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STUDY OF EFFECTIVENESS OF AMBULANCE VEHICLE'S SIREN SOUND AS WARNING DEVICE FOR ITS DUTY RUN

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ABSTRACT

This research targeted 5,000 ambulance crew members in 89 cities in Japan, and investigated their perceptions of siren sound as a feasible warning device during their duty operations in various field situations. This study data and analyses suggest the following conclusions: (1) The way other drivers yield to the ambulance is poorly mannered; (2) In the field, duty operations encounter various hindrances, especially at the cross road; (3) The siren sound is considerably effective for persuading for the yield actions; (4) Although the siren sound is appropriate in warning to some extent, alternative methods of warning should be devised for various reasons.

1 - INTRODUCTION

In Japan, ambulance duty calls have been increasing in number every year. In 1997 on average it numbered 10,000 calls per day, and this meant the crews of ambulance vehicles shipped one out of every 38 citizens of Japan in that particular year. Ambulance vehicles are equipped with rotating red lights and electronic siren sound system ($f=960$ Hz, 770 Hz, cycles are each 0.7 s) in order not only to alert other drivers on the road about its approach, but also to further persuade them to yield to it. It is known, however, that the electronic siren sound is not well audible to the drivers for various reasons. This present investigation has targeted this poorly functional electronic siren sound. We have carried out a survey of the crews of ambulance vehicles.

2 - METHOD OF DATA COLLECTION AND SURVEY QUESTIONS

In order for our survey to well represent Japan, we targeted cities of medium and small sizes. 99 fire stations were carefully selected, and we mailed our survey forms to each. After crew members (research subjects) filled out the forms, as instructed each station gathered them and mailed them back to us. 89 stations have completed the task (90% collection), and we have collected responses from 5400 subjects. The topics of survey questions are as follows:

1. About the driver's yielding manners.
2. Things crew member feels upset about and/or wants to protest about the driver's mannerism on the road during his or her field operation.
3. The effect of siren sound on the drivers in informing them of the approach of ambulance vehicle.
4. Whether or not the electronic siren sound interferes with crew's communication in the cabin and, thus, if it interferes also with their entire operation of urgent transport of patients.
5. Whether or not the loud electronic siren sound affects the crew's mental and physiological health.

3 - DATA AND ANALYSIS

Crew member responses were sorted out in the simplest possible way for each topic, and presented in table form (Tables 1, 2, 3, 4, 5, 6 and 7). In the following pages each table is explained and discussed.

3.1 - Things crew member feels upset about and/or wants to protest about the drivers' mannerism during the field operation

		(n)	(%)
1.	Very satisfied	17	0.3
2.	Satisfied	514	9.7
3.	Somewhat dissatisfied	2534	47.8
4.	Dissatisfied	577	29.8
5.	Very dissatisfied	639	12.1
6.	Others	15	0.3
7.	Not clear/no answer-invalid-	104	—
	Total	5296	100.0

Table 1: Drivers' yielding manners.

These figures indicate only 10% of the entire crews see drivers' yielding manners as "Satisfactory". On the contrary, 90% of crew members consider yielding manners to be "Dissatisfactory".

Rank Order		(n)
1.	Do not yield (intentionally/unintentionally)	1470
2.	Stop haphazardly (do not select appropriate place)	771
3.	Drive close behind the ambulance vehicle	705
4.	Fail to notice (due to portable phone/car stereo/not attentive)	538
5.	Some drivers pass yielding vehicles on the left side of the road	425
6.	Facing the approaching ambulance vehicles, some drivers become in confused the middle of the road (cannot take the yield action)	424
7.	Cut/enter into the line of traffic by force	356

Table 2: Things crew member feels upset about and/or wants to protest about the drivers' mannerism during the field operation.

Most crews of the ambulance vehicles are not satisfied with the other drivers' yielding manners. The contents of such dissatisfactions are detailed in Table 2.

Responses to this open-ended question are multiple and are ranked in order by frequency, where the most frequent answer is ranked as 1. In the mission of urgent transportation of patient(s), the crews of ambulance vehicles encounter various difficult situations. To be honest, often the other drivers are unable to be aware of the ambulance vehicle's approach. Other drivers often completely fail to notice the approach of the ambulance vehicles full of warning devices.

