traffic).

Time index is one of the vital factors in patient survival in the pre-hospital emergency setting, which is also very effective in improving the quality of services (21). Therefore, most system administrators are focussed on this index. Indeed, the current study, with the effect of instant feedback, confirms the level of desirability of time indicators. In a study conducted by Gaia et al to evaluate the effectiveness of instantaneous audio-visual feedback on the total delay time in thrombectomy of patients with acute stroke, door-to-needle times were significantly reduced (17). Another study by Kant et al in Maryland showed that quality can be improved by repeated measurements by

other people who repeatedly remind expectations (15). In a study on the effect of quality improvement program on the scene time of paramedics for penetrating trauma victims, it was found that an intensive quality improvement program can significantly affect the scene time in patients with penetrating trauma. It seems that monitoring and instant feedback could be a valuable method to decrease time indexes during EMS missions (13).

On the other hand, some experts believe that forced reductions of time intervals are not the case in the response time and transfer time intervals. Indeed, the pressure to reduce these time intervals may lead to more aggressive driving and increased risk of vehicle crashes. However, contact with EMTs has been done with a problem-solving approach and intervention to expedite the relief process. In some cases, the reason for the delay was issues such as traffic, the lack of police on the scene, the problems regarding rescue and release of trapped injured patients, and unavailability of a bed in the hospital. In such cases the problem was solved immediately by coordinating with relevant services, such as police or hospital staff.

Also, a number of studies have been conducted in favor of the usefulness of the Hawthorne effect (22-24). This effect "refers to a type of reactivity in which individuals modify an aspect of their behavior in response to their awareness of being observed". McCambridge et al conducted a systematic review on this topic and concluded that although some investigators reported the role of the Hawthorne effect, still further research in this area should be a priority for health scientists (25). In the current study, we tried to clearly define the situation and variables to assess the Hawthorne effect on the measured time indexes, and found it useful on the period in which the study was conducted.

Limitations

During the audit period many of the EMS personnel must have learned or reconfirmed that time reduction is critical for better outcomes among emergency patients and tried to act as quickly as possible in order to improve the system. Such improvements may be due to the Pygmalion effect. However, by reviewing our study methods and other similar studies, we cannot find an answer that can differentiate the Hawthorne and Pygmalion effects. Perhaps the Hawthorne effect and the Pygmalion effect have some overlap.

Also, other factors such as traffic, incomplete address and driving skills of the EMTs can be effective on the time indexes, which could be different in various phases of the study, so we did not consider such biases on the results. As well, The Hawthorne effect's duration was not assessed, which could be a valuable topic for further research in this regard.

Conclusion

Our audit was effective in reducing the total time of missions, and in phase two, the greatest effect was due to the audit,

instant feedback, and coordination. It seems that, in the monitoring phase, the reduction of missions' time was still widely maintained under the influence of the Hawthorne effect.

Author contribution

Conception and design by PS, PHS and AB; data acquisition by PHS, HM and MJ; analysis and interpretation of data by NM, PHS and AB; drafting the work by NM, HM and MJ; revision by PS, PHS and AB. All the authors approved the final version of the work.

Competing interests

The authors declare no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

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