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## Time Saved With Use of Emergency Warning Lights and Sirens During Response to Requests for Emergency Medical Aid in an Urban Environment

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### EMERGENCY MEDICAL SERVICES

Time Saved With Use of Emergency Warning Lights and Sirens During Response to Requests for Emergency Medical Aid in an Urban Environment

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**Study objective: To determine whether the use of warning lights and sirens saves a significant amount of time for ambulances responding to requests for medical aid in an urban, 2-tiered EMS setting.**
**Methods: A prospective design was used to determine run times for ambulances responding to calls with lights and sirens (Code 3), and for a similarly equipped "chase" vehicle traveling to the same call on the same route without lights and sirens (Code 2). Data were collected for run times, distance traveled, visibility, road surface condition, time of day, and day of the week. Simple statistics and analysis of variance were used to test for significant differences between Code 3 and Code 2 operation, as well as the other variables listed above.**
**Results: Sixty-four runs were timed during a 9-month period. The average Code 3 response interval was 4.46 minutes. The average Code 2 response interval was 7.48 minutes. The 3.02 minutes saved on average represents a significant time savings of 38.5% (*P*< .01). Run distance was the only variable that was statistically significant in affecting time saved during a Code 3 response.**
**Conclusion: Code 3 operation by EMS personnel in an urban, 2-tiered EMS setting saved significant time over Code 2 operation when traveling to a call. [Ho J, Casey B: Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment. *Ann Emerg Med* November 1998;32:585-588.]**

## INTRODUCTION

The use of warning lights and sirens for EMS vehicles has become a controversial topic. Traditionally it has been assumed that time is saved by responding to requests for medical aid with lights and sirens (Code 3). However, because many EMS responses are for non-emergencies, some have argued in favor of responding to requests for medical aid without warning lights and sirens (Code 2). This argument is supported by several studies that suggest Code 3 response is ineffective and dangerous while offering minimal time savings. [1] [5]

Current literature reports show that Code 3 operation increases risk of injury to EMS crews and the general public. [1] [3] [6] [8] In addition, it is not clear how much time (if any) is saved by use of a Code 3 operation, because there has been no prospective study addressing this question.

In this study, we evaluated the time saved by Code 3 response when compared with Code 2 response in an urban environment.

## MATERIALS AND METHODS

We prospectively evaluated randomly selected Code 3 ambulance runs made within the city limits of a metropolitan area (population 378,000). Data were collected from a third service/public utility model ambulance service, during a 9-month period (October 1995 to June 1996). This project was approved by the authors' institutional review board before its initiation.

Two types of vehicles were used for this study. The first was a standard type III paramedic ambulance with state-approved Code 3 equipment. The second was a marked EMS "chase vehicle" with identical Code 3 equipment. The ambulance was staffed by 2 paramedics, and the chase vehicle was staffed by 1 of the investigators. The paramedic crew and the investigator were each equipped with an identical digital stopwatch and a 2-way transceiver for communication. The investigator had a data collection sheet with predetermined data points to be collected during the run.

Data were gathered by selecting a paramedic crew through a random drawing. Data collection was done during various hours of the day and over various days of the week, including rush hours, weekends, and holidays. Data collection was made only on calls within the city limits. After a crew had been selected, they were given a stopwatch and instructed on its use. The crew was blinded to the purpose of the timing and they were instructed to respond to all calls in normal fashion, using standard Code 3 driving techniques. The nondriving crew member was responsible for timing the event.

Because the ambulances provide roving coverage for their districts, 2 types of timing scenarios were possible. The paramedics were instructed on timing their runs for each scenario. If the crew was dispatched to a call from a stationary location, they were instructed to start timing the event when the ambulance transmission selector was placed into the "Drive" position. If the crew was dispatched to a call while moving, they were instructed to start timing the event when the ambulance warning lights were activated. In both scenarios, the crew was instructed to stop timing the event when the ambulance arrived at the scene and the transmission selector was placed into the "Park" position. The investigators also followed these timing procedures for the Code 2 chase vehicle.

The chase vehicle mimicked the Code 2 response interval in the following manner: if the ambulance was dispatched from a stationary location, the investigator and the crew had a brief, face-to-face discussion on the exact route the ambulance would use for the call. If the ambulance was dispatched while moving, the investigator and the crew discussed route selection by 2-way transceiver. After decision of the route was made, the ambulance would respond Code 3 and the chase vehicle would respond as a Code 2. If the ambulance deviated from the predetermined route, the investigator was notified by 2-way transceiver and also made the same route change. The investigators proceeded to all calls using standard Code 2 driving techniques (compliance with all posted signs, speed limits, and traffic signals).

