

## Time distribution of ambulance requests in the Utstein Style

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### 1. Background

Since 1990, the Utstein template has been the international code for out-of-hospital cardiopulmonary arrest (OHCA). Japan adopted the template in 2005. The Fire and Disaster Management Agency Ministry of Internal Affairs and Communications approved the Utstein template as the national guideline for emergency medical services (EMS) OHCA resuscitation and care. The Utstein database has contributed to the development and greater understanding of emergency medicine in OHCA cases, such as the nationwide use of the automated external defibrillator (AED).<sup>1, 2)</sup> However, for the Utstein database to remain effective and precise, data reporting must occur timely and accurately. There have been data errors reported in the Utstein database.<sup>3, 4)</sup>

### 2. Purpose

The purpose of this study is to assess Japanese EMS OHCA cases to clarify the distribution and precision of response intervals, which are calculated from the time bystanders witness the incident, time of the request call, contact with the patient, and the arrival at the hospital.

### 3. Method

From 2005 to 2012, the Fire and Disaster Management Agency granted permission to use the Utstein database. From each of the 925,288 total cases, we recorded the time at which a bystander witnessed the incident (witness time), the time at which EMS received the 119 request call (call time), the time at which the ambulance arrived (arrival time), the time at which the EMS crew contacted the patient (contact time), and the time at which the patient arrived at a medical facility (hospital time).

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After cleaning the data, we calculated the interval by minutes between each stage of the process : from witness time to call time (witness-call interval), from call time to contact time (call-contact interval=contact time-call time), and from call time to hospital time (call-hospital interval=hospital time-call time). In OHCA cases, we hypothesized that the order of time would trend serially (Figure 1). The witness-call interval was calculated for the 377,705 cases that were witnessed by bystanders (witness-call interval=call time-witness time).

In the witness-call interval, outliers were defined as negative ; in the call-contact interval, outliers were defined as negative or if time exceeded 120 minutes ; in the call-hospital interval, outliers were defined as negative or if time exceeded 240 minutes in call-hospital interval. All of these interval outliers were counted. R (3.2.0, The R foundation, Austria) was used as the statistical software package.

#### 4. Result

The intervals of call-contact, call-hospital and witness-call are summarized in quartiles (Table 1).

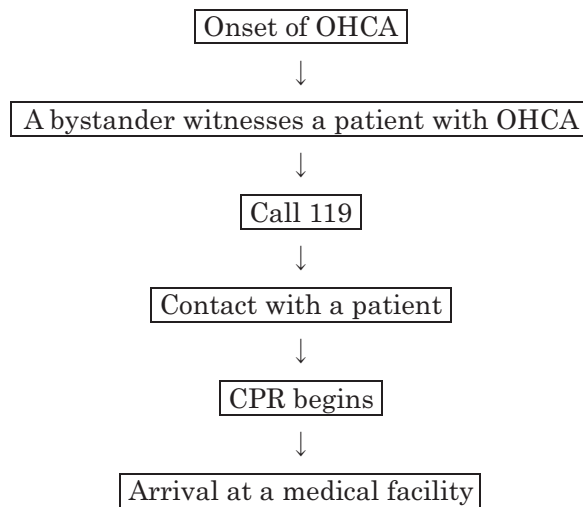


Figure 1. Hypothesis of time-series of OHCA in EMS

Table 1. Quartiles of three intervals

Interval	unit	1 <sup>st</sup> quartile	median	3 <sup>rd</sup> quartile
Call-contact	min	6	8	10
Call-hospital	min	24	30	38
Witness-call	min	-5	1	4

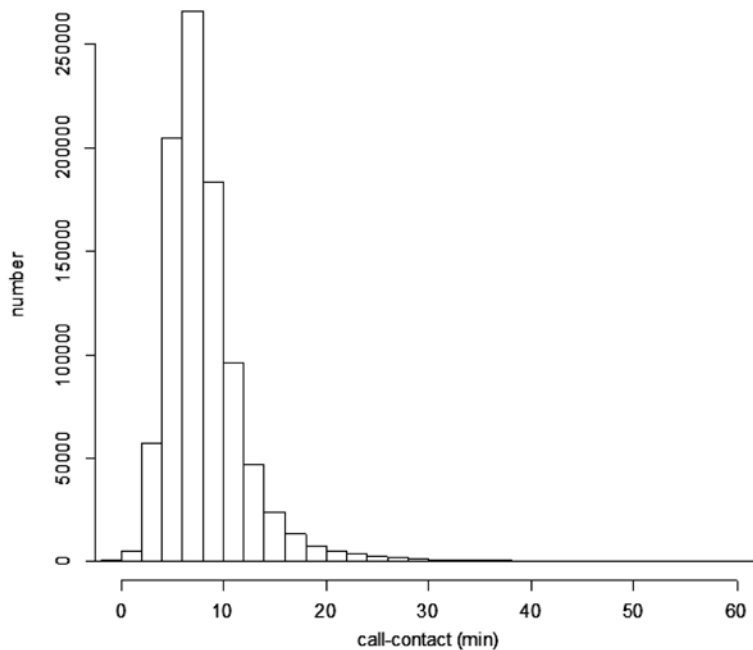
The outliers of the three intervals are shown in Table 2. The distribution of the call-contact interval and the call-hospital interval are asymmetrical and right-tailed (Figure 2 and 3). The distribution of the witness-call interval is almost symmetrical and the number below zero is 35.7% (Figure 4).

