Impact of a Government Triple Zero Awareness Campaign on Emergency Department Patient Characteristics

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Abstract

Objective: To evaluate the impact of a government triple zero community awareness campaign on the characteristics of patients attending an emergency department (ED).

Methods: A study using Emergency Department Information System (EDIS) data was conducted in an adult metropolitan tertiary-referral teaching hospital in Brisbane. The three outcomes measured in the 3-month post campaign period were arrival mode, Australasian Triage Scale and departure status. These measures reflect ambulance usage, clinical urgency and illness severity, respectively. They were compared with those in the 3-month pre campaign period. Multivariate logistic regression models were used to investigate the impacts of the campaign on each of the three outcome measures after controlling for age, gender, day and time of arrival, and daily minimum temperature.

Results: There were 17,920 visits in the pre and 17,793 visits in the post-campaign period. After the campaign, fewer patients arrived at the ED via road ambulance (OR 0.90, 95%CI 0.80-1.00), although the impact of the campaign on the arrival mode was only close to statistical significance (Wald chi-square test, $p = 0.055$); and patients were significantly less likely to have higher clinical urgency (OR 0.86, 95%CI 0.79-0.94), while more likely to be admitted (OR 1.68, 95%CI 1.38-2.05) or complete treatment in the ED (OR 1.46, 95%CI 1.23-1.73) instead of leaving without waiting to be seen.

Conclusions: The campaign had no significant impact on the arrival mode of the patients. After the campaign, the illness acuity of the patients decreased, while the illness severity of the patients increased.

Key words: campaign, emergency department, ambulance, urgency, departure status

Introduction

Increasing ambulance usage and overcrowding of emergency department (ED) have become common problems in many developed countries.[1-4] In Queensland, Australia, the number of ED presentations per 1,000 population increased from 316.1 in 2001-2002 to 345.1 in 2008-09.[5, 6] **There is evidence that a significant proportion of increased demand is caused by inappropriate use,[7] although the growing demand for emergency health services is somewhat contributed by the aging population.[8]** The scarce health care resources could have been better directed to patients with genuine needs in emergency care.

Many interventions have been introduced in a number of countries in order to reduce inappropriate emergency health service use.[9-11] Of those studies that have attempted to evaluate the effectiveness of these interventions, many focused on the number of ambulance calls and ED visits, few have looked at the impacts of these interventions on other characteristics of the patients visiting the ED, in particular, the impacts on the clinical urgency and severity of the patients' illness.

In 2008, the Queensland Government launched an advertising campaign between 14th September and 15th November. The campaign, known as a Queensland Ambulance Service (QAS) Triple Zero Community Awareness Campaign, focused on raising public awareness of appropriate ambulance usage through posters, print media, radio and television advertisements. At the same time, the scope of practice for paramedics was expanded to enable them to deal with some minor ailments at the scene.

The aim of this research was to examine whether the characteristics of patients attending an ED at a teaching hospital in Brisbane, changed significantly following the QAS Triple Zero Community Awareness Campaign. The findings from this study may facilitate future policy development in providing emergency health services in Queensland and Australia.

Methods

Study setting

This comparative study was conducted in the ED at the Royal Brisbane and Women's Hospital (RBWH). The RBWH, located close to the central business district of Brisbane, is a large adult tertiary-referral teaching hospital in Queensland, Australia with over 900 beds.The ED in RBWH is one of the largest in Australia, with around 70, 000 presentations each year. Therefore, an analysis of the patients in the ED at RBWH could capture the impact of the QAS Triple Zero Community Awareness Campaign on the characteristics of ED patients.

Data collection and statistical analysis

Research subjects were patients attending the ED in the RBWH for three months prior (14th June 2008 to 13th September 2008, 92 days) and post (16th November 2008 to 15th February 2009, 92 days) introduction of the campaign. Data for all the ED patients were

extracted from the Emergency Department Information System (EDIS), including patient age, gender, arrival day (weekday, weekend or public holiday), arrival time, arrival mode, Australasian Triage Scale (ATS) and departure status. The arrival mode was coded as arrival via 1) own transport including walk-ins and public or private transport, 2) road ambulance, and 3) others including police or prison vehicle, and community services. ATS is an ordinal scale for rating clinical urgency. It ranges from 1 to 5 with 1 being assigned to the most urgent presenting problems. The departure status was categorised into 1) patient admitted, 2) ED service completed – patient discharged, 3) did not wait, and 4) others including dead on arrival and died in ED. Data on daily temperature were retrieved from the Bureau of Meteorology of Australia including daily minimum temperature and daily maximum temperature.