Crew members were asked whether or not the electronic siren sound has the effect on the other drivers in informing of the approach of ambulance vehicle. Witnessing the crew responses of "Effective" (=81%) and "Not Effective" (=20%), we may state the electronic siren sound as generally effective in informing and thus it serves the purpose (Table 3).

Crew member's Response		(n)	(%)
1.	Very Effective	229	4.3
2.	Effective	790	14.9
3.	Somewhat Effective	3242	61.3
4.	Little Effective	959	18.1
5.	Not Effective	54	1.0
6.	Others	16	0.3
7.	Unclear -Invalid-	110	—
	Total	5290	100.0

Table 3: The effect of electronic siren sound on the drivers in informing of the approach of ambulance vehicle.

3.2 - Whether or not the electronic siren sound is suitable as a warning device

Responses		(n)	(%)
1.	Suited	3744	72.0
2.	Not Suited	991	19.1
3.	Others	463	8.9
4.	Unclear / no answer -Invalid-	202	–
Total		5198	100.0

Table 4: Is the electronic siren sound suitable as a warning device for letting other drivers know the approach of ambulance vehicles?

3.3 - Whether or not the loud electronic siren sound interferes with crew's communication in the cabin and thus interferes with operation of urgent transportation

Responses		(n)	(%)
1.	Yes, it does	390	7.3
2.	Yes, it occasionally does	2159	40.7
3.	No, it hardly does	2187	41.2
4.	No, it does not	546	10.3
5.	Others	29	0.5
6.	Unclear/no answer -invalid responses-	89	0.3
Total		5311	100.0

Table 5: Does the loud siren sound interfere with the communication in the ambulance cabin, among the crews with the patient(s), with the base center, with the medical staffs at the hospital, etc.

3.4 - The effect of electronic siren sound on the crew member's mental and physiological health

The responses to the question " During the field operation does the siren sound have any negative effect on your mental and/or physiological health?" were summarized in Table 6 below.

Responses		(n)	(%)
1.	Yes, it does to a great extent	33	0.6
2.	Yes, it does a lot	111	2.1
3.	Yes, it does	326	6.2
4.	Yes, it does a little	706	13.5
5.	No, it hardly does	2685	51.4
6.	No, it does not	1366	26.1
7.	Unclear/no answer-invalid-	173	–
Total		5227	100.0

Table 6: Negative effects of the siren sound on crew member's mental and/or physiological health.

Including "Yes, it does a little", the number of subjects who admitted the negative effects on their own health were 22% of the entire 5227, and those who stated no effect were 78%. These figures indicate one out of four crew members of the field operation does admit the negative effects of some sort on their mental and/or physiological health. As this is their health matters, we take these figures seriously. In the similar way, the crews were questioned " Does the siren sound become a cause of any hearing impediment? ". Answers are in Table 7, and including " Yes, it does become a cause but a little," " Yes" counts 15% of the entire 5248 valid responses, while " No," including " No, it hardly becomes a cause," counts 86%.

Responses		(n)	(%)
1.	Yes, it does to a great extent	92	1.8
2.	Yes, it does	59	1.1
3.	Yes, it does a little	609	11.6
4.	No, it hardly does	1935	36.9
5.	No, it does not	2551	48.6
6.	Others	2	0.0
7.	7. Unclear/no answer-invalid-	152	—
Total		5248	100.0

Table 7: Does the siren sound become a cause of any hearing impediment?

4 - CONCLUSION

1. Electronic siren sound is not easily heard by the drivers on the road.
2. Drivers on the road often do not yield to the ambulance, though it is difficult to judge whether or not they could have heard the warning siren sound (poor driving manners).
3. Over 80% of the ambulance crew members believe the electronic siren sound has an effect in warning.
4. While 70% of the ambulance crew members reported the electronic siren sound as suited in warning other drivers on the road, over 19% of them saw it otherwise.
5. Those subjects who stated " Not suited " explain that the electronic siren sound can not be easily heard by the drivers on the road, and that even when it was heard, it is very difficult for them to locate the ambulance vehicle and determine the direction and distance to it from their vehicles.
6. Due to the large volume of siren sound, nearly half the crew members report that the siren interferes with their field operations in various ways.
7. Due to the large volume of siren sound, one out of four ambulance crew members admits the effect of it on his or her mental and/or physiological health of some kind.
8. Because of the siren sound, nearly 15% of the ambulance crew members suffer from hearing impediments of some kind.

REFERENCES

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