## 5. Discussion

In this study, the interval from call time to contact time to hospital time showed distribution. In addition, the outliers of both intervals were less than 1%, which is reasonable. However, 35.7% of the witness-call interval was negative, meaning approximately a third of the OHCA incidents occurred after the ambulance request call. This derivation is less reasonable. The time of the request call and the time of hospital arrival were more objective, as these stages involve telephone operators or dispatchers and medical facility staff, respectively. Witness time is likely skewed by recall bias, as

**Table 2.** Definition and number of outliers

Variable	definition of outliers	number	total	%
Call-contact	> 120 min	257	925,288	0.03
Call-hospital	> 240 min	108	925,288	0.01
Witness-call	< 0 min	134,960	377,705	35.7



**Figure 2.** Distribution of call-contact interval  
The number of cases with from 0 to 60 was 921,973 (99.6% of all cases).

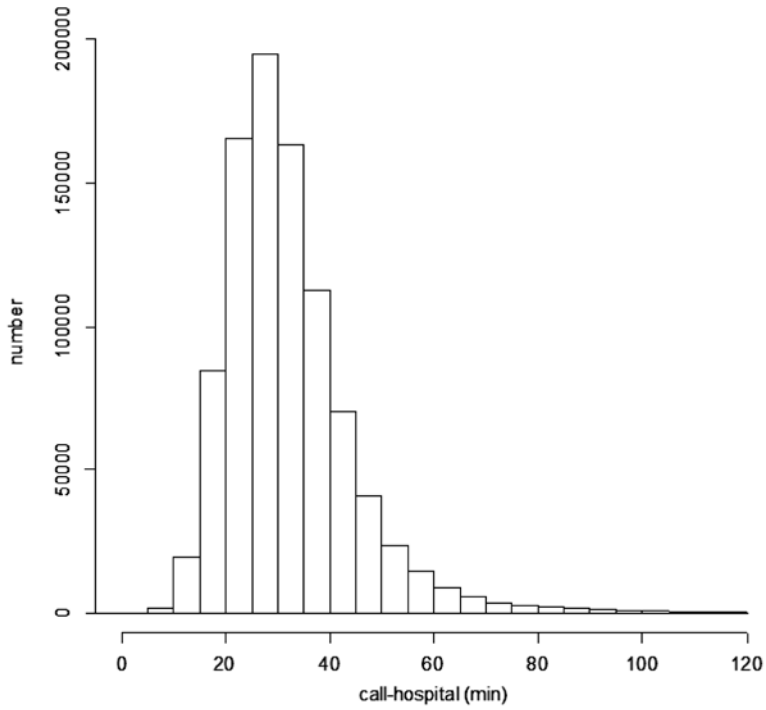


Figure 3. Distribution of call-hospital interval  
The number of cases with from 0 to 120 min was 922,496 (99.7% of all cases).

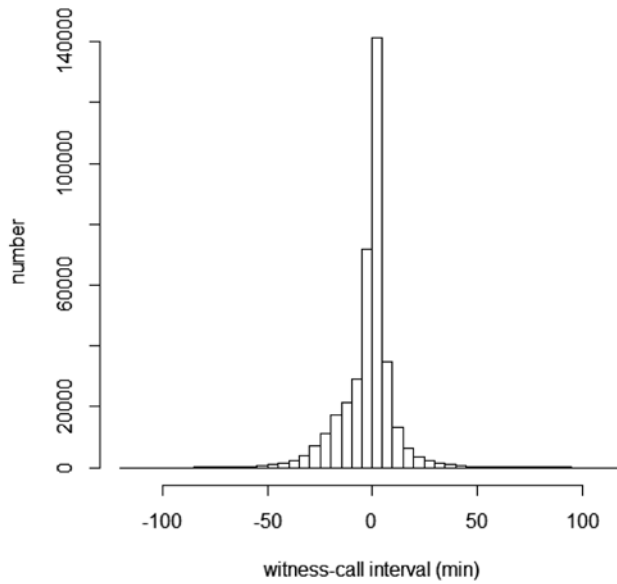


Figure 4. Distribution of witness-call interval  
The number of witness-call interval from -120 to 120 min was 375,147 (99.3% of witnessed cases).

this stage depends upon the memory of bystanders. Therefore, witness time should be cautiously included in statistical analysis.

For missing data, errors, or deleted data in the Utstein database, Tu<sup>5)</sup> suggests treating the missing data as listwise or pairwise deletions and perform mean substitution and regression imputation to estimate the values. New full information maximum likelihood methods and multiple imputation methods are now focused on missing data. We cleaned the contents of the Utstein database under the time-series (Figure 1).

This study has several limitations. First, the Utstein database values were not directly compared with original individual data. Second, only four time-series variables were surveyed in this study. Additional variables, such as time of AED usage and cardiopulmonary resuscitation, require the checking and cleaning of data. Finally, we did not survey the methods of EMS transportation, which also use helicopters.

## Conclusion

The call time interval, contact time interval, and arrival time interval seem to be acceptable for statistical analysis ; however the witness time interval should be cautiously used, as it is subject to recall bias.

## References

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