Statistical analyses including t test and Pearson chi-square test were used as appropriate to examine whether there were any significant differences in patient characteristics between the pre-campaign and post-campaign periods. Multivariate logistic regressions were used to analyse the impacts of the campaign on three outcome measures, including the arrival mode, ATS and departure status of the ED patients, while controlling for daily minimum temperature, age, gender, arrival day and arrival time. These three outcome measures reflect ambulance usage, clinical urgency and illness severity, respectively. ATS was used as ordinal responses, while the arrival mode and departure status were used as nominal responses in the logistic regression models. For the ordinal response model with ATS as the response variable, the probability of a high clinical urgency was modelled. For the nominal response model with arrival mode as the response variable, the following outcomes were modelled: the probabilities of patients 1)

arriving via road ambulance versus arriving via own transport, and 2) arriving via other means versus arriving via own transport. For the nominal response model with departure status as the response variable, the following outcomes were modelled: 1) being admitted versus did not wait, and **2)** being discharged versus did not wait. Based on the results of a multicollinearity diagnostics, daily minimum temperature was included in the models instead of daily maximum temperature or daily average temperature to control for the seasonal impact on the outcomes.

The data were analysed using SAS version 9.2.[12] A two-sided 5% statistical significance level was used. Point estimates were presented with 95% confidence intervals (CIs).

Results

In total, there were 35,713 ED visits including 17,920 visits in the pre-campaign period and 17,793 visits in the post-campaign period. There were no significant changes between the pre- and post-campaign periods in terms of patient age, gender, and arrival mode (Table 1).

The daily minimum temperature was significantly higher in the post-campaign period compared to the pre-campaign period, which was consistent with seasonal change. After the campaign, there were more patients visiting the ED at night and in public holidays (mainly because there were more public holidays in the post-campaign period). Patients arriving at the ED had significantly lower clinical urgency after the campaign compared with those before the campaign. The changes were mainly driven by the decrease of

ATS 3 from 46.5% to 44.0% and the increase of ATS 4 from 26.7% to 29.5%. The proportions of patients who were admitted or discharged after completion of the ED service increased from 27.0% to 28.5% and from 61.8% to 63.3% respectively, while the proportion of patients who did not wait in the ED decreased from 11.1% to 8.2% significantly after the campaign compared with before the campaign.

Results of the nominal logistic regression analysis with arrival mode as the outcome variable are shown in Table 2. After the campaign, fewer patients arrived at the ED via road ambulance or other means as opposed to own transport, although the impact of the campaign on the arrival mode was only close to statistical significance after controlling for other factors (Wald chi-square test, $p = 0.055$).

Older patients were more likely to use an ambulance than younger patients. Patients visiting the ED at the weekend had a higher probability of using an ambulance than those on weekdays, as did the patients arriving at the ED at night compared with those in the daytime. Patients with higher clinical urgency or higher illness severity, which were reflected by lower ATS and the departure status being admitted respectively, both increased the probability of ambulance use.

Results of the ordinal logistic regression analysis with ATS as the outcome variable are presented in Table 3. After the campaign, patients attending the ED were significantly less likely to have higher clinical urgency compared with those before the campaign. This is consistent with the results of the chi-square test (Wald chi-square test, $p = 0.0007$).

Older age was associated with lower clinical urgency; female patients tended to be more urgent than male patients; patients visiting the ED at the weekend were likely to be more urgent than those on weekdays; and the same applied to the patients visiting the ED at night compared with those in the daytime. Similarly, patients arriving at the ED via road ambulance or other means were more likely to have higher clinical urgency than patients arriving at the ED via own transport; and patients with departure status being admitted or discharged after completing the ED service instead of not waiting were more likely to be urgent.

Table 4 shows the results of the nominal logistic regression with departure status as the outcome variable. Compared with patients before the campaign, patients attending the ED after the campaign were significantly more likely to be admitted or discharged after completing treatment in the ED instead of not waiting to be seen indicating possibly higher illness severity following the campaign (Wald chi-square test, $p < 0.0001$).

Compared with younger patients, older patients were more likely to be admitted or discharged after completing treatment in the ED instead of not waiting to be seen. Likewise, females were less likely to leave ED without being seen than males. Visiting the ED at the weekend or at night, having higher illness severity, and arriving at the ED via other means all increased the probability of being admitted or discharged after completing treatment in the ED versus not waiting.

Discussion

This study aims to examine the impact of a government triple zero awareness campaign on the characteristics of patients attending the largest ED in Brisbane. Use of ambulance was found to be significantly associated with higher clinical urgency and illness severity, and the latter two indicators were also positively associated with each other. However, it is interesting to note that the campaign had different impacts on the three outcome measures. The results suggest that the campaign had no significant impact on the arrival mode of the ED patients. After the campaign, the patients attending the ED had lower clinical urgency. These patients would be expected to be more likely to leave the ED without waiting to be seen, yet significantly more patients were admitted or discharged after completion of the ED service, which suggest that the severity of the ED patients may have increased following the campaign.

When the campaign was implemented, the QAS expanded the scope of practice for paramedics.[13] In such cases, the paramedics could provide more treatments to patients than before instead of just taking them to hospital. This might be the reason that the proportion of patients transported to the ED via road ambulance declined following the campaign, although the magnitude of the decline was not great enough to be statistically significant. It would also be likely that some acute conditions were dealt with in a timely manner by paramedics, and therefore patients arriving at the ED became less urgent following the campaign. **The patients with minor ailments may have been treated rather than were taken to hospital.** This may explain why the proportion of

patients leaving the hospital without waiting was reduced, and the proportions of patients being admitted or completing treatment in the ED increased.

Older patients were more likely to use road ambulance and be admitted to hospital. This finding is consistent with other studies.[7, 14, 15] Older patients tend to have low mobility and independence, limited abilities to use private or public transport,[8] and more illness comorbidities[16] and serious conditions requiring monitoring[14] compared with younger patients, which leads to more admissions to the hospital.[17] Contrary to previous studies, [18, 19] older patients were found to be less urgent compared with younger patients in this study. One reason for this may be that injury-related conditions are the most common reasons for ED visits of younger patients, while chronic conditions like cerebrovascular, cardiac and respiratory diseases are more often seen in older patients.[15] Compared with previous studies, this study adjusted for a greater number of confounders including individual patient age (not age group commonly used in previous studies), gender, arrival day, arrival time, arrival mode, departure status and temperature, which might be the reason that gives rise to the difference.

Female patients visiting the ED tend to have more clinical urgency and illness severity compared with their male counterparts. This finding may have been partly due to women consulting their general practitioners (GP) more frequently than men,[20, 21] and may not attend the ED unless conditions are determined by their GP to be urgent or severe. There is evidence that females use ambulance services and EDs less often than males,[8] but have more hospital admissions.[22] It is also possibly that women report more symptoms[23] and rate their health as poorer[21, 24] than men.

Patients arriving at the ED at the weekend or at night were more likely to use an ambulance and have high clinical urgency, but less likely to have high illness severity. It is reasonable that ambulance use increases after-hours when access to alternative transport and primary health care is often limited.[7] In most cases, patients tend to postpone non-urgent or complex visits to working hours, as identified by one study that the highest proportion of ED visits was on a Monday.[15] Therefore, the ED presentations after hours are genuinely urgent conditions requiring rapid responses but not admissions to hospitals.

It seems that ambulance use was also positively associated with the daily minimum temperature, although the association was only close to significance. There is conflicting evidence in the literature with regard to the association between ambulance use/ED visits and temperature. Chen and Tescher[25] found that the number of ED visits of a rural hospital in Australia was the highest in warmer months. This finding was further validated by the results of a study in the UK that ED visits were positively correlated with daily minimum and maximum temperature.[26] In contrast, a number of studies reported that ambulance use/ED visits increased in the colder seasons of the year.[14, 15, 27] These studies used different indicators to reflect temperature change, selected different study populations, and were conducted in subtropical areas or temperate areas, which might be the reason that the association between ambulance use/ED visits and temperature varies by study. Therefore, further in-depth analyses are needed before any reliable conclusions can be drawn.

Limitations

This study is limited to data collected from an urban tertiary teaching hospital. The patient characteristics may not necessarily be the same as the population characteristics in suburban or rural areas. Including data from other hospitals may produce more generalisable findings. **The sample size of 35,713 ED visits used in this study was greater than usually seen in such research. This may cause the study to be 'over powered', that is, even very small differences were tested to be statistically significant. However, we checked all the results and the results that were statistically significant were also clinically meaningful.** We use departure status to reflect the illness severity. It must be clarified that these two indicators are not exactly the same, that is, some patients leaving the ED without waiting to be seen may have more serious conditions than those completing the ED service. However, this has no impact on the accuracy of the results, although the interpretation of the results may be slightly different. The daily minimum temperature was used in the statistical models to control for the seasonal impact on the outcomes. However, the temperature alone may not adjust for all the potential effect of seasonality on the outcomes. The outcomes may also be affected by other aspects of seasonal variation, such as different admission patterns in different seasons. The campaign may also increase service usage by raising awareness of the resource, but a lack of data prevented us from examining this. As mentioned in the discussion, the outcomes were also affected by the concurrent change in paramedic practice, although it is difficult to quantify its separate impact in the statistical models. More details of the campaign, such as reach (who got the message?), impact (how strong was the effect of the message?), and duration (how long was the

message remembered?), **would allow us** deeper understanding of the campaign's basic principles of both marketing and health interventions,[28] however, more details of the campaign had not been made publically available at this time.

Conclusion

A study of 35,713 ED visits in a tertiary-referral teaching hospital indicates ambulance use, clinical urgency and illness severity were positively associated with each other. However, the Triple Zero Awareness Campaign had different impacts on the three outcome measures. The arrival mode of the ED patients was not significantly influenced by the campaign. The clinical urgency of the ED patients decreased, while the illness severity of the ED patients increased after the campaign. The impact of the campaign might be affected by the potential impact of normal seasonal change and normal variation in case mix. Other factors, including patient age, gender, arrival day, arrival time, and temperature, also affect the three outcomes in different directions. Further studies, such as studies incorporating attitude change of individual patients in ambulance use as an outcome, may help fully explore the impact of the campaign.

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Ethics approval

The Research Ethics Unit of Queensland University of Technology determined that this study used routinely collected unidentified data and was therefore exempt from ethical review.

Author contributions

The idea was from Xiang-Yu Hou and Kevin Chu; the data analysis and drafting the manuscript were undertaken by Jingzhou Zhao. Xiang-Yu and Kevin also contributed to the final draft.

Competing interests

Dr K Chu is a section editor of the *Emergency Medicine Australasia* journal.

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Table 1. Daily minimum temperature and patient characteristics in the pre-campaign and post-campaign period

Indicator	**Pre-campaign (n = 17,920)**	**Post-campaign (n = 17,793)**	**p-value**
Daily minimum temperature (℃), mean ± SD†	10.4 ± 3.1	20.8 ± 2.0	<0.0001
Age, mean ± SD†	40.9 ± 20.5	41.1 ± 19.8	0.2329
Gender			0.9623
Male, n (%)	9375 (52.3)	9313 (52.3)	
Female, n (%)	8545 (47.7)	8480 (47.7)	
Day, n (%)			<0.0001
Weekday	12637 (70.5)	11946 (67.1)	
Weekend	5098 (28.5)	5043 (28.3)	
Public Holiday	185 (1.0)	804 (4.5)	
Time, n (%)			<0.0001
Day (7:00 am – 18:59 pm)	12216 (68.2)	11716 (65.9)	
Night (19:00 pm – 6:59 am)	5704 (31.8)	6077 (34.2)	
Arrival mode, n (%)			0.1918
Own Transport (walked in/public or private transport)	11289 (63.0)	11328 (63.7)	
Road ambulance	6265 (35.0)	6075 (34.1)	
Others	366 (2.0)	390 (2.2)	
Australasian Triage Scale, n (%)			<0.0001
1	349 (2.0)	358 (2.0)	
2	2309 (12.9)	2165 (12.2)	
3	8326 (46.5)	7827 (44.0)	
4	4786 (26.7)	5253 (29.5)	
5	2042 (11.4)	2092 (11.8)	
Missing	108 (0.6)	98 (0.6)	
Departure status, n (%)			<0.0001
Admitted	4844 (27.0)	5066 (28.5)	
ED service completed‡	11082 (61.8)	11255 (63.3)	
Did not wait	1980 (11.1)	1455 (8.2)	
Others	14 (0.1)	17 (0.1)	

†SD = standard deviation

‡ED = emergency department

Table 2. Nominal logistic regression analysis modelling the impact of the campaign on the arrival mode

	Road ambulance versus Own Transport (walked in/public or private transport)			Others versus Own Transport (walked in/public or private transport)		
	Odds Ratio	**95% CI†**	**p-value**	**Odds Ratio**	**95% CI†**	**p-value**
Time period						
Pre-campaign	Reference			Reference		
Post-campaign	0.90	0.80,1.00	0.0548	0.78	0.56,1.07	0.1246
Daily minimum temperature	1.01	1.00,1.02	0.0832	1.03	1.00,1.06	0.0410
Age (10 years)	1.31	1.29,1.32	<0.0001	1.08	1.03,1.13	0.0003
Gender						
Male	Reference			Reference		
Female	0.98	0.94,1.03	0.5064	0.71	0.61,0.82	<0.0001
Day						
Weekday	Reference			Reference		
Weekend	1.15	1.09,1.22	<0.0001	0.79	0.67,0.94	0.0077
Public Holiday	1.05	0.90,1.23	0.5139	0.92	0.59,1.43	0.7109
Time						
Day (7:00 am – 18:59 pm)	Reference			Reference		
Night (19:00 pm – 6:59 am)	1.75	1.66,1.84	<0.0001	1.98	1.70,2.30	<0.0001
Australasian Triage Scale	0.45	0.43,0.46	<0.0001	0.58	0.53,0.64	<0.0001
Departure status						
Did not wait	Reference			Reference		
Admitted	1.22	1.10,1.34	<0.0001	1.49	1.03,2.16	0.4348
Discharged (ED service completed)‡	0.72	0.66,0.79	<0.0001	1.84	1.32,2.57	<0.0001

†CI = confidence interval

‡ED = emergency department

Table 3. Ordinal logistic regression analysis modelling the impact of the campaign on the ATS category

	Odds Ratio	**95% CI†**	**p-value**
Time period			
Pre-campaign	Reference		
Post-campaign	0.86	0.79,0.94	0.0007
Daily minimum temperature	1.00	0.99,1.01	0.6587
Age (10 years)	0.97	0.96,0.98	<0.0001
Gender			
Male	Reference		
Female	1.13	1.09,1.18	<0.0001
Day			
Weekday	Reference		
Weekend	1.36	1.30,1.42	<0.0001
Public Holiday	1.08	0.96,1.22	0.1955
Time			
Day (7:00 am – 18:59 pm)	Reference		
Night (19:00 pm – 6:59 am)	1.58	1.51,1.65	<0.0001
Arrival mode			
Own Transport (walked in/public or private transport)	Reference		
Road ambulance	3.17	3.02,3.32	<0.0001
Others	2.51	2.18,2.88	<0.0001
Departure status			
Did not wait	Reference		
Admitted	11.54	10.64,12.52	<0.0001
ED service completed‡	2.79	2.60,2.99	<0.0001

†CI = confidence interval

‡ED = emergency department

Table 4. Nominal logistic regression analysis modelling the impact of the campaign on the departure status

	Admitted versus Did not wait			Discharged (ED service completed) versus Did not wait‡		
	Odds Ratio	**95% CI†**	**p-value**	**Odds Ratio**	**95% CI†**	**p-value**
Time period						
Pre-campaign	Reference			Reference		
Post-campaign	1.68	1.38,2.05	<0.0001	1.46	1.23,1.73	<0.0001
Daily minimum temperature	1.00	0.99,1.02	0.6829	1.01	0.99,1.02	0.435
Age (10 years)	1.42	1.40,1.47	<0.0001	1.06	1.04,1.09	<0.0001
Gender						
Male	Reference			Reference		
Female	1.18	1.08,1.29	0.0002	1.18	1.10,1.28	<0.0001
Day						
Weekday	Reference			Reference		
Weekend	0.51	0.46,0.56	<0.0001	0.56	0.51,0.60	<0.0001
Public Holiday	0.85	0.64,1.12	0.2477	0.90	0.71,1.16	0.4206
Time						
Day (7:00 am – 18:59 pm)	Reference			Reference		
Night (19:00 pm – 6:59 am)	0.35	0.32,0.39	<0.0001	0.37	0.34,0.40	<0.0001
Australasian Triage Scale	0.18	0.17,0.20	<0.0001	0.47	0.45,0.49	<0.0001
Arrival mode						
Own transport (walked in/public or private transport)		Reference			Reference	
Road ambulance	1.32	1.20,1.46	0.6834	0.79	0.72,0.87	<0.0001
Others	1.61	1.11,2.33	0.0779	1.98	1.42,2.78	<0.0001

†CI = confidence interval

‡ED = emergency department