The information recorded included Code 3 time intervals, Code 2 time intervals, distance traveled, visibility, road condition, day of week, time of day, and use of freeways. Data were entered into a database (Lotus format) and analyzed with SYSTAT software. The variables of distance, visibility, road conditions, and use of freeways were examined individually and in combinations to determine whether they explained statistically significant amounts of time saved. In addition to descriptive statistics, when appropriate, ANOVA was used with significance set at $P<.05$. When ANOVA was used, the logs of run time intervals and mileage were used as covariates and analyzed against each variable.

## RESULTS

A total of 64 runs were timed. The distance range of the runs was .20 miles to 8.00 miles (mean 2.28 miles; SD ±1.42 miles). During Code 2 operation, the range of time intervals varied from 1.82 minutes to 15.92 minutes. The mean Code 2 response interval was 7.48 minutes (95% confidence interval [CI]=5.04, 9.92 minutes). During Code 3 operation, the range was .97 minutes to 10.27 minutes. The mean Code 3 response interval was 4.46 minutes (95% CI=2.2, 6.72 minutes). The mean speed of the chase vehicle during Code 2 operation was 17.49 mph. The mean speed of the ambulances during Code 3 operation was 28.87 mph (speed derived by dividing the total distance by the time interval).

The time saved during Code 3 operation ranged from .37 minutes to 7.40 minutes. The mean time saved by operating as a Code 3 versus Code 2 status was 3.02 minutes (95% CI=.8, 5.24 minutes; $P<.01$). This represents a mean time savings of 38.5% (95% CI=35.7%, 41.3%). The only variable significantly associated with the amount of time saved was the distance of the run.

## DISCUSSION

No prospective studies measuring the time saved by Code 3 response have been published. A review of 2 reference sources from the National Association of EMS Physicians (NAEMSP), including a position paper on Code 3 driving, offers little insight to this question.[9] [10] Both sources indicate that Code 3 driving is a privilege granted to emergency vehicles, but is an activity that compromises public and crew safety.[10] [11] Neither source indicates whether Code 3 operation is actually useful in saving time.

Recently a Code 3 time study was performed in Greenville, North Carolina. [5] It identified an average time saving of only 43.5 seconds when Code 3 and Code 2 operations were compared. The authors concluded that in 99% of all EMS calls studied, a time savings of 43.5 seconds would not have mattered in the care or outcome of the patient. They suggested considering abolishing the practice of Code 3 operation because of the high risk involved.

Although this study is often referred to by individuals in EMS, several important points should be noted. The study was a retrospective review (using run sheet times that may have been inaccurate), and its results may not apply to urban areas (Greenville has a population of 46,000). These limitations were noted by the authors, who suggest that similar studies be performed in urban settings before conclusions can be drawn related to those areas.[5]

The Greenville study has been misinterpreted as proof that Code 3 operation is of no benefit in patient care. It should be noted that the study only evaluated the transport interval (scene to hospital). The response interval (dispatch to scene) may also be important. This is the time that elapses before rescue personnel are able to perform potentially life-saving interventions. Reduction of this interval is clearly beneficial in out-of-hospital cardiac arrest, and may have value in other responses. Because of this, we chose to prospectively evaluate the effect of Code 3 operation on this potentially critical time interval.

This study has several limitations; first, it is small. In addition, most runs occurred during peak operating times (rush hour and early evening). Another limitation was the potential for the Code 2 vehicle to experience heavier traffic than the Code 3 vehicle as a result of cars stopping to allow the Code 3 vehicle to pass through traffic. This so-called wake effect is well described in the literature and tends to be a contributing factor in emergency vehicle collisions.[1] Typically the Code 2 vehicle was in sight of the Code 3 vehicle for less than 20 seconds. Thus the Code 2 vehicle would often get stopped by a traffic signal or lose sight of the Code 3 vehicle because of a turn. Therefore we believe that this phenomenon had a minimal effect on the Code 2 vehicle times.

An additional limitation to our study is the possibility that the paramedics in the Code 3 vehicles displayed enhanced driving performance as a result of being observed, the so-called Hawthorne effect. The results also could have been affected by variable compliance with the timing methodology. We attempted to minimize this problem by clearly instructing each crew on the timing methods before and during their shifts.

We have not addressed the important issue of when it is necessary to save time while responding to calls. Several literature reports identify the inappropriate and unnecessary use of Code 3 operation, and very few address how or when to use it. [2] [4]

In summary, Code 3 operation in this urban environment resulted in a mean time savings of 38.5% of the response interval when compared with Code 2 response. The time saved during Code 3 operation was significantly altered only by the distance of the run. Larger prospective studies are needed in various types and sizes of systems to identify which settings benefit from meaningful time saved. Additional studies should be conducted to determine the types of calls that should mandate Code 3 operation in the interest of EMS crew and public safety